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Physics and Space Science

Wave-Particle Duality

Math-Phys-Chem-Virology

Highlights

General Theory Relativity

Context of New Mars Data

Discovering Thoughts, Inventing Future

VOLUME 23 ISSUE 5 VERSION 1.0

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Physics & Space Science

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The Cydonian Hypothesis in the Context of New Mars Data

By J. E. Brandenburg

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I. Lay Summary

The Cydonian Hypothesis, the hypothesis that Mars was once Earthlike in climate, and persisted in this state for a long period geologically, so that life and humanoid intelligence could evolve on its surface, and build large monuments, before being destroyed by a Mass Extinction Event, is reexamined in the light of new Mars data and found to be confirmed by this new data. New high resolution images confirm that, despite expected erosion, The Face and D&M Pyramid at Cydonia Mensa and the Face of Galaxias at Galaxias Chaos possess anatomical and ornamental details indicating they are archeological. This apparently means that Mars was the home of a past, humanoid, indigenous, approximately bronze-age, civilization that dates from a period of Earthlike climate on Mars, and these relics are approximately a ½ billion years old. It is recommended that an emergency Mars program be initiated immediately by the US government, in concert with the full ISS consortium, using robotic probes and astronauts, to gain more knowledge of this culture and the reasons for its demise. This course of action is considered the best way to increase chances of long-term human survival in the cosmos.

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II. Implications and Applications

The confirmation of the Cydonian Hypothesis: the hypothesis that Mars was once Earthlike in climate, and persisted in this state for a long period geologically, so that life and humanoid intelligence could evolve on its surface, and build large monuments, before being destroyed by a Mass Extinction Event, also confirms the Principle of Mediocrity. Mediocrity is the concept that Earth and it's inhabitants and history, are not an aberration in the Cosmos but typical. The Principle of Mediocrity is the guiding assumption of SETI, because it says that products of intelligent life will be recognizable to us. The combination of the confirmation of the Cydonian Hypothesis and with it Mediocrity, makes another problem of SETI, the Fermi Paradox, more acute and perhaps ominous. Fermi's Paradox is the apparent contradiction confronting humanity of our own noisy and expansive presence in the Cosmos, and the Principle of Mediocrity, the assumption that we typical, with the seeming graveyard-like silence of the surrounding Universe. Given this context, this discovery on Mars requires immediate action by the space powers to explore the Cydonia Mensa and Galaxias Chaos sites on Mars, to maximize knowledge concerning the life and death of the culture discovered there. Mediocrity means Earth and humanity are not alone or remarkable in the universe, with all that implies, both good and bad.The Fermi Paradox, the unexpected silence of the stellar neighborhood, when, naively, it would be expected to be lively and noisy, is now ominous, given that two humanoid cultures apparently arose independently in the same planetary system, and one is now extinct due to unknown causes. This is also, unfortunately, in keeping with extreme Mediocrity, suggesting that in the cosmos, like on Earth, the greatest danger to intelligent life may be other intelligent life.

III. Introduction

In a previous article the Cydonian Hypothesis was proposed [1] where it was hypothesized that what appeared to be geologically anomalous landforms seen in orbital Mars Viking imagery, were, in fact, eroded archeology from an extinct, humanoid, , stone-age or early bronze-age, humanoid culture indigenous to Mars,

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and dating from the end of a long Earthlike period of Mars climate. Based on estimates of the ages of the terrains where these objects were found on Mars, approximately 1/2 billion years old, such a hypothetical humanoid culture was considered to be a completely independent biological development on our own culture on Earth. This culture, termed the Cydonians, was hypothesized to have developed and existed in a past period of Earth-like conditions on Mars. If true, this would be in keeping with Principle of Mediocrity[2] the idea that humanity, and all its habits, are not alone or even remarkable in the cosmos. Unfortunately, this latter point suggests that the cosmos, like the Earth, is dominated by intelligent social predators, like ourselves and killer whales. The Fermi Paradox [3], the silent "ghost town" character of a cosmos that, naively, should be lively and noisy, also overshadows these considerations. The full implications of Mediocrity and the Fermi Paradox, makes our investigation of what appears to be humanoid relic archeology on Mars, more than an academic exercise, but possibly related to long-term human survival in the cosmos.

The Cydonian Hypothesis was the simplest hypothesis that could be proposed, for interpreting the objects as archeological, given the Mars data then available. It proposed for Mars only processes already seen to operate on Earth: the appearance of a liquid water environment, the appearance of a photosynthetic biosphere, the evolution of a humanoid intelligence, its organization into a bronze age culture building urban centers and massive monuments, and finally a terrible mass extinction, like the Great Permian Extinction , only more severe, that destroyed Mars living environment. Therefore, the Cydonian hypothesis proposed no new phenomena, only a new location, Mars, for these phenomena. It was also falsifiable by images of the hypothetically archeological objects to see if they revealed new anatomical or artistic details, as would be expected for objects created by an indigenous culture and thus made to observed closely from the ground. The original Cydonian Hypothesis article included the statement "Archaeological monuments found on Earth almost always display more detail at higher resolution, even when eroded." Such higher resolution images have now been obtained. Therefore the Cydonian Hypothesis can be tested. The results of these tests will be discussed in the remainder of this article. The Cydonian Hypothesis is apparently confirmed.

Mars is a planet with an apparently complex history, which apparently included a geologically long period of Earth-like conditions, as evidenced by evidence of long periods of liquid water erosion and extensive sedimentary formations, as found [4] on Earth. Further, Mars, on its youngest portions-as determined by relative crater-counting contains the bed of a Paleo-ocean [5, 6] as depicted in Fig. 1. The existence of this Paleo-Ocean bed on the youngest part of Mars indicates that it existed for most of Mars geologic history.

Sedimentary beds imaged on Mars surface are seen in Fig. 2. These sediments are consistent with formation processes operating in an oxygen rich atmosphere [7].

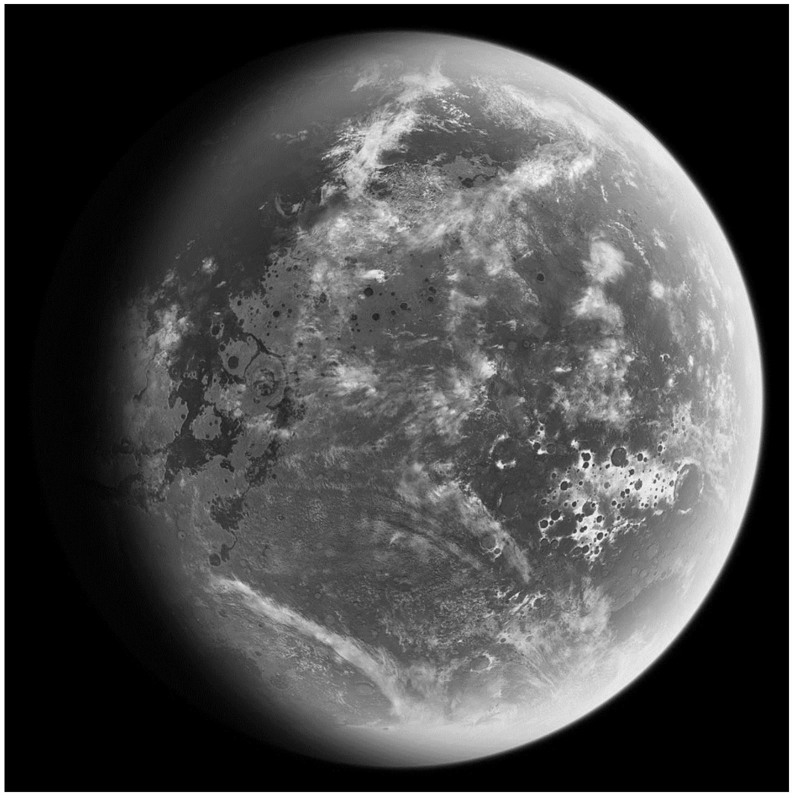

Figure 1: The Paleo-Ocean of Mars. The Red Planet as it once was

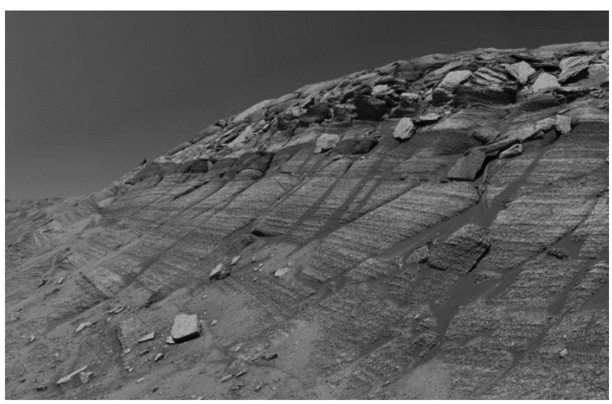

Figure 2: Highly oxidized sediments found in Endurance Crater on Mars

Finally, there exists strong evidence that conditions conducive to biology occured on Early Mars. [8,9].

It can also be inferred, from evidence of this past Earth-like environment on Mars and its contrast with Mars present state, that a catastrophic change in environmental conditions occurred on the Red Planet. The rapidity of this catastrophic change and the time of its occurrence is unknown, was its exact cause.

In the previous article, apparent archeology imaged at 4 different sites on Mars was examined: Cydonia Mensa, Deuteronilus Mensa, a Utopia region site - now named Galaxias Chaos- and the landforms called the Pyramids of Elysium, made famous by Carl Sagan in his book *Cosmos*[6]. These sites are marked on a global Mars map seen in Fig. 3.

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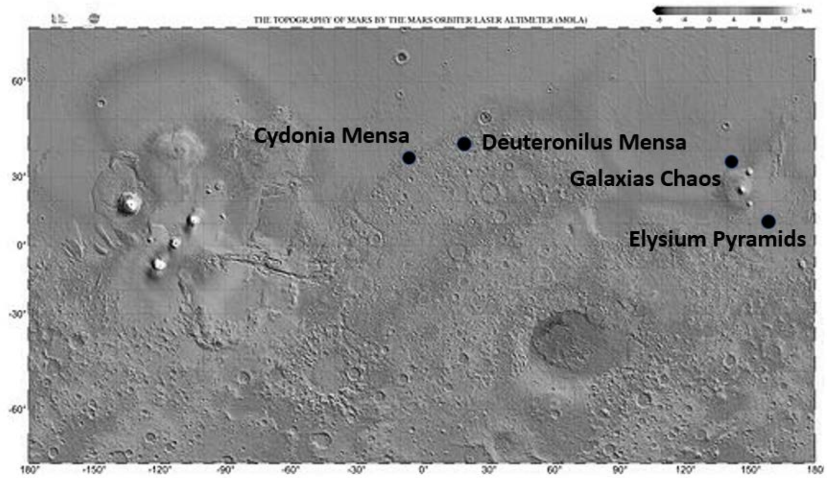

Figure 3: Sites of landforms suggestive of archeology on Mars

In this article, we will focus on new imagery, from recent probes, obtained at Cydonia Mensa and Galaxias Chaos, since this imaging data is at higher resolution and much more extensive there, as seen in Fig. 4 below.

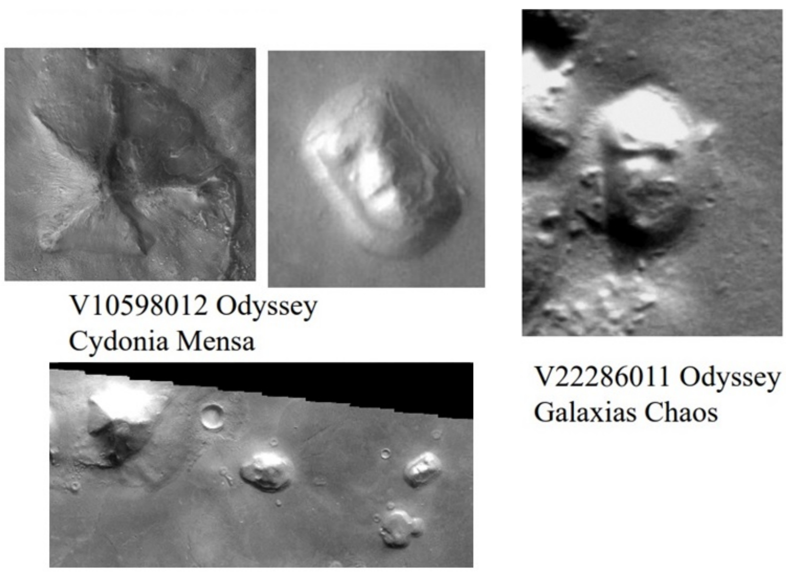

Figure 4: Recent images by Mars Odyssey of objects at Cydonia Mensa and Galaxias Chaos, that will be main focus of this article

Recent images of the other two sites, Deuteronilus Mensa and Elysium indicate that the geologically anomalous objects there, whatever their origin, are heavily eroded, and thus can provide little information. A Viking image and a more recent image of the object at Deuteronilus, illustrating this point are shown below in Fig. 5

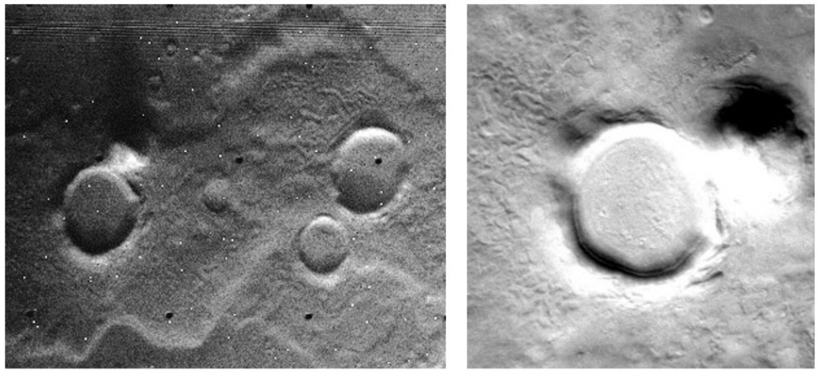

Figure 5: Images from Viking and more recent image from Mars Odyssey of a tall object on the debris lobe of a crater, showing what appears to be a heavily eroded object

Likewise, better imaging data from Elysium Planitia is reveals an area of eroded landforms with only the faintest suggestions of artificiality (see Fig. 6 below)

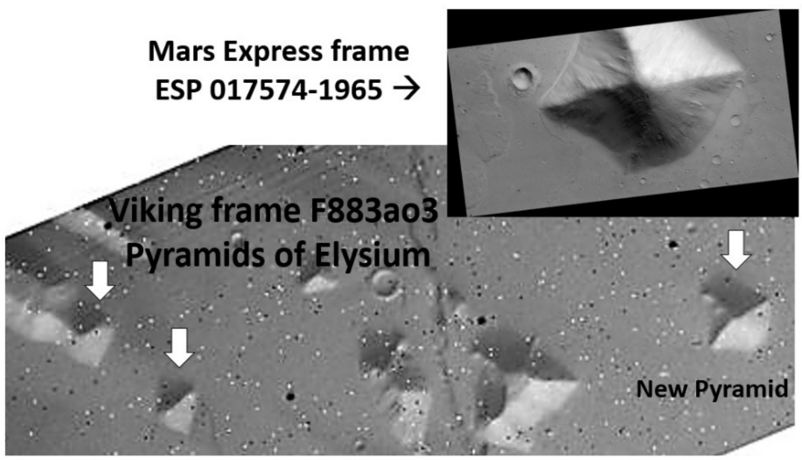

Figure 6: Images of the Elysium region

It will be seen, however, that new probe imaging data from Cydonia Mensa and Galaxias Chaos strongly supports the original Cydonian Hypothesis. Because of extensive new imagery, we will concentrate our analysis there. It will be seen that Mars was, in fact, apparently the home of a humanoid, primitive, indigenous civilization during its period of Earth-like conditions.

Accordingly, we are not alone in the Cosmos, but share it with beings such as ourselves. The illusion that we were alone, perhaps convenient in its time, must now be discarded, since we now know it is not true. That knowledge makes us responsible for our next actions as a people, rather than pretending ignorance.

The confirmation of the Cydonian Hypothesis leads to urgent questions regarding the reason Mars appears to have possibly suffered a catastrophic climate change from a past Earth-like state into its present form. This environmental catastrophe was perhaps caused by the Lyot impact late in Mars geologic history (see Fig. 7 below) Also the Cydonian Hypothesis confirmation relates to Fermi's Paradox, the unexpected radio silence of our cosmic neighborhood. As will discussed, the confirmation of the Cydonian Hypothesis makes that paradox more acute. This is especially true if one considers Mars and Fermi's Paradox in the context of the Principle of Mediocrity, with all the possibilities that implies.

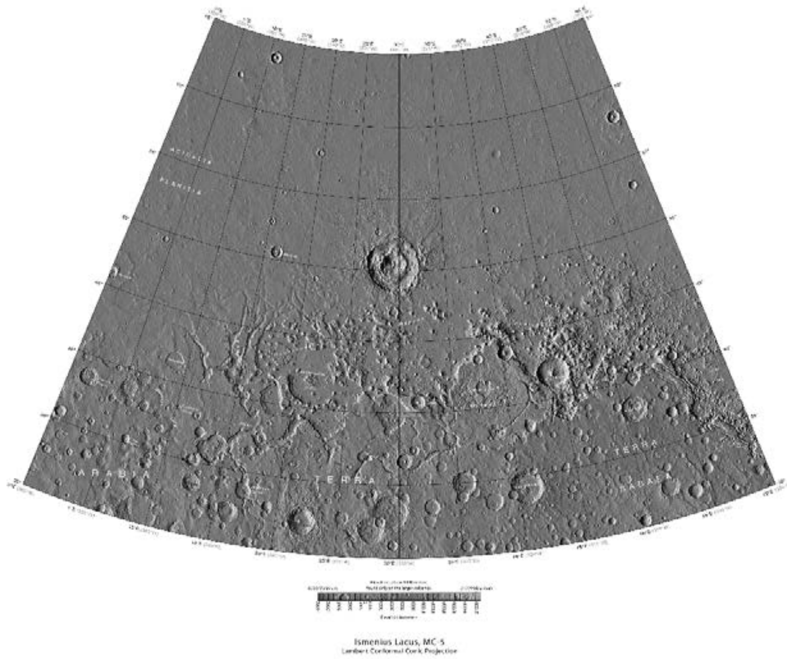

Figure 7: Showing the Chixulube-sized Lyot Impact basin in Northern Mars. Note that the impact basin formed on terrain with few craters, indicating it formed in recent geologic time on Mars

IV. The Problem of Finding Relic Archeology on Mars

The Cydonian Hypothesis[1] was based on evidence of eroded archeology on Mars at several sites , principally the Face in Cydonia and the nearby D&M Pyramid, plus evidence of a long period of Terrestrial climate on Mars. It was, thus, the simplest hypothesis that could be formulated, based on Viking data, to explain the apparent archeology on Mars since it assumed the same processes: life, evolution, and civilization, that produced the Pyramids and the Sphinx on Earth, had operated on Mars and for similar periods. (see Fig. 8)

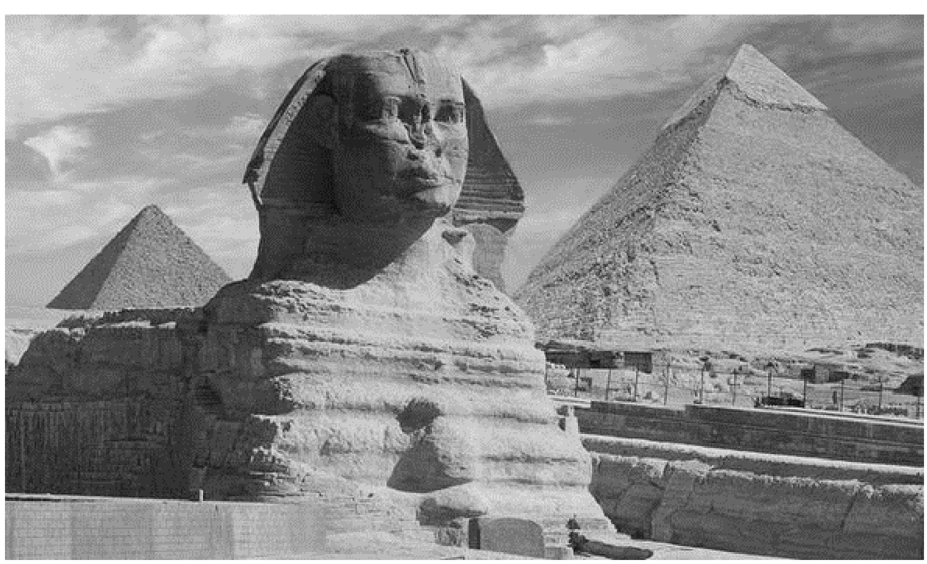

Figure 8: Showing the eroded Sphinx and Pyramids at Giza in Egypt

The Cydonian hypothesis is thus as much a hypothesis about Mars past climate as it is about life and evolution on Mars. The hypothesis predicted that, "despite erosion" new details would be seen on the artifacts, since they would be the product of an indigenous intelligence and thus made to be seen at close range and that new evidence would be found of a geologically-long period of Terrestrial conditions on Mars. The objects would also be eroded since they were created at a time of Earthlike climate on Mars.

The human visual system, thanks to our long history of existing as warrior hunter-gathering tribes, is tuned to recognize humanoid faces and straight lines. Picking out faces of ambushers in the forest undergrowth or noting a spear or arrow flying in your direction, perhaps from a symmetrical fortification, had obvious survival value, even if it this instinct was prone to occasional false alarms. Nature obviously favored a: "better safe than sorry" approach in the evolution of the human visual system. In a universe possibly populated by intelligent social predators such as ourselves, these visual instincts might still be useful.

These human visual instincts, tuned to finding faces and straight lines, are also obviously tuned to picking out faces and linear symmetries even in the presence of "noise" such as war paint or camouflage. The imaging processing system is thus "holistic" ignoring fine details in favor of recognizing a whole face or symmetrical object by analyzing images at larger scales. This trait is important to our analysis of possibly intelligently shaped objects seen on Mars, since the same environmental conditions that would support intelligent life, also degrade its creations in time, beginning with fine details. The problems this creates are seen in examples of archeology found on Earth, as see in Figs. 9, where it can be seen that erosion destroys the very same holistic patterns and symmetries that one seeks to establish artificiality.

Figures 9: (L) The Sphinx before partial restoration. (R) Olmec carved head showing helmet ornamentation, helmet frame corner, and erosion. All real archeology shows some signs of erosion

Erosion effects, preferentially destroying fine structure, can also leading to "mass wasting" events leading to the collapse of parts of an archaeological structure. This especially true in the object in question is of low relief and thus more easily destroyed. These effects can also make real, unrestored, archeology look far more impressive when viewed from a distance under particular lighting conditions, than views of the same object at close range under more general lighting conditions. This "looks better from a distance" effect is seen in two views of the unrestored Sphinx of Egypt when it was first photographed. (Fig. 10)

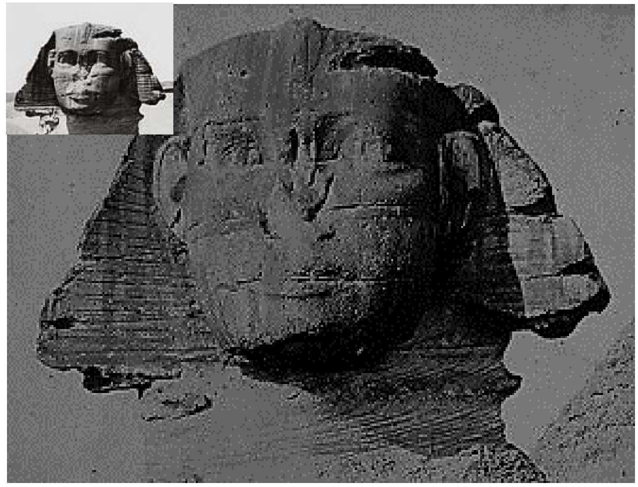

Figure 10: (L) The Sphinx before partial restoration from a distance. (R) The unrestored sphinx at higher resolution and different sun angle

These effects of erosion, due to the same environment that could foster intelligent life, make the determination of whether an object's appearance is a product of intelligence or a "plaything of nature", and thus a false alarm, ultimately a "judgment call." Such a "judgement call" draws, of necessity, from a vast array of data about Mars, Earth, and the cosmos itself, with the ultimate motive of maximizing chances of long term human survival. As will be shown however, the Cydonian Hypothesis, has now been confirmed by new imaging and geochemical data from Mars.

V. Cydonia Mensa

The Cydonia region of Mars was the Prime Landing site of the Viking expedition to Mars in 1976, directed by the Jet Propulsion Laboratory. It is terrain formed recently in geologic time on Mars, as evidenced by its sparce cratering and proximity to the Paleo-Ocean shoreline. It was chosen as the Prime Viking landing site because of its geography as a place where water vapor from the North polar cap could penetrate far South, to near the equator, in the Mare Acidalium depression, making Cydonia a good place to look for life. However, Cydonia was ruled out for a soft landing as being too rocky and another site in Utopia Planum was chosen instead. Despite this, a discovery would be made in Cydonia that would change how we viewed Mars.

On July 25 1976 Dr. Tobias Owen, then a graduate student, discovered the image of the Face in Cydonia on Viking frame 35A72 The picture was taken near local sundown, in order to maximize relief in the Cydonia region of Mars. The location of the Face on a Mars map is shown in Fig. 11 below.

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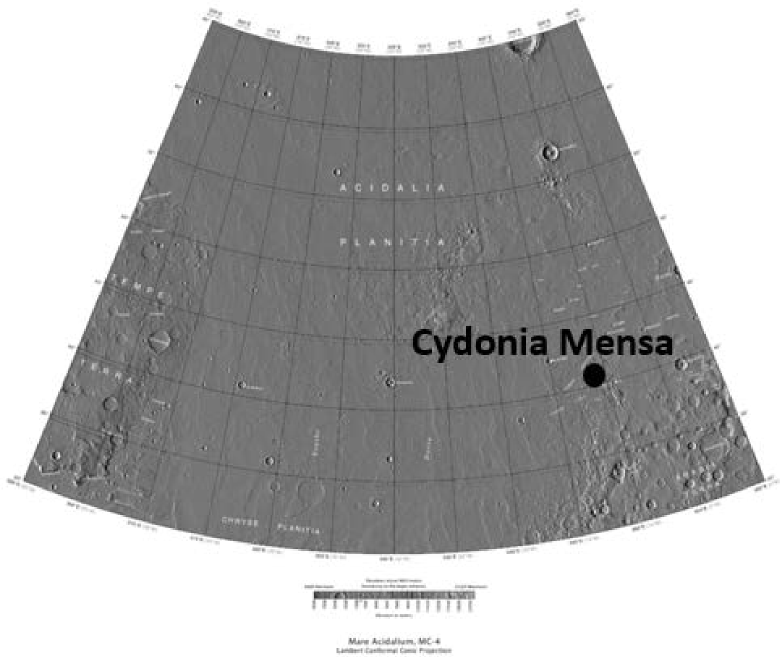

Figure 11: Map of Cydonia Mensa region showing the approximate location of the Face

The provocative image was publicized under the NASA descriptor "Head" at a JPL press conference, and created a sensation, resembling the Sphinx in Egypt or an Olmec head carving (Fig.9), complete with a frame corner where the face is framed by the helmet. However, the Viking scientists dismissed it 'a trick of light and shadow.' In a pattern of behavior that was to be repeated continually in the following decades, JPL announced that another image was taken a few hours later that showed nothing. This was deliberate misinformation because Cydonia would then have been in darkness and no image could be taken. In reality, JPL waited for 30 orbits (roughly 4 weeks) before reimaging the Face in Cydonia on frame 70A13, at local early-afternoon lighting, and never announced that a second image had been obtained. This established a pattern of misrepresentation and evasion by JPL concerning this matter, which continues to this day.

Vincent DiPietro and Greoory Molenaar, two image processing experts working at NASA's Goddard Space Flight Center, far from JPL, seized on the discovery frame of the face in Cydonia, and obtained it in electronic form and enhanced it. They also discovered the second image of the face in Cydonia on Viking frame 70A13. They also discovered a pyramid like object on three frames, within 10km of the face (Fig. 11.) When enhanced and the two images of the face compared, the results were stunning. The face in Cydonia appeared to be a symmetric carved face in a helmet (Fig. 11).

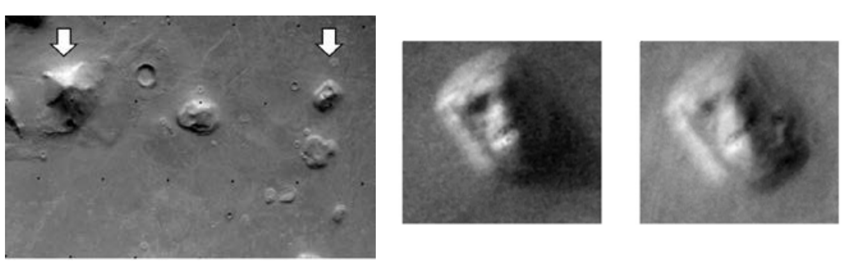

Figure 12: (L) Viking image 70A13 showing the Face in Cydonia and the nearby D&M Pyramid indicated by arrows. (R) Images of the Face from Viking 35A72 and 70A13 respectively.(Courtesy Mark Carlotto)

Inspired by The work of DiPietro and Molenaar, a group of scientists and engineers called the IMIT (Independent Mars Investigation Team), was organized by a science journalist Richard Hoagland, [11, 12] to investigate further. In a superb bit of "guerrilla science" the IMIT team investigated Mars science in the winter and spring of 1984 and reported their findings at the seminal 1984 Case for Mars II conference in Boulder Colorado. Further analysis of the two Viking images of the face by Mark Carlotto, revealed what appeared to be forehead "helmet ornamentation' [13] (see Fig. 11). He also developed 3D "shape-from-shading" models of the face [14], showing the object to be basically domelike in geometry.

As discussed earlier, erosion is the natural consequence of any Earthlike environment. That is: the same environment that would allow humanoid life forms to carve large artifacts on Mars also erases them in time. Thus, eroded artifacts, provided they contain enough surviving detail to be identified as artifacts, are what we would expect to find if Mars was once a Mars-Gaia and supported intelligent life before its catastrophic (that is - brief on geologic timescales) transition to its present climate.

Thus, the presence of erosion, particularly by liquid water, while creating difficulties in studying details of the artifacts, also supports the Cydonian Hypothesis because it demonstrates the climatic conditions, consistent with Earth-like artifacts, existed on Mars in recent geologic history. Thus, under the Cydonian Hypothesis any artifacts must bear signs of erosion. However, on any archeology, details are still apparent despite erosion, to betray its origin.

VI. New Imaging Data from Cydonia Mensa

Mars Odyssey imaged the objects in Cydonia beginning in 2004, but at slightly better resolution than Viking and at similar lighting and viewing geometry. These images confirmed its face-in-a helmet basic structure. As seen in Fig. 13.

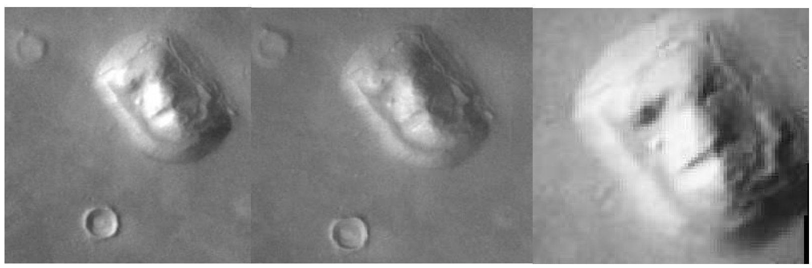

Figure 13: Mars Odyssey images (L-R) V10598012 (L) V1024003 (middle) and V12445004 (R), imaged in years 2001-2005, of the face in Cydonia taken under similar viewing and lighting conditions as the Viking images. Note helmet ornamentation and circular crater beside the face

However, before this, occurred, the face at Cydonia was first imaged by the Mars Global Surveyor, after appeals to NASA from Professor Stanley McDaniel [15] of the SPSR (Society of Planetary SETI Research) and,equally important, "death bed " appeals by Carl Sagan that the Face be investigated as a valid scientific issue.[16] The new image , was taken , but at much different viewing and illumination conditions than the Viking images (see Fig. 14) and released with great fanfare but without any explanation of these differences of viewing conditions or even contrast enhancement, apparently in an attempt to mislead the public and scientific community [17]. This poorly enhanced image has been termed the "cat box" image, because of its resemblance to an object in cat litter box.

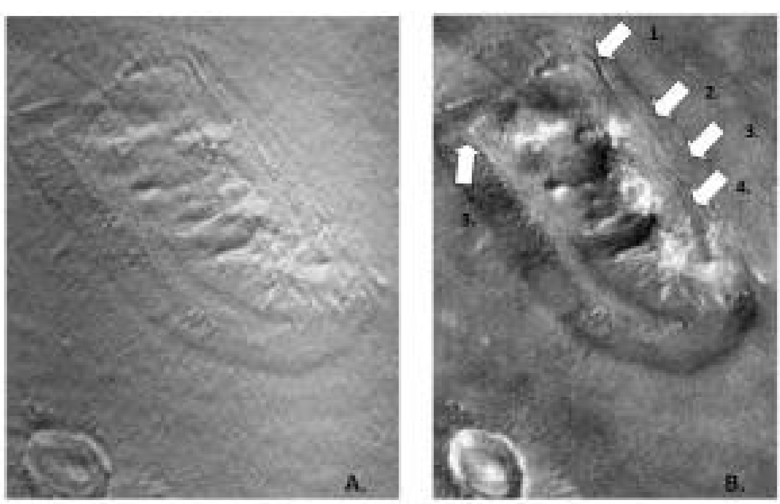

Figure 14: A and B. (A) Poorly enhanced "cat box" MSSS image (P220-03 NA image) released 5 April 1998 (B) Enhanced version by Mark Carlotto showing 1. Helmet ornaments, 2. Eyes, 3. Nostrils, 4. Mouth 5. Helmet Frame-corner. Note elliptical shape of crater beside face confirming oblique viewing angle. (Courtesy Mark Carlotto)

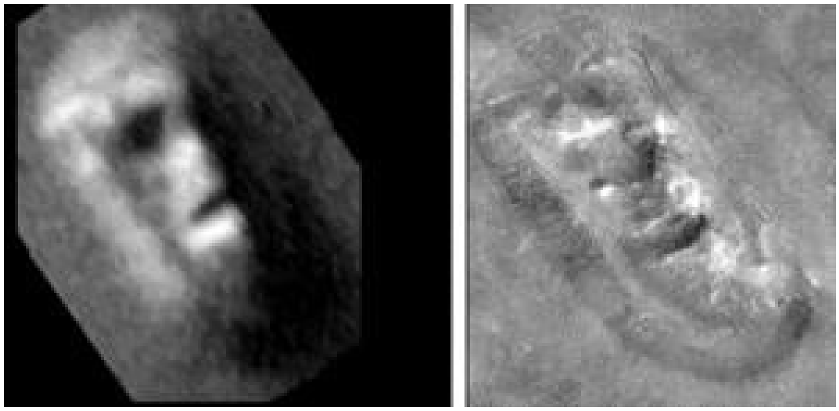

Figure15: Carlotto shape-from-shading 3-d model derived images showing expected view of the Face from Viking data (left) at MSSS image viewing angle versus (right) enhanced MSSS image (Courtesy Mark Carlotto)

Using the three dimensional shape-from-shading model developed by Mark Carlotto, it was possible to rotate the oblique image to give an approximate view of the object in the illumination it experienced, as if viewed from above, as on the Viking images. When this was done, the presence of helmet ornaments, predicted by Carlotto, and nostrils, as well as the overall symmetry of the Face was confirmed. (Fig. 16). Thes enhanced images were presented at a scientific conference shortly after the "cat box" image was released. [18]

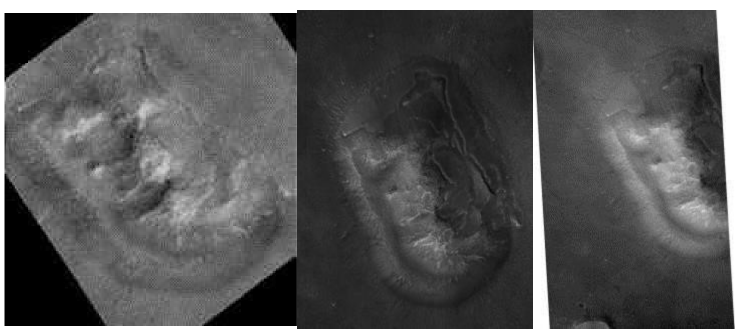

Figure 16: (L) The P220-03 NA face image rotated using a 3-d model of the Face from Carlotto shape-from- shading model. (R) S1501533 MOC image and E10-03730 with visible erosion, eyes, nostrils, mouth, and helmet ornaments and clear helmet-frame corner

Finally, full frame images of the Face were obtained under various illumination conditions, confirming both overall symmetry, anatomical completeness and the presence of nostrils and helmet ornaments. (Fig. 17)

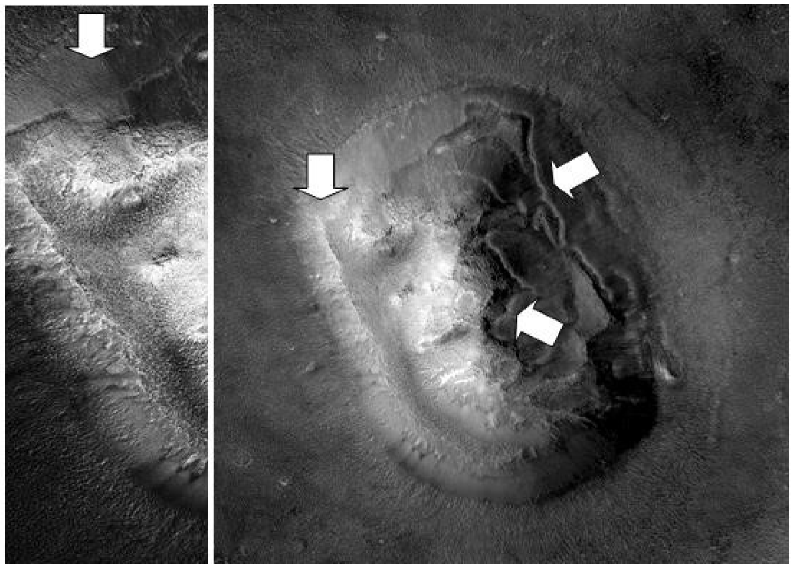

Figure 17: (L) MOC image M16-00184 showing part of the face. (R) MOC image MOC image E03-00824 showing (arrows) eyes, nostrils, frame corner, and helmet ornamentation

Despite obvious erosion, the eyes, nose, mouth and helmet ornamentation are clearly evident.
The D&M pyramid was also imaged (Fig.18, 19) and appears to show a masonry collapse zone.

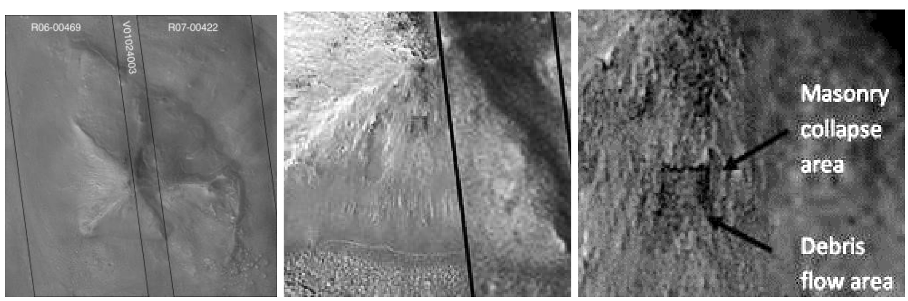

Figure 18: (L) High resolution composite image of the D&M Pyramid with MSSS frame numbers. (R) Enlargements of apparent collapse zone of masonry

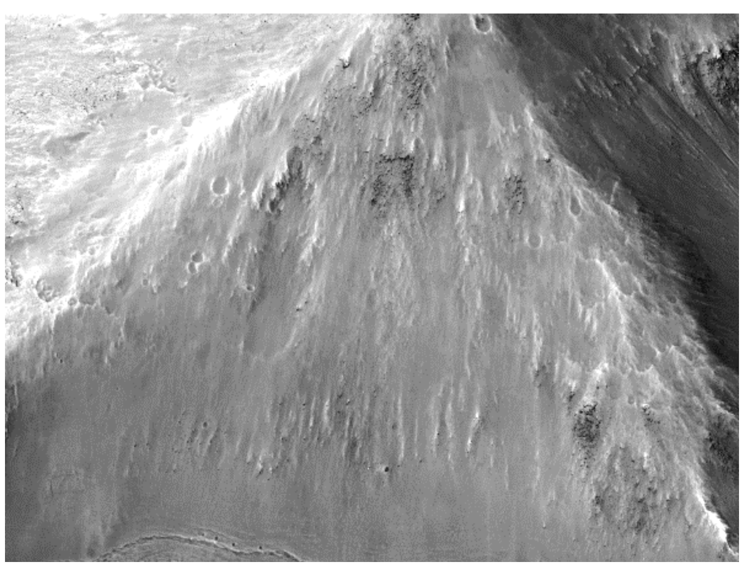

Figure 19: Second image of “masonry collapse zone” on D&M Pyramid in Cydonia Mensa from MRO frame # 42318

Therefore, the new images of the two most provocative objects in Cydonia Mensa, allowing for erosion that affects all Earthly archeology, strongly confirm the Cydonian Hypothesis, which, based on observations of Earthly archelogy, states that the objects would show increased anatomically and architectural details at higher resolution "despite erosion." The fact that it also shows erosion confirms that that were created in time when Mars had more Earthlike climate and erosion rates.

Other numerous objects at the Cydonia Mensa site, less extensively imaged, are never-the-less, very interesting and are shown and discussed at length in the book *Monuments of Mars* by Richard Hoagland [11] and elsewhere.

It must be said that Mars is large, with many landforms on many different terrains, giving many opportunities for "false alarms": objects appearing to be artifacts in low resolution images, but appearing completely natural at higher resolution. However, even the human visual system's susceptibility to occasional false alarms is there because it conferred survival ability. It must also be said that given the whole of our present knowledge about Mars, Earth, and the cosmos, finding even *one single confirmed artifact* of a past civilization on Mars must provoke a "sea change" in our thinking about the cosmos and our place it. As has been shown, we now are confronted with two distinct objects at Cydonia Mensa which appear, despite obvious erosion and on closer examination, to be products of intelligent activity. Nor, as will be shown, are these objects isolated artifacts on Mars. At Galaxias Chaos on Mars, a collection of what appear to archeological objects also appears to exist.

VII. New Imaging Data in Galaxias Chaos (Utopia)

Based on the site of the Cydonia Mensa objects, a search was made of a similar site on Mars in the Utopia region (see Fig.20), (now called Galaxias Chaos by NASA) and pictures obtained, sight-unseen, they revealed a similar site as Cydonia Mensa , but with two apparent faces. The faces (here called Galaxias and Chaos) (Fig. 21) were discovered by the author on Viking frame 86A10 [12] and subsequently investigated further using Viking image frames 541A453 and 243S01 and other lower resolution frames. These images confirmed the face-like structures seen in Viking image 86A10.

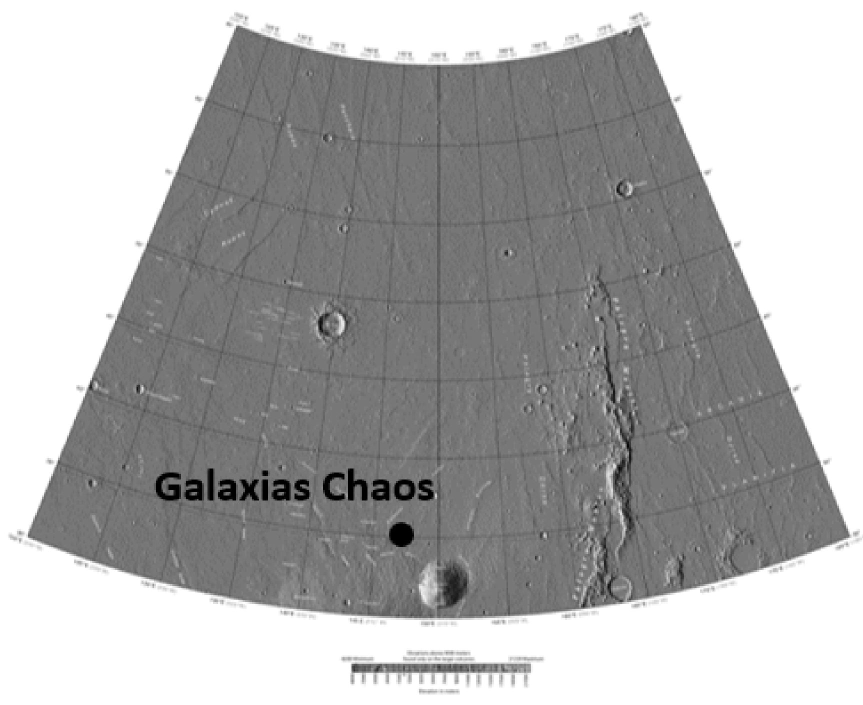

Figure 20: A map of the Utopia region showing the approximate site of Galaxias Chaos Faces

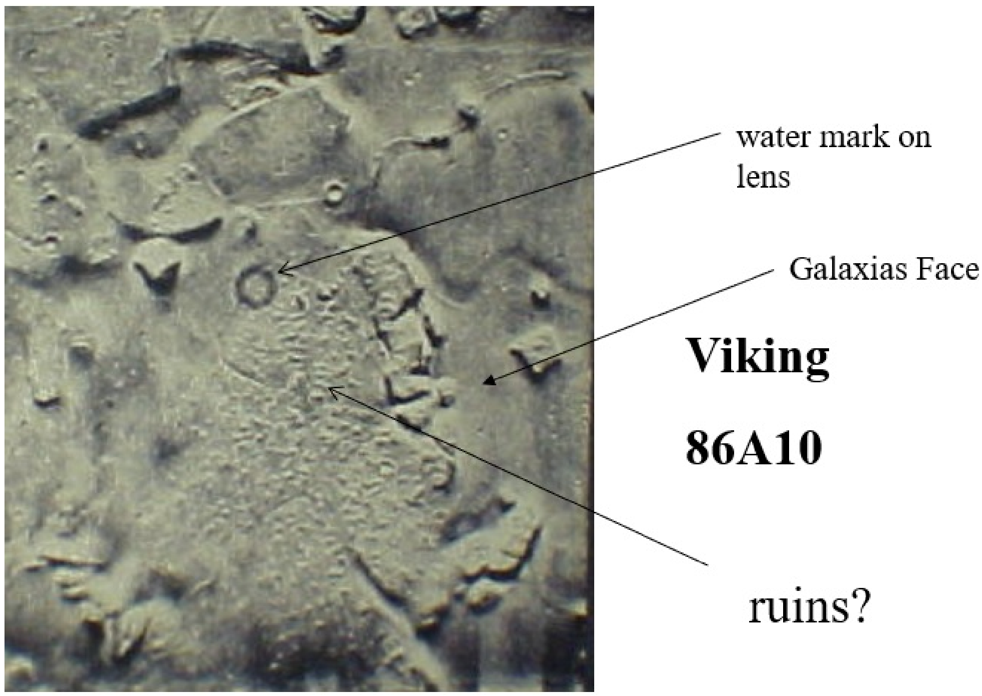

Figure 21: A portion of the Viking image frame 86A10

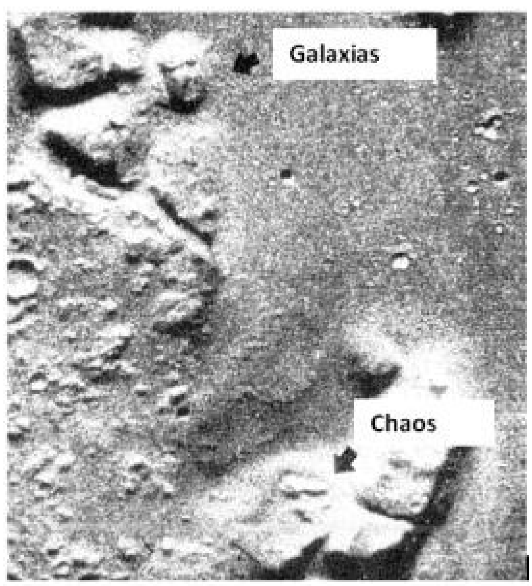

Figure 22: An enlarged portion of the Viking image frame 86A10 showing the what appear to be two faces, the upper one (Galaxias) strongly resembling the face at Cydonia and the bottom one (Chaos), apparently, based other Viking images, of much lower relief

The objects were discovered by the author using an archeological site model developed at Cydonia Mensa to find a similar site. Face Galaxias resembles the face in Cydonia, though on approximately 2/3 scale. The face appeared complete, with two eyes, nose, mouth, and helmet like the Cydonian face. It was noted in the original publication of the Cydonian Hypothesis [4] that the object most resembling the Face in Cydonia shared apparent ornamental details (see Fig. 23) with the Face at Cydonia. Because of this, and its numerous new images, it will be the focus of our analysis at Galaxias Chaos.

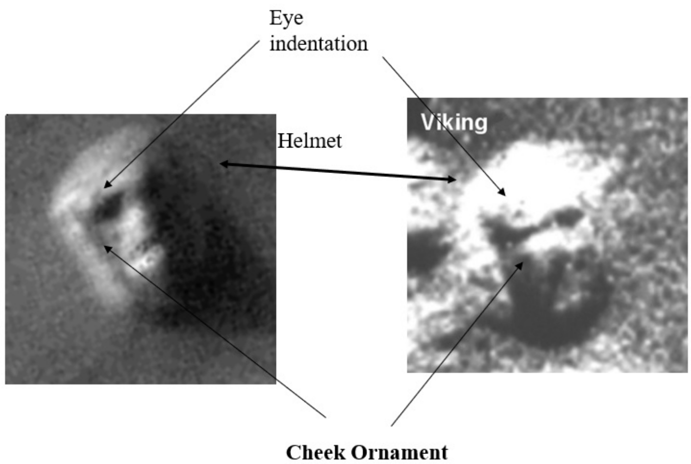

Figure 23: A comparison of the Face at Cydonia and the Face of Galaxias, showing apparent shared details

A new image, discovered by Walter Hain of Germany, (private communication) was obtained by the Mars Odyssey and is shown in Fig. 24. As can be seen it confirms the face-like structure of the Face of Galaxias and the shared ornamental details with the Face of Cydonia.

Other objects at the Galaxias Chaos site, such as the lower relief, Face of Chaos, are less extensively imaged, but very-never-the-less, very interesting and are shown and discussed at length in the author's book *Death on Mars*. [19] Shown below is one of the recent images of the Face of Chaos object from Galaxias Chaos. It is of lower relief and thus more subject to erosion, yet still confirms the overall face structure.

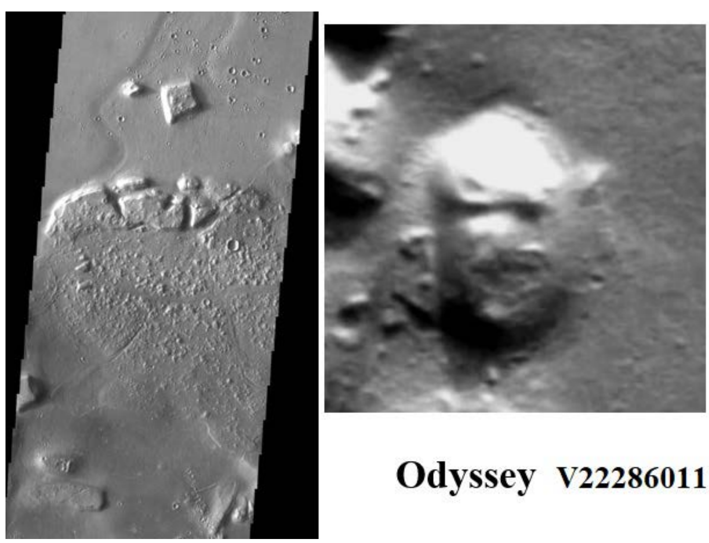

Figure 24: A new image of the Face of Galaxias taken by Mars Odyssey

Several new images of the Galaxias Face A have been obtained, they confirm its overall resemblance to the Face in Cydonia : face-in helmet structure, ornamental details and presence of erosion (Figure 25and 26) .

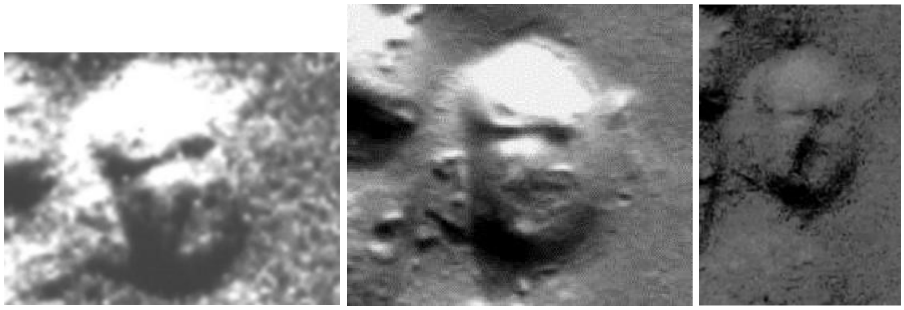

Figure 25: (L) Galaxias Face, from Viking image 86A10. (L) Galaxias Face A, 2006 MARS ODYSSEY image V2228601 and from Mars Express High Res image H5406_0001_ND3.

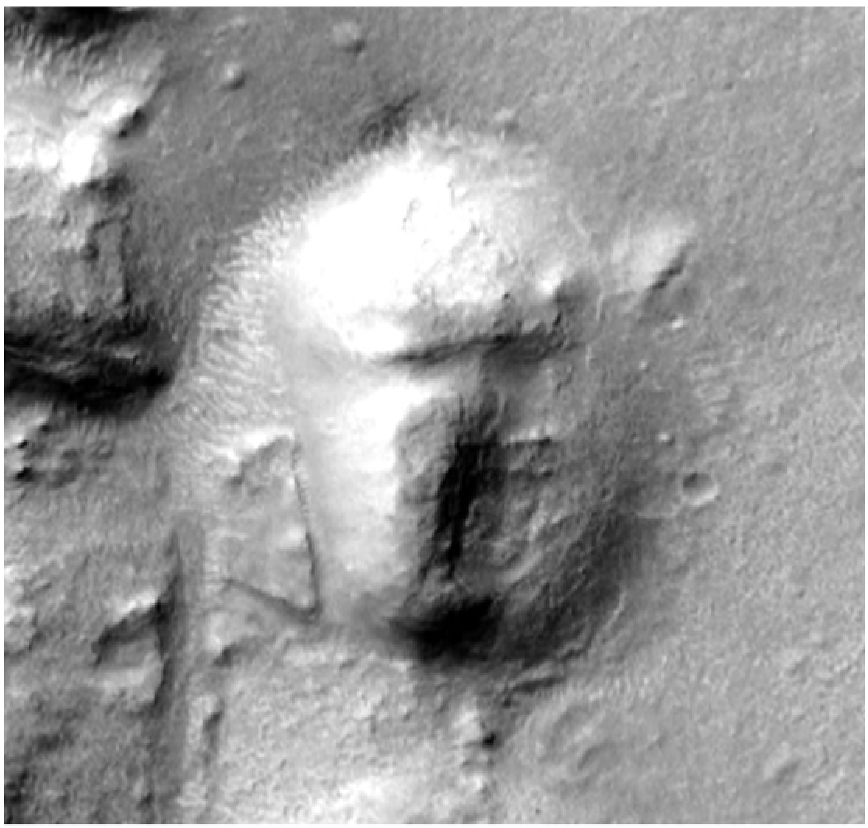

Figure 26: MRO orbiter image of the face from CTX:P04_002714_2144_XI_34N212W of Galaxias at different lighting. Note the right lower part of the face-shaped object has apparently collapsed, due a mass wasting event, to a lower level than the rest of the object.

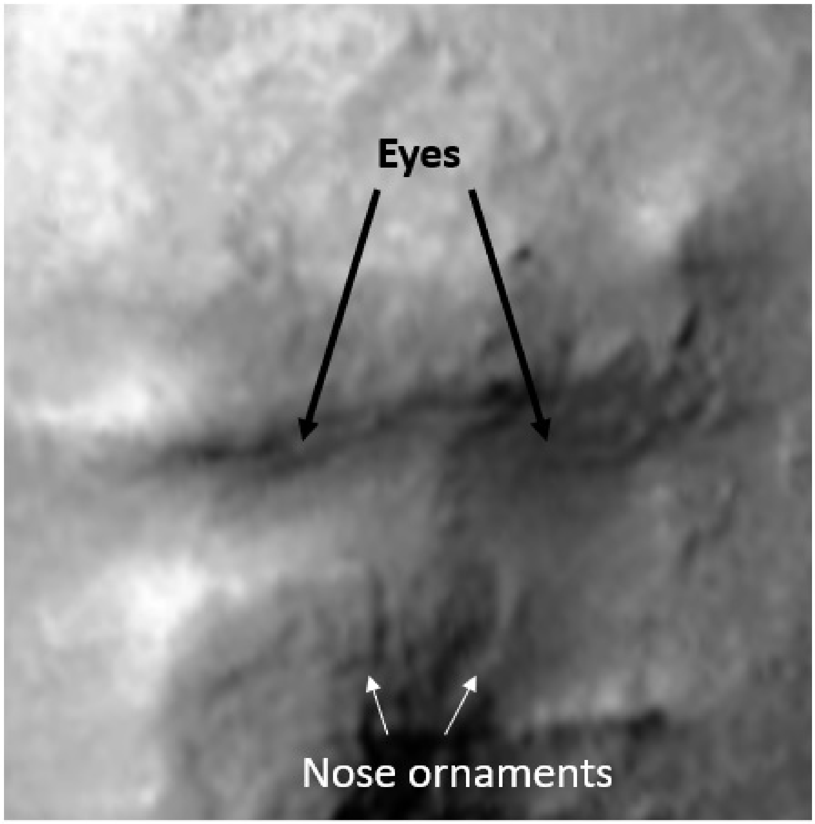

Figure 27: A portion of the MRO orbiter image of the Face of Galaxias at different lighting.Note the apparent symmetrical nose ornaments

Other objects at the Galaxias Chaos site, such as the lower relief, Face of Chaos, are less extensively imaged, but, -never-the-less, very interesting and are shown and discussed at length in the book *Death on Mars*. [19] Shown below is one of the recent images of the Face of Chaos object from Galaxias Chaos.(Fig. 28) It is of lower relief and thus more subject to erosion, yet still confirms the overall face structure.

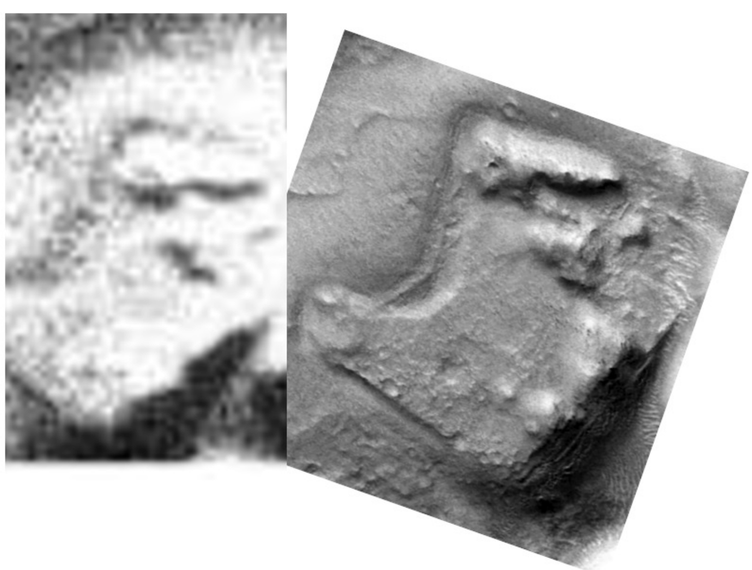

Figure 28: The lower relief Face of Chaos imaged by Viking in 86A10 and a high resolution by MRO inCTXP17_007685_2133_XN_33N211W

Therefore, the numerous new images of Galaxias Face A or "Galaxias" appear to strongly confirm the overall resemblance of the object to the larger Cydonia face and also confirm shared details. This, along with the nearby D&M Pyramid at Cydonia, reinforces our perception that the Cydonian face is eroded archeology, dating from an extended Earthlike period of Mars climate. The Cydonian Hypothesis is thus confirmed.

Many other strange objects have now been imaged on Mars, a subset of which may represent actual artifacts of the Cydonian culture. This array of data is too extensive to be discussed here, however, interested readers are encouraged to familiarize themselves with their existence in the literature [20, 21].

VIII. Summary and Discussion

Higher resolution images of the face and D&M pyramid in Cydonia Mensa showing apparent brickwork and,despite erosion, new anatomic and artistic details not seen in Viking Images, and the new images of the face "Galaxias" in Galaxias Chaos (also called the Utopia site), that confirming its similar structure to the face in Cydonia Mensa as well as new details suggesting brickwork, the author now concludes that the Cydonian Hypothesis has been confirmed. It was the simplest hypothesis that could be proposed that interpreted the objects as archeological, because it only assumed that Earth and humanity were not remarkable but part of the natural processes of the cosmos. That is, apparent eroded archeology exists from a dead indigenous civilization on Mars at several sites, consistent with a long-lived and evolved biosphere on Mars in the past, as on Earth. This monumental discovery on Mars is made in the name of the entire SPSR, because of their joint efforts that enabled this discovery.

The existence of a dead humanoid civilization on Mars is completely consistent with its apparent long-live Earthlike past climate and the Principle of Mediocrity[2], the idea that humanoid intelligence is not exotic or miraculous, but is a natural consequence of any long lived Earthlike biosphere. Based on an Earth-normative reference, this civilization appears to have been primitive, approximately bronze age, however its exact technological level must be presently considered unknown. Therefore, access to the ruins must be considered a space security priority. This Martian civilization apparently perished due to a planet-wide environmental catastrophe. that changed Mars climate from being Earth-like, to its present state in a brief period compared to geologic time. However, what ended this civilization? We cannot afford to dismiss or ignore this body of evidence indicating not only a past humanoid civilization on Mars, but also its death.

A large impact for the nearby asteroid belt could have possibly occurred, forming the Lyot impact basin, and devastating the planet Mars. However, data also exists suggesting massive nuclear explosions may have also occurred on Mars in the past [22] , so this is a dreadful puzzle. That the Cydonian Hypothesis is correct, has been strongly established indicating that Mars was once an Earthlike living planet complete with a long lived Paleo-Ocean. That two humanoid civilizations could emerge independently in one planetary system makes Fermi's Paradox even more acute. The next immediate question is, what then killed Mars? Is it possible that, on Mars, we now have the answer to Fermi's Paradox, his great question: "Were the hell are they?"Could they be largely dead like Mars? Our own existence and habits, along with the Principle of Mediocrity naively suggest the cosmos around us should be lively, and full of radio-noisy neighbors, but instead it is silent. Do civilizations such as our own have a short lifespan? Does Mediocrity also suggest the universe is not only lively but can be deadly?

The Astronomer Edward Harrison suggested one major factor cutting short the lifetime of young civilizations was older predatory civilizations who would wipe out young civilizations once they became detectable through radio broadcasts. The motivation for such genocidal actions would be to avoid later competition [23].

The discovery of a dead civilization on Mars, whose end was apparently catastrophic and due to unknown causes, reinforces our understanding that the cosmos can be a dangerous place and requires a vigorous response from the human race, to reduce the probability that we will perish the same way. A large asteroid impact forming the Lyot impact basin, causing, at least a temporary collapse of a Mars greenhouse system, is a hazard of the cosmos that we were aware of, and can prepare for, and was formerly considered the cause of the demise of any Earthlike Mars biosphere [1]. Such a catastrophic impact would be understandable as merely bad luck, given Mars proximity to the asteroid belt. However, the second possible catastrophe, a pair of large and anomalous nuclear events, centered apparently near Cydonia and also near Galaxias, and leaving no craters, indicating airbursts, appears to more fully match our present full scope of data at Mars. For this reason we must rapidly maximize our knowledge of what transpired on Mars, and this requires an immediate human mission supported by the ISS international consortium. Knowledge is our best defense against the unknown.

Therefore, we have discovered a dead primitive, humanoid civilization on Mars that perished due an unknown catastrophe. It is therefore recommended that "Mars Emergency" be declared and an urgent effort be mounted by the US government, in concert with the ISS consortium, to place astronauts on Mars as soon as possible, at the two sites, Cydonia Mensa and Galaxias Chaos to maximize knowledge concerning this discovery.

In summary, Mars has been found to have been the site of intelligent humanoid life, and its possibly catastrophic death. This makes the cosmos is both highly interesting and full of warning. Again, it is recommended that an emergency international human mission to Mars be prepared including archeologists in the crew manifest. Rovers and other robot space craft can prepare the way for such landing at Cydonia Mensa, with additional landings at Galaxias Chaos and other areas, being made to maximize knowledge.

Given what may lay on Mars, in a Mediocre and anomalously silent universe we must do, with dispatch, what is necessary to maximize chances of long term human survival in a cosmos that is beautiful, fascinating, and dangerous.

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Quantization Essence

By Stanislav Ordin

Abstract- Ideal Resonance does not fade, and thus, it is, as it were, out of time. So the corresponding Planck QUANTUM, which determines the STATIONARY Allowed States of Energy, is simply a reflection of the Ideal Resonance. which "Quantum Mechanics" used on the example of the Mechanical Harmonic Oscillator. And the fundamental difference of QUANTUMS is only that for frequencies not equal to zero and their minimum energy of the Resonance-Quantum has a finite, non-zero initial value, which also determines the minimum distance between the allowed energy levels. At the same time, the internal structure of the QUANTUM can be not only electromagnetic, like Planck's, and not only acoustic, like Einstein's, but also be determined by the so-called de Broglie matter waves. But, in order to remove any mysticism from QUANTUMS, one must UNDERSTAND that the DUALISM introduced by them is determined by Pontryagin's functional connection of the ELEMENTARY PARTICLE and the Packet of Waves that form it.

Keywords: resonance, harmonic oscillator, quantum, pontryagin dualism.

GJSFR-A Classification: LCC: QC UDC: 53 DDC: 530

QUANTIZATIONESSENCE

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Keywords: resonance, harmonic oscillator, quantum, pontryagin dualism.

I. Introduction

In the works included in the book "FOUNDATIONS of Quantization Principles" a detailed, scrupulous analysis of a number of aspects of Quantization is given. His main task was to fish out fundamental errors in the historical "turns of thought", which led away from the real Quantization. If Max Planck himself went to Quantization on the way to eliminate the Divergence, "scientifically" called the Singularity, then the modern "Quantum Theory" actually came down to the search for Divergences and, thereby, from avoiding Reality into Mysticism. So the book provides the identification and, if possible, the strict elimination of the theoretical mysticism of Divergences - Singularities, modestly called by Pearls "Surprises" [1].

But these "Surprises" are nothing more than the limits of applicability of the mathematical formulas used, and, often elevated to the rank of "Discoveries", only led away from Reality into Mysticism, veiled by scientific appearance. Here are the presented beginnings of modeling in the right direction and allowed us to formulate the ESSENCE of Real, and not Mystical Quantization. And, if we highlight the main finishing elements of the works presented in the book, then this ESSENCE, in contrast to Mysticism, based on what is not given to UNDERSTAND, is quite SIMPLE-CLEAR. At the same time, instead of interpreting the imaginary solutions of the Schrödinger equation, it returns the very UNDERSTANDING of the ESSENCE of Quantization given by the brilliant Planck as an undamped resonance of waves. And it is necessary to eliminate mysticism from the entire modern "Quantum Theory", which now gives a continuous "quantum bluff" [2, 3, 4], disorienting not only scientists, but also ordinary people.

II. Resonances

Allowed Quantum States, as Planck himself introduced them for radiation, calling them Quanta, are undamped resonances. Electromagnetic resonances in various media are well known - these are standing electromagnetic waves. At the same time, Planck realized that each length of the resonant wave corresponds to its minimum amplitude and, accordingly, its minimum energy. Both the first, minimum energy, and subsequent ones, since waves can, if they are in phase, adiabatically add up in a given region of space, can be written in the following form:

$$E_1 = h\nu_1 = \hbar\omega_1 = \hbar 2\pi \frac{1}{T_1} = h\frac{c}{\lambda_1} \Rightarrow E_n = nE_1 \quad (1)$$

We will not dwell on the displacement of antiphase waves from a given region of space to neighboring ones and on electrostatics.

And for any traveling waves, the law of their dispersion can be written - the dependence of their energy on the momentum, which can be written in accordance with formula (1) in the form

$$E_n^i = n \cdot c \cdot \left|\vec{p}_1^{\,i}\right| = n \cdot c \cdot \hbar \cdot \frac{2\pi}{\lambda^i} = n \cdot c \cdot \hbar \cdot k_1^i \quad (2)$$

where c is the phase velocity of the wave (the speed of light for electromagnetic waves or the speed of sound for acoustic waves), the wave vector differing from the impulse by the Planck factor is usually called the quasi-momentum.

So, for an extended medium, quanta are resonant waves, which are marked with dots on a series of dispersion dependences for waves in a medium (Fig. 1a)

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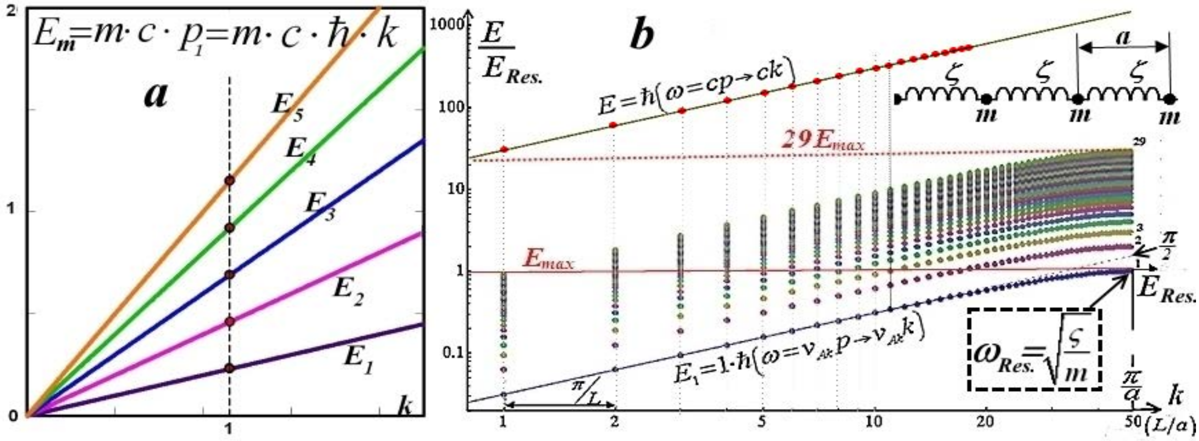

Fig. 1: Dispersion dependences of waves in a medium (lines) and resonances arising on them (points): a - near the first resonance, b - in the entire Brillouin zone for a medium with a size of 50 translation periods (bottom - for acoustic waves, top - for electromagnetic waves without taking into account their interaction with local fluctuations of the medium)

But the purely mechanical resonance, to which Einstein extended the Planck Quanta, was mathematically analyzed by Newton, using the Differential Calculus developed by him.

And for any medium, the linear dispersion law (f.2) corresponding to a harmonic wave is violated at large impulses and goes to an asymptotics determined by a certain local region - the translation period and the local resonant frequency (Fig. 1b). For solids, this is the size of an elementary cell and the frequency of atomic or molecular vibrations in it, described by Newton's solution for the Harmonic Oscillator. The increase in the amplitude of these local oscillations and, accordingly, their energy, according to Planck, is stepwise.

Those. an increase in the amplitude of the Harmonic Oscillator is an increase in the number of corresponding high-frequency acoustic quanta, which leads either to the melting of the entire crystal or to local destruction of the molecule (which is usually associated with each other). This local resonant frequency is also felt by optical quanta in a crystal, while in an optically active one they are absorbed and excite the noted mechanical vibrations. In this case, the dispersion law for light intersects with the maximum energy for the first acoustic oscillation (much to the left of the pulse region shown in Fig. 1b, since the light pulse is very small) and, similarly, at large pulses, the dispersion and photons saturate. But the presence of this optically active local resonant frequency, in accordance with the principle of causality, changes the phase velocity of light at all frequencies below the resonant one, which manifests itself in an increase in the refractive index of the medium at low frequencies (the Kramers-Kronig relation). Similarly, we can assume that the minimum spatial size and the corresponding resonant frequency also exist for electromagnetic waves in vacuum (to the right of the region of impulses shown in Fig. 1b). and that it is precisely this, with a large number of corresponding quanta, that leads to the splitting of the vacuum with the formation of a particle and an antiparticle.

But when exciting waves both in a Solid Body and in vacuum, it must be taken into account that Newton received only a Particular Solution for the Elementary Harmonic Oscillator A, as analysis showed [5], and the Partial Solution he himself obtained, as well as its subsequent rough addition in order to obtain the General The solution under the action of a driving force at a frequency different from the resonance one, strictly speaking, does not take into account natural oscillations at the resonance frequency. Newton, by reducing (by the method of separation of variables) a differential equation to an algebraic one, simplified it and, thereby, considered the excitation of oscillations only at the frequency of the driving force. And for small attenuations, the Harmonic Oscillator and its own oscillations make a significant contribution to the spectral dependence of the total oscillation amplitude (total interference), in principle, in an infinite frequency range. For the Ideal case, the total oscillation consists of the interference of two harmonics, each of which has its own frequency dependence of the oscillation amplitude:

$$x''[t] + x[t] = Sin[\omega \cdot t] \quad \Rightarrow$$

$$x[t] = \frac{\omega\, Sin[t] - Sin[\omega \cdot t]}{-1 + \omega^2} = \frac{\omega}{-1 + \omega^2} Sin[t] - \frac{1}{-1 + \omega^2} Sin[\omega \cdot t] \qquad (3)$$

where the resonant frequency and amplitude of the driving force are assumed to be unity.

The frequency of the harmonic described by the first term of the complete solution without damping is a constant equal to the resonant frequency, and the frequency of the second harmonic is equal to the variable frequency of oscillations of the harmonic driving force (Fig. 2).

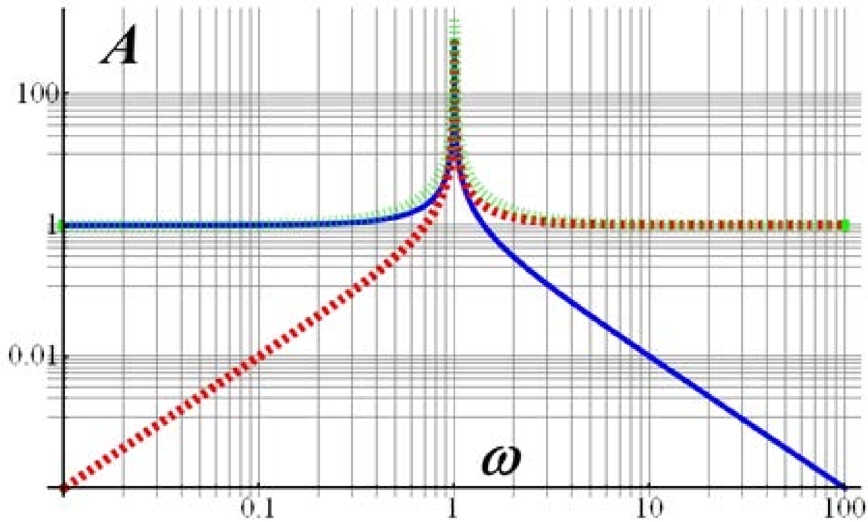

Fig. 2: Frequency dependences of amplitudes of oscillation harmonics of the Ideal Mechanical Oscillator: blue curve - classical, red dotted curve - missing, proper resonant, green dotted curve - the sum of these amplitudes

In this case, the frequency dependence of the second harmonic completely coincides with the frequency dependence of the amplitude of the oscillations of the Harmonic Oscillator, obtained by the method of separation of variables by Newton (Fig. 2, blue solid curve).

Whereas the first, skipped harmonic of OSCILLATIONS AT RESONANT FREQUENCY, which gives a small additive (response) at a frequency of the driving force below the resonant one, gives a giant additive at a frequency of the driving force greater than the resonant one (Fig. 2, red dotted curve).

The Newtonian term determines, as a consequence of RESONANCE, the change in the properties of the crystal at frequencies below it. Whereas the missing term defines RESONANCE as a consequence of the driving force at frequencies above it!

And at low attenuation, the relative contribution of the missing term is the greater, the higher the frequency of oscillations of the driving force. Strictly speaking, not up to infinite frequencies - up to a frequency reciprocal of the attenuation. But. strictly zero damping leads to nonphysical properties of the obtained solutions. But we will not dwell on this here.

The omitted first term actually explains both the flutter and the photoelectric effect described by Einstein as the interaction of a particle of Newton's light with the resonant levels of an electron in an atom for any Planck quanta whose energy is greater than the potential barrier, and in general - optical transitions. True, because Since the momentum of the photon is very small, then the excitation of the electron must occur, in accordance with the law of conservation of momentum, from a state with an initial momentum equal to the final one, which is described by the law of dispersion of electronic waves, which is constructed similarly to the law of dispersion of acoustic waves.

And finally, when translating the Classical model of the Harmonic Oscillator into the space of operators, Schrödinger also did not take into account this first term of his Own RESONANCE. This determined the discrepancy between the calculated levels of allowed energies and the experimental values of ionization potentials, which catastrophically increases with increasing atomic mass. And since Schrodinger's calculations need not a small correction, but fundamental corrections, by orders of magnitude, they cannot be used as basic ones [6, 7, 8].

III. Dualism

The fact that one and the same object can manifest simultaneously both the properties of a particle and the properties of a wave was initially supposed to be UNDERSTANDING. In fact, this “quantum-mechanical mysticism” was decided to simply ACCEPT. Adopted, among other things, for the photons that “generated” DUALISM [9]. Whereas this MISSION is simply a consequence of the fact that the particle was considered without an internal structure and as an infinitesimal Newton point or as a region of space with infinitely thin Heaviside boundaries [10]. This for photons, after the creation of lasers, became in fact

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obvious, but the development of MYSTICISM by Schrödinger led to UNDERSTANDING the generality of the problem of DUALISM. But Schrödinger actually wrote the operators used in the equation of the Harmonic Oscillator with a simple enumeration. Whereas Pontryagin then built a rigorous theory of DUALISM of Functional Sets. And it's up to the "small" - a new senior telegrapher Heaviside is needed, who will transfer Pontryagin's Theory to mathematical physics.

If, however, any ELEMENTARY particle, not only a photon, but, say, an electron, is represented not as the Ideal Newton Point or the Ideal Heaviside Impulse filled with de Broglie waves, but a blurred (exponentially decreasing in amplitude from the center) packet of these waves, then, in principle , the contradiction between the partial and wave descriptions of phenomena is removed. Moreover, from the parameters of the envelope of the wave amplitudes inside the particle, both the Heisenberg Uncertainty Principle and its "radio engineering" MEASURABILITY directly follow (Fig. 3)

$$\Delta\varphi_x = \Delta x \cdot \Delta p \geq \frac{\hbar}{2} \quad \Leftrightarrow \quad \Delta\omega \cdot \Delta t = 2\pi \qquad (4)$$

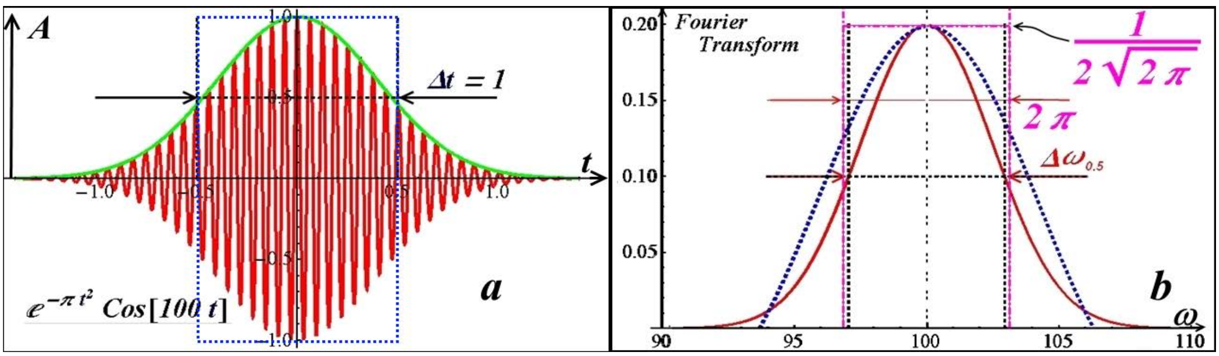

Fig. 3: The filling of an exponentially smeared individual pulse with oscillations with a circular frequency equal to 100 (a) and the corresponding packet of pulse filling frequency harmonics (b): red curves for a smeared pulse, blue dotted curves for an ideal Heaviside pulse (the first frequency packet from an infinite series of bands).

"IMMEASURABLE" are only the energy states between Planck's QUANTUMS. But these are non-resonant rapidly decaying, so-called Forbidden States, not only for a photon, but for any, in principle, particle.

So the representation of a particle by a packet of resonant waves corresponds both to the manifestation of the wave properties of particles during the diffraction of their flow by a slit, and, in strict accordance with Pontryagin's Dualism for functional sets, and the Heisenberg uncertainty principle for an ELEMENTARY particle. It simply manifests itself when the size of the particle is commensurate with the lengths of the waves that form / fill it. Whereas in the usual macroscopic scale that we observe, either the particles forming a wave are much smaller than its length, or the size of a macroscopic body is much larger than the wavelengths of the particles filling it. Or, as in the same lasers already mentioned, all QUANTUMs are in phase, forming a coherent (continuous) wave.

But an obstacle to UNDERSTANDING THE DUALISM of the properties of ELEMENTARY particles is also the non-strict formalism of the description of the wave processes themselves [11]. If for a single wave, say a tsunami, its destructive pressure on an obstacle, equivalent to a huge mass and high speed of the wave, is obvious, then for harmonic waves with their non-strict description, these parameters are generally neglected. And an erroneous conclusion is made that all manifestations-influences of waves are described exclusively by an harmonic processes. And, as a consequence, it is argued that both the transmission of any information and the impact of the wave are determined only by its group velocity. Somehow it was simply thrown out of consideration that the force of the wind transfers part of the energy to the excitation of precisely harmonic waves moving with phase velocity to the shore washed away by them. Yes, and the total constant MEASURED pressure of sound and light waves is initially thrown out, and only the amplitude of the variable pressure is considered. Whereas it is obvious that the speed of movement of a selected section of a continuous wave with a constant phase in a medium without dispersion is simply identical to the speed of movement of a physically selected wave vector (quasi-momentum) of this wave (Fig. 4):

$$E_{/\varphi=0} = A \cdot \mathrm{Sin}\left(\omega \cdot t - k \cdot x\right)_{/\varphi=0} \Rightarrow k = \frac{\omega}{x/t} = \frac{\omega}{v_{Ph}} \qquad (5)$$

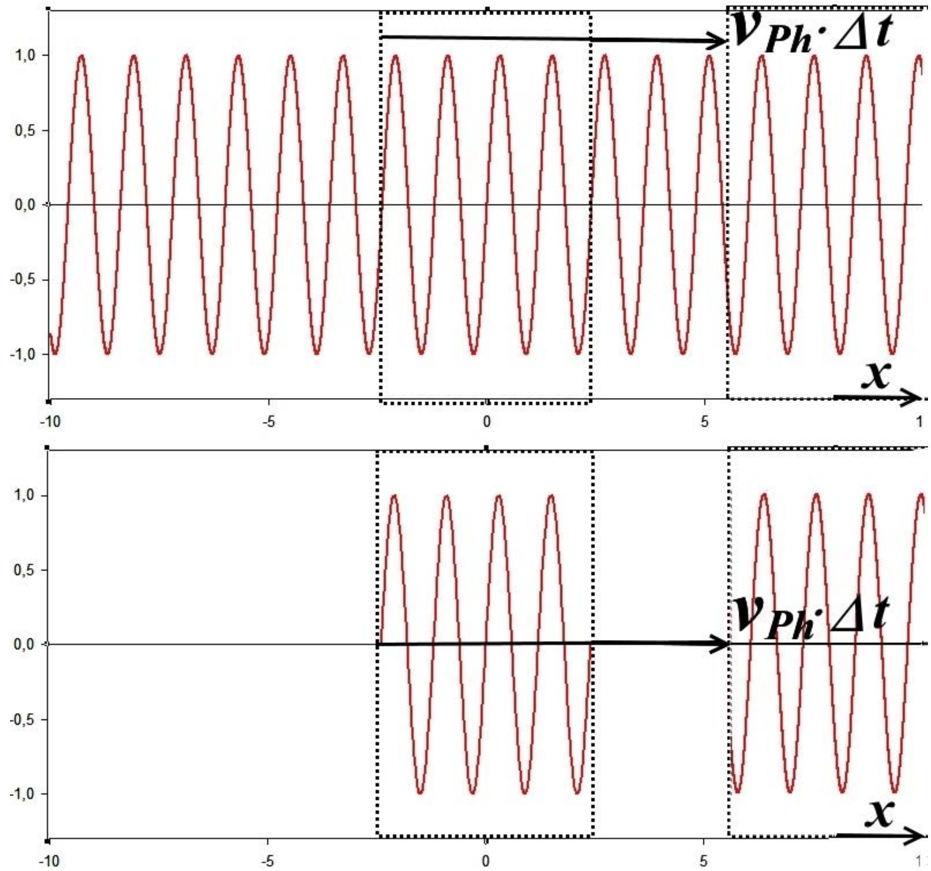

Fig. 4: Overflow in space of a continuous wave in a selected phase section (upper figure) and overflow-displacement of a physically selected impulse - a fragment of this wave (lower figure), moving with the phase velocity of the wave

As can be seen from Fig.4, the velocities of movement of a conditionally selected section of a continuous wave and a physically selected pulse filled with this wave are identical and equal to its phase velocity multiplied by the time of recording the movement.

Thus, diffuse light "standing" in the Planck box is similar to the Brownian motion of particles and, conversely, the Brownian motion of particles is similar to the chaotic motion of short wave packets. But the OBSERVED fundamental difference between the velocities of photons and the velocities of Brownian particles is not only that the particles are packets of precisely short-wavelength waves, but also that motionless particles consist of STANDING, resonant on micro-scale waves. Whereas photons propagating with phase velocity are, in principle, NONSTANDING - freely moving with phase velocity. In the "defense" of the REALITY of the phase velocity, one can add the fact that in both radio and laser rangefinders it is the phase velocity that is used to MEASUREMENT the distance to the object. Yes, and the very fact of the identity of the phase velocity of a diffuse photon and a coherent wave in a laser, to speak about its measurability.

But the mysticism generated by the formal “prohibition” of the OBSERVABILITY of the phase velocity of photons is aggravated by the confusion in the concept of the photon mass. It is argued that its rest mass of a photon is zero, and according to the formula used by Einstein, there is only its relativistic mass, which (mysticism squared) is used for a photon, but which, in fact, is not applicable to particles with non-zero rest mass:

$$E_{v_{Ph}} = \frac{m_{Ph}\left(v_{Ph}\right)^2}{2} = \hbar\omega \quad \Rightarrow \quad m_{Ph} = \frac{2\hbar\omega}{\left(v_{Ph}\right)^2} = 2\frac{\hbar\omega}{c^2} = 2m_{rel}\,. \tag{7}$$

But the very emergence of the so-called group velocity, which differs from the phase velocity, occurs when approaching the local oscillation frequency (Fig. 1b), which is due to the fact that the photon carries

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along a “fur coat” of mechanical oscillations. Those. for light, a polariton arises (mixed electromechanical oscillations), and as a result, a decrease in the group velocity to zero at a frequency corresponding to a standing wave with an increased (infinitely) “coat” mass (for acoustic oscillations at the edge of the Brillouin zone, such a “coat” becomes the mass of the entire crystal). In this case, the locality can also be set simply by the size of the macroscopic resonator, in which the resonant wave naturally stands. And similarly, for microparticles, as for short-wave packets of standing waves, their resonant nature corresponds to the polaritons of the microscopic substructure inside the elementary particle.

But according to Einstein's formula, non-zero mass tends to infinity as it approaches the speed of light. And without taking into account the above, a “logical” conclusion is made: since the mass of a photon is finite, then it has only a relativistic mass:

$$m_{rel} = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (8)$$

And they reinforce the “logic” by the fact that from the identity of the rest mass to zero from formula (8) the zero relativistic mass follows! Whereas this formula containing a singularity, strictly speaking, cannot be used for photons. Whereas from formula (7) the "relativistic" photon mass is simply equal to half the phase mass. So, exactly the opposite, from the singularity of formula (8) it follows that it cannot be considered GENERAL for any particles [12, 13]. And the use of formula (8), as a first approximation, allowed only for speeds much less than the speed of light. And its singularity for a mass near the speed of light only adds mysticism and additionally interferes with UNDERSTANDING. Moreover, this formula is easy to correct by removing the singularity from it.

Similarly, one can remove "anharmonic" mysticism from the description of light pressure.

The flow of particles J is related to the speed of movement of a layer filled with a certain number of particles. So, the intensity of light ***I*** (the flow of its energy - power *N*) divided by its “immeasurable” phase velocity will give us the relationship between the pressure of light waves *P* and the phase mass of photons:

$$P = \frac{I}{c} = \frac{N}{c} = \frac{J \cdot h\omega}{c} = J \cdot \frac{\frac{m_{Ph}(c)^2}{2}}{c} \qquad (9)$$

And for one photon incident on the surface per second, we find that its pressure on the absorbing surface is simply equal to half of its phase momentum, which, in accordance with the Planck relation for the photon energy (7), is equal to the wave vector ***k*** (5), multiplied by the constant Planck ***ℏ***

$$P_1 = \frac{I_1}{c} = \frac{m_{Ph}c}{2} = \frac{p_{Ph}}{2} = \frac{\hbar\omega}{v_{Ph}} = hk \qquad (10)$$

So the real phase momentum of a photon is simply proportional to the wave vector of the wave forming the photon. So, without any mysticism, the average pressure of harmonic waves is determined by their wave vector - the number of waves hitting the coast per unit time. And for a standing wave, due to its reflection from the resonator wall, the pressure is naturally equal to its whole phase momentum, which is the usual momentum of a particle described by a packet of these waves.

IV. Electronic Waves

The mysticism of Schrödinger's wave functions actually obscured the DUALISM not only visually manifested for the Quanta of Light, but for any particles. Whereas the correct, according to Planck, quantization of electronic waves in Solid State Physics has long been and reliably used. Moreover, it is precisely these electronic but coherent waves that make it possible to describe superconductivity [14]. But everything did not prompt earlier to revise the Schrödinger equation, in the solutions of which, at the ELEMENTARY level, electronic waves in the atom are replaced by the MYSTICITY of wave functions.

And the orbital model of the atom guessed by Niels Bohr Logarithmic Relativity does not in the least contradict the wave manifestation of electron DUALISM if the resonances of these waves are correctly considered on a 3-dimensional sphere, the radius of which is determined by the resonant vibrational energy of electron waves. We will not dwell here on the subtleties of wave resonances on surfaces of the constant vibrational part of the energy, other than a sphere - and on an ideal sphere there are enough resonances that describe the allowed energy levels for an electron in an atom in the first approximation (Fig. 11) and which do not give, as Schrodinger wave functions “flying” through the nucleus of an atom, their catastrophic discrepancy with the measured Ionization Potentials.

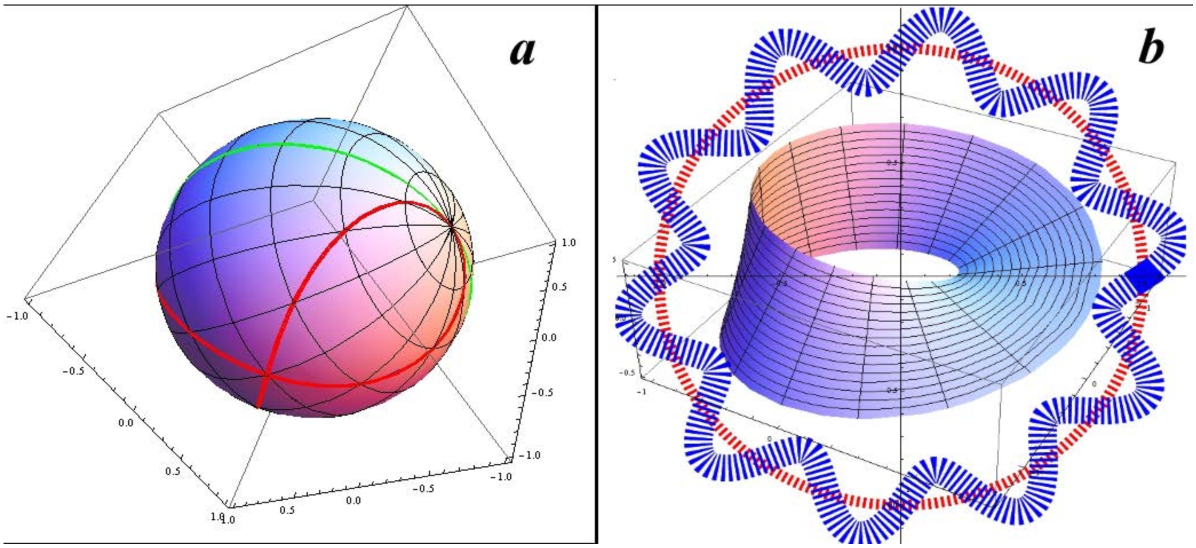

Fig. 5: Possible resonant trajectories of electron waves on the sphere of constant energy (a) and possible types of resonant waves on these trajectories (b)

The orbit, say, of the same electron in an atom, must be built, of course, in a real 3-dimensional space, which corresponds to the Bohr model. And taking into account the Planck resonance for a wave formed from a packet of waves of an isolated particle, on a 3-dimensional sphere of constant energy, it ensures the stationarity of the orbit - the conservation of the wave energy at the resonant level, "prohibiting" its arbitrary change and the fall of an electron onto an atom. At the same time, the value of the Planck Quantum for an electron corresponding to the energy of its resonant wave, which does not contradict the Bohr orbital model in any way (like the Schrödinger wave functions), but only reveals the internal parameters of this model.

These (inside) electron waves also include de Broglie matter waves (in order to understand this, one must return to their original interpretation [15]) and Bohm pilot waves [16]. Moreover, such an approach is actually based on the conclusion made by de Broglie about the existence of matter waves. He simply translates them phenomeno logically from the category of indeterminate into real small-scale waves inside the particle. In this case, the annihilation of particles corresponds to their interference cancellation at a given point at a given point with the release (“evaporation”) of energy from this point in the form of electromagnetic waves.

Such an approach does not remove the question about the internal structure of de Broglie's matter waves, on the contrary, this question is raised as the following one. And in accordance with the Principle of Logarithmic Relativity, it is possible and necessary to use the models developed for macroscopic waves to determine the INVARIANTS of small-scale de Broglie waves.

This approach, in accordance with the Principle of Logarithmic Relativity, makes it possible to use models of microscopic structures, say, crystals, to determine the INVARIANTS of a substructure in general, including vacuum.

This eliminates both the mysticism of Quantization itself based on the Schrödinger equation, and their results that contradict REALITY, such as an electron in an atom for a number of orbitals spends most of the time in the nucleus - this is nothing more than finding the projection of the imaginary components of the Schrödinger wave functions onto the real axis, for which the equation is constructed.

So it's up to the "small" - behind the calculation shown in the book by the de Broglie method of resonant waves on the sphere of Planck's constant energy.

V. Quantum and Relativity

Galileo's Principle of Relativity, promoted by Einstein to the constancy of the speed of light in vacuum [17], was already implicitly present in the foundations of Quantization (f. 6, 7). And it is quite natural that all world constants must be taken into account when describing the phenomenon. And vice versa, it is not at all natural that not all world constants are included in the Schrödinger equation. But Einstein, pushed aside by Schrodinger's mysticism from the Fundamentals of Quantization, issued the "Special" Theory of Relativity, where he also replaced the polarity of TIME with mystical imaginary. Whereas its polarity directly follows from the Logarithmic Relativity of TIME, its polarity is visible without any mysticism (Fig. 12).

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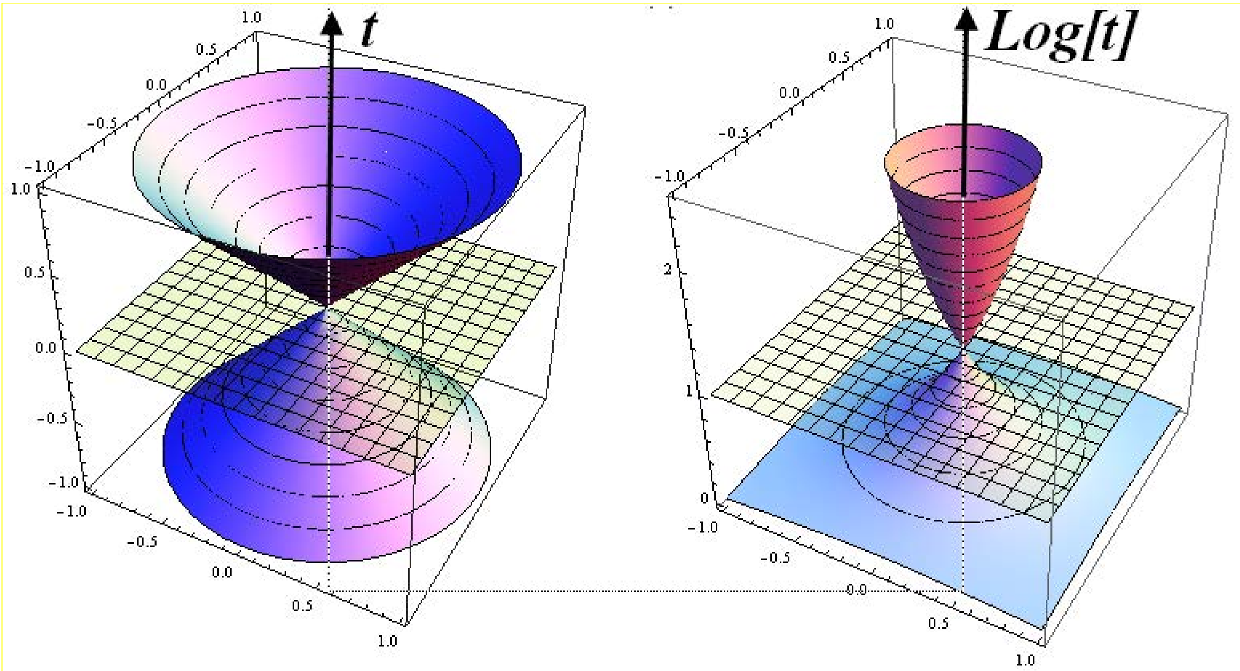

Fig. 6: Einstein's cone of "visibility" with "imaginary" TIME and the real cone of visibility, taking into account the Principle of Logarithmic Relativity (the past is lower, and the future is higher than the plane HERE and NOW)

So, the "imaginary Specialty" of Einstein's Theory is connected with the distortion by the imaginary of "Quantum Mechanics", with the imaginary, the meaning of which was not understood by the authors of the formulas themselves.

The real, exponentially expanding cone of visibility of the past simply reflects the fact that Einstein himself emphasized, adding it to Galileo's Principle of Relativity - on the finiteness of the propagation speed of any perturbation of the field, which is strictly logically reflected in the fact that the particle's own field, when it is displaced, does not can change to infinity instantly. So, as can be seen from the figure, there is nothing unusual in the visible recession of distant galaxies that we see in the long past time and, as a result, the absurdity of the assumption from the visible (with a decrease in the telescope aperture) recession to conclude that the beginning of this recession is a POINT, in which there was supposedly a big explosion. Based on the thermodynamic flows in the Universe, in its Local areas constantly (everything continuously flowing TIME) both Local contractions and Local explosions arise. We can observe this on any arbitrarily large scale And only. When we look beyond its horizon, we can see expansion instead of contraction, and vice versa.

I think that with the shown expansion of the cone of visibility, they connected, erroneously, the infinitely fast recession of distant stars by switching to telescopes with a higher resolution and, accordingly, a smaller aperture. The recession, like contraction, is possible on different scales, including the scale of the visible Universe, but this also means reverse processes beyond the limits of the achieved visibility. Moreover, in the mystical expansions/contractions of the supposedly infinite Universe, an elementary logical error was made – the expansion over the visible sphere leads to compression on it at the same time.

And there is an additional point that requires adjustment - this is the luminosity of the stars, which we measure here and now. The incoming radiation registered here and now has a certain intensity, but it corresponds there to a far different radiation intensity. But a detailed study of this issue, as well as a number of others related to the mathematical blunders of SRT due to the "imaginary" TIME, will be in a separate work.

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The New Mars Synthesis: Circumstantial Evidence of a Past Persistent Gaia on the Red Planet

By J. E. Brandenburg

Abstract- Based on a large scale synthesis of data, Mars can be understood to be a planet with a flourishing, Gaia-type, biosphere in the past, where life modified its environment from an early epoch so that it became the home of a massive Earth-like biosphere, before an anomalous mass extinction event, reduced it to its present state with only a weak, residual biosphere. Such a possibility is strongly suggested by circumstantial evidence gathered form a variety of sources. The Mars crate ring rate, is shown to be much higher than Lunar leading to the average surface age in the Northern Hemisphere to be approximately 1/2 billion years or less. This is proven by the average age of younger Mars meteorites, the Nakhlites and Shergottites, of less than 1 Billion years. The young surface ages make signs of liquid water on Mars more recent and indicate that the liquid water epoch on Mars lasted for most of Mars geologic history. This requires a high pressure CO_2 greenhouse in the presence of large amounts of ferrous silicates, requiring, in turn, a high oxygen level atmosphere to provide geochemical stability. This results in a red Mars due to large amounts of Hematite in the soil and few carbonates. This oxygenated atmosphere, in turn, requires massive photosynthesis, as occurs on Earth, since UV photolysis of water is self-limiting whereas photosynthesis is self-amplifying by formation of an ozone layer to protect plant life. Mars thus became very Earthlike in environment, with a mixed CO_2 and CH_4 greenhouse produced by a high pressure oxygen rich atmosphere, until some cataclysm ended all but a present residual biosphere.

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THENEWMARSSYNTHESISCIRCUMSTANTIALEVIDENCEOFAPASTPERSISTENTGAIAONTHEREDPLANET

Strictly as per the compliance and regulations of:

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I. Introduction: Inductive Reasoning and The Role of Biology In Understanding Mars Past and Present

To form or test hypothesis by some precise measurement is the favored mode of modern science, and is deductive reasoning, however, to recognize a pattern formed by large numbers of measurements is to form a synthesis, which is inductive reasoning. These are two modes of thought recognized since Aristotle. . To form a synthesis is to recognize a galaxy and its associated dynamics, as opposed to studying the individual stars of the galaxy. Both processes of thought are essential to science, one process provides precise data and the other uses that data to understand the larger relationships of that data.

A modern example of inductive reasoning was the recognition of the Gaia Principle by Lovelock and Margulis, (1974). The recognition of the relationship of life as part of a biosphere that helped shape the geochemical evolution of the Earth so that it was more hospitable to life, was a grand synthesis using data drawn from many disciplines within chemistry, biology, ecology, and geology. It can be said that the Gaia Principle is the inference from a vast body of data on Earth that the laws of physics favor biology on a massive scale. But what of other planets? Would not the laws of physics be cosmic in their application, and therefore create Gaias beyond the Earth?

The planet Mars, with its surface displaying a range of terrains, some heavily cratered and others only lightly cratered, and evidence of massive, global, water induced erosion, including a Paleo-Ocean bed on its most lightly cratered portion, Brandenburg (1986) Clifford and Parker (1999), and highly oxidized surface, with only scarce carbonates, betrays a past much different than its present state. That extensive past may now be understood as an epoch of an Earth-like Gaia regime, where a massive and persistent biosphere modified the Mars environment to favor life bearing conditions. The end of those same conditions meant also the end of the massive biosphere, explaining Mars present state. Massive biology can be understood to have stabilized the Mars environment, Brandenburg (2015), over most of geologic time, as it did on Earth. Mars past can be understood as a pattern of interlocking puzzles, however, as will be shown, the solution of one puzzle leads to the solution of another.

It will be shown that the proximity of Mars to the asteroid belt, and hence suffering a high cratering rate, Brandenburg (1994), Treiman A. (1995) and Nyquist et al. (1998), leads to an understanding of Mars as a dynamic Earth-like planet for most of its history. Further, the persistence and abundance of signs of liquid water, Tanaka (1996), even on its most lightly cratered regions (see Figure 1),including a lightly cratered Paleo-Ocean bed *Brandenburg (1986), requires* Earth-like atmospheric pressures and a powerful greenhouse effect to have operated until recent geologic times.

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This persistent greenhouse, it will be shown, requires a highly oxygenated atmosphere to achieve geochemical stability, which only biology can supply. Thus, Mars past cannot be understood without massive biology being present. Sadly, the fragility of life, seen in evidence of mass extinctions on Earth, explains also the present environment of Mars, where only a residual biosphere appears to be present. To solve this problem of Mars past requires a broad New Mars Synthesis, Brandenburg, (2015),drawing on a vast trove of data from Mars, the Moon, and even the Earth. This data ranges from meteorites collected in Antarctica, and sediments found in the bottom of the Grand Canyon on Earth, to Moon rocks collected by astronauts, and finally to a vast array of data collected by robotic probes from Mars orbit, meteorites from Mars collected in Antarctica, and lander/rovers on its surface. Once again, the key to understanding Mars past environment appears to be abundant life. But first we must understand our models of Mars Geochronology and their problems. In particular, we want to know the answer to the question: what was the length of the Mars "Liquid Water Epoch" in geologic time?

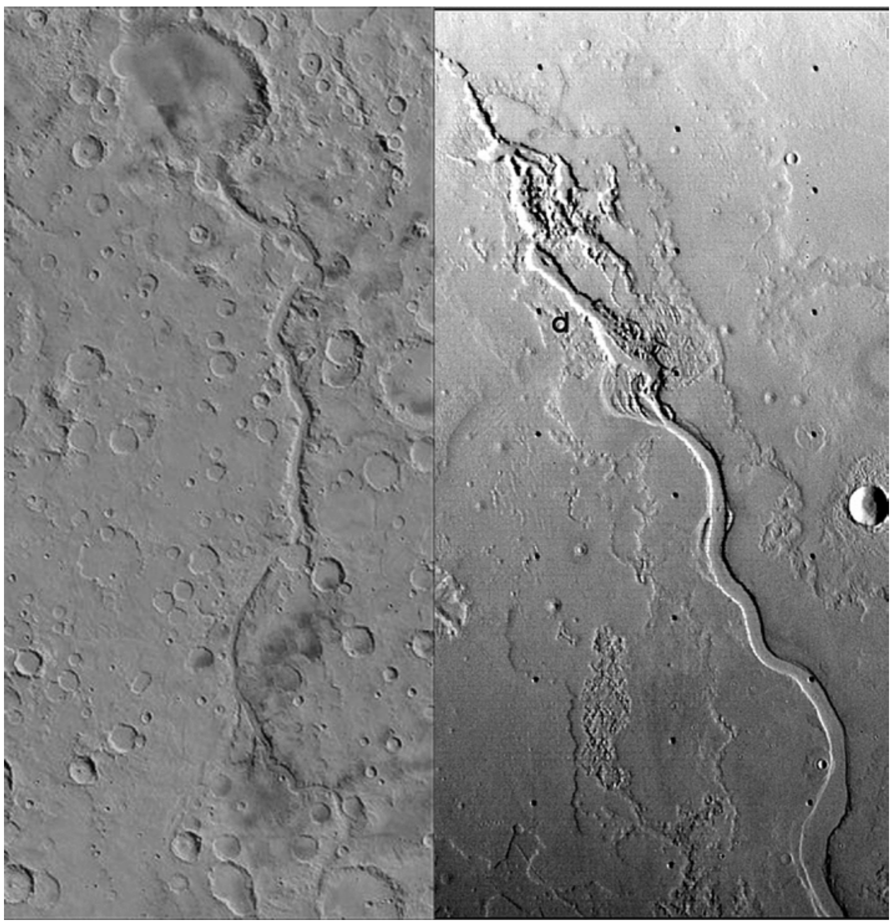

Figure 1: MaadimVallis (L) on old terrain draining into Gusev Crater. Hradd Vallis on young terrain, draining into the Paleo-Ocean bed. Both channels are approximately 800km long

II. The Mars Age Paradox and Its Resolution

Cratering densities are used on both the Moon and Mars as an indicator of the age of a surface, and the water channels on those surfaces, since its last resurfacing event, such as lava flow or water erosion. More craters correlate with greater surface age, being the straightforward interpretation, calibrated for Lunar surfaces, by Apollo rock samples and imagery. With this large body of Lunar data, it made sense to apply the Apollo derived models to Mars. However, Mars defines the inner edge of the asteroid belt, the source of most meteoritic impacts on Earth. That Mars cratering rate should be much higher than Earth's, appears obvious, and is consistent with the much larger amount of MM (Mars Meteorite) materials being recovered on Earth, versus those originating from the Moon. Despite this, application of LCG (Lunar Cratering-Geochronology) models to Mars persists, leading to the seeming paradox of the average age of MMs being much less than the estimated average surface age of Mars, as given by LCG models Brandenburg (1994), Treiman A. (1995) and Nyquist et al.(1998).

Mars, like the Moon, has a glaring dichotomy of surface ages: the Southern Highlands on Mars dis playing primordial cratering patterns and densities similar to those found on the Lunar Highlands versus the lightly cratered Northern lowlands of Mars, similar to the younger Lunar Maria. On Mars this is reflected, to a degree, in the dichotomy of MM crystallization ages, either of very old or very young geologic ages, though the young MMs, statistically, much outweigh the older ones. While this statistical problem may be resolved by the discovery of more older MMs in the meteorite collections, such as possibly the CI carbonaceous chondrites Brandenburg (1996), we can concentrate on the younger MMs as a group and assume they came from the younger Northern Martian Lowlands. However, even when this is done the Mars age paradox remains.

The solution to the Mars Age Paradox is fairly simple: the Mars cratering in recent geologic time, the unknown free parameter in these LCG models applied to Mars, must be allowed to be much larger, approximately 4xLunar. When this adjustment of the Mars cratering rate is done, the paradox largely disappears. The mean surface age of the Northern Lowlands of Mars becomes approximately ½ billion years, matching the mean age of the young MMs. However, this creates a new problem for the Mars community, it transforms the Red Planet from being a simple place that died geologically in its early days, to a lively, complex, dynamic place, that appears to have been Earthlike until recent geologic times. The Mars age paradox is thus solved, but in its place is a host of more profound puzzles emerges. These puzzles center around the new, younger ages of liquid water erosion landforms, spanning almost the whole geologic age of Mars, that, given our new younger ages for Mars surfaces, must now be recognized as being formed right up until recent geologic times. (see Fig. 2)

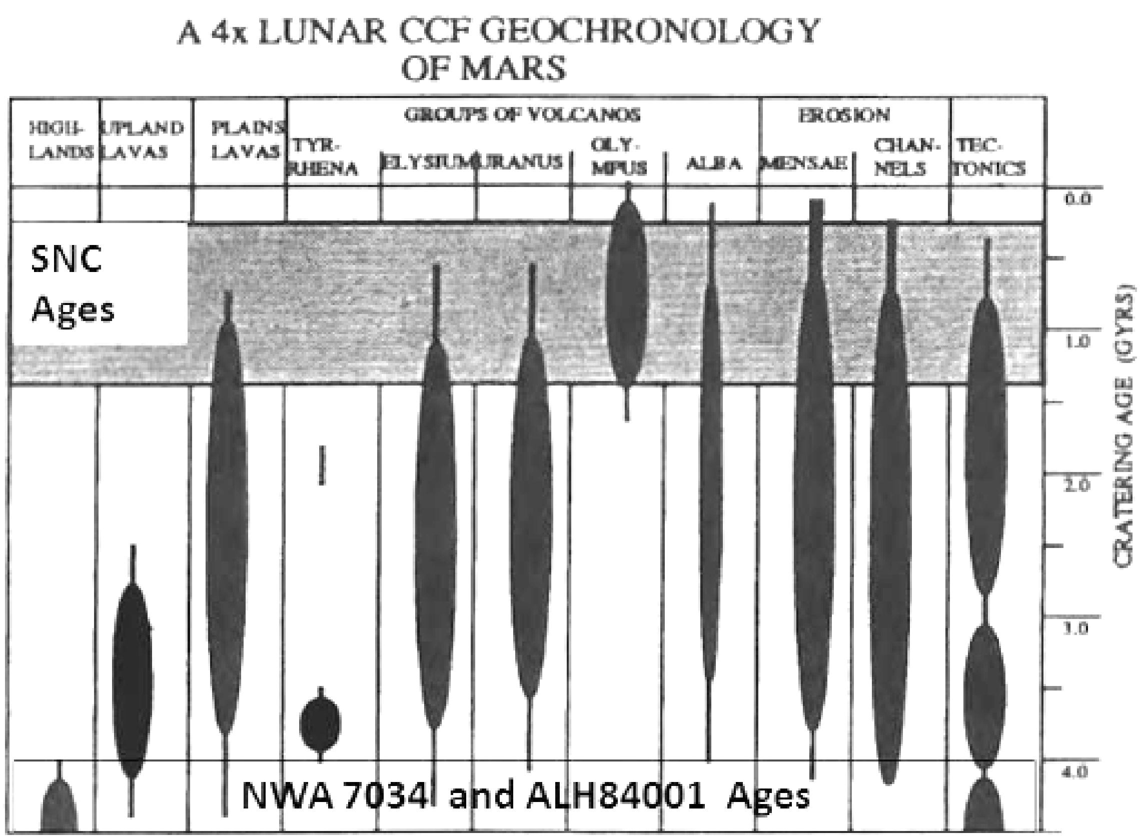

Figure 2: Taken from Brandenburg (2005) reference 3 SNC (Shergottites Nakalites and Chassignites) are the group of young MM s.

III. The Liquid Water Epoch on Mars

Liquid water channels or lake/sea beds, (see Figure 2) are found on terrains of Mars spanning the geologic ages from the ancient, heavily cratered Southern Highlands to the apparent Paleo-Ocean bed in the lightly cratered Northern Lowlands (Figure 3) Brandenburg (1985). This indicates that conditions of atmospheric pressure and temperature were Earthlike for most of Mars geologic history. This requires a

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greenhouse of near Earthly atmospheric pressure, however, studies of such greenhouses, basically with CO_2 and water vapor, as the main greenhouse gases, perhaps assisted by a small methane component, while plausible, are geochemically unstable. This is due to the formation of carbonic acid and its reaction with iron rich phyllosilicate lavas to form ferrous-carbonates and magnesium carbonate along with quartz. This geochemical instability means that the greenhouse could not last long on Mars, but would instead collapse to form massive carbonate deposits. However, the greenhouse regime on Mars was obviously of long duration and only trace amounts of carbonate minerals have been found in Martian atmospheric dust, Bandfield et al. (2003). However, this geochemical instability can be solved by adding a strong free oxygen component to the greenhouse atmosphere either photolytically Fairen et al (2004), or photosynthetically, Brandenburg (2015) Molecular oxygen is presently the 4th most abundant gas in the Mars atmosphere, following argon in abundance and being twice as abundant as carbon monoxide. Oxygen is very reactive, and breaks down ferrous carbonates into CO_2 and bright red ferric oxide, hematite. The CO_2 is thus displaced by oxygen and recycled back into the atmosphere to maintain the greenhouse. Therefore, for iron rich soils, as found on Mars, McGlynn et al. (2012), (see Figure 4) a CO_2 greenhouse system can be stabilized by a strong oxygen component. Free oxygen in the presence of vulcanism also leads to the formation of sulfuric acid, Fairen (2004) which further reacts with carbonates to release CO_2 and form sulphates. Therefore, a strong and persistent CO_2 greenhouse, leading to long lived liquid water conditions, is possible on Mars, provided a strong molecular oxygen component is also present. The result would be a Mars with abundant, bright red, sedimentary beds formed by standing water, as seen in Fig. 5 at Gale crater. Also sulphates but few carbonates would be seen in the case of an oxygen stabilized CO_2 greenhouse on Mars. The question then becomes, what would be the source of the molecular oxygen that would stabilize this persistent greenhouse? The answer is biology.

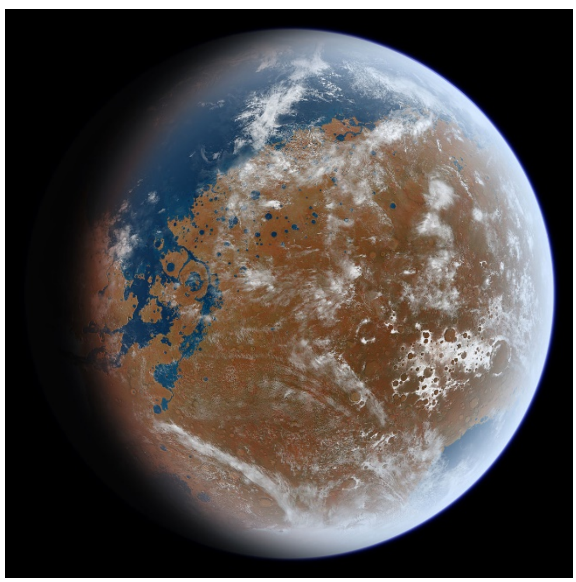

Figure 3: Mars with a Paleo-Ocean

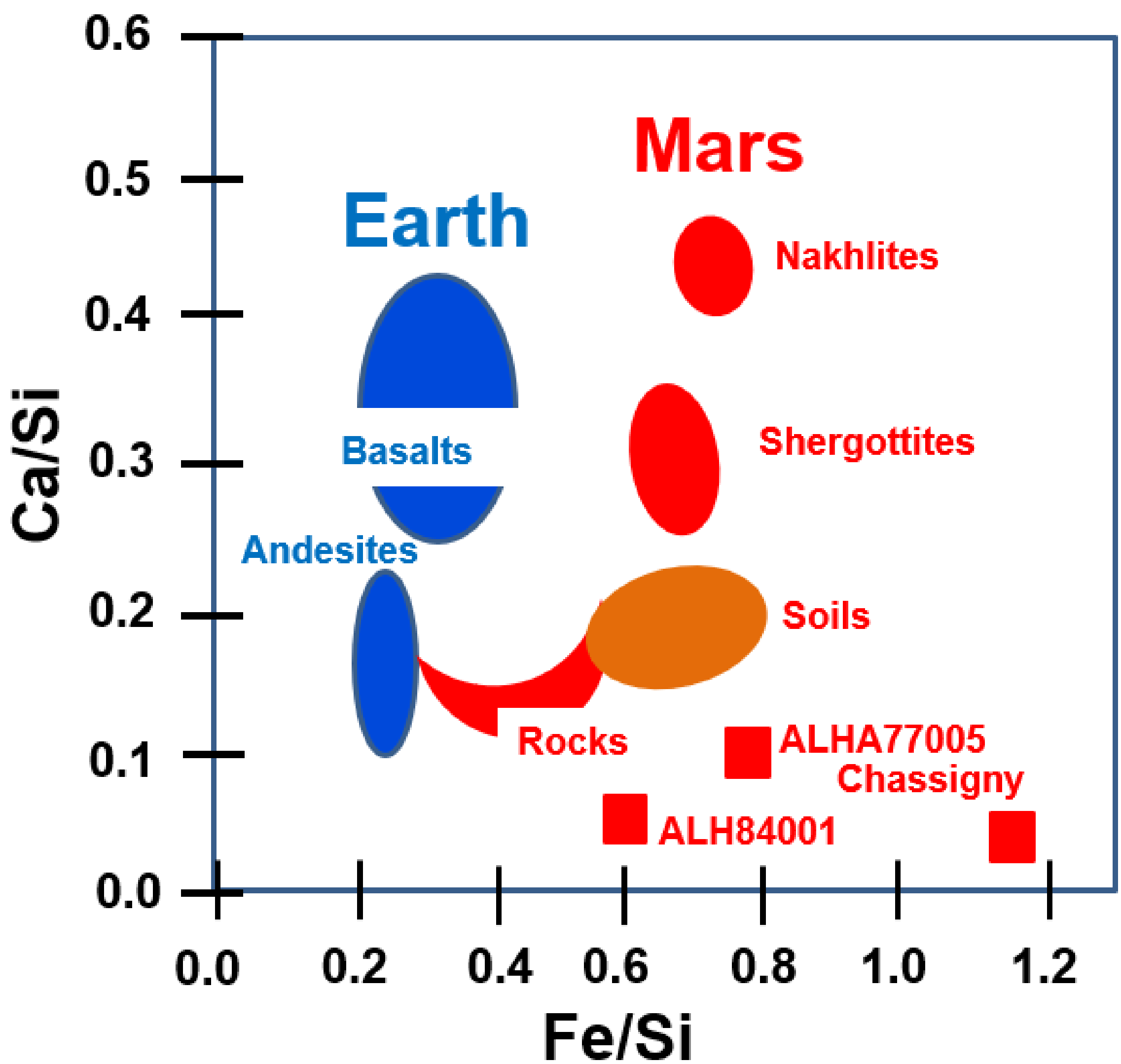

Figure 4: Mars soil composition compared to Earth, showing a significantly higher iron content(230%) on the Red Planet. Graph adapted from McGlynn et al. (2012)

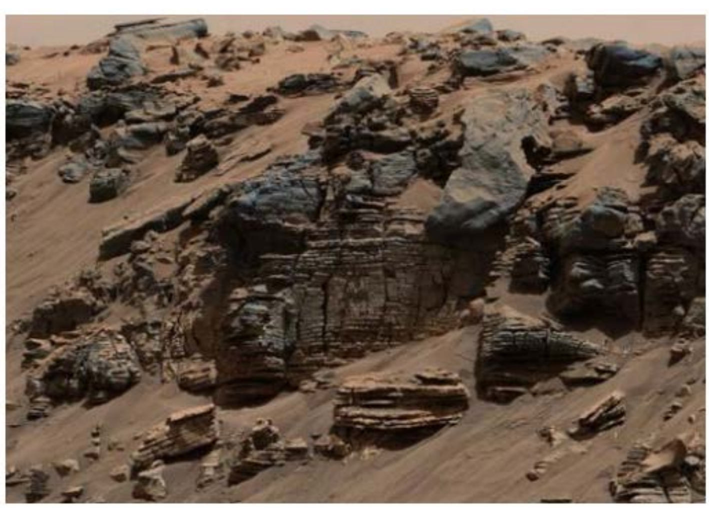

Figure 5: Hematite rich sedimentary beds exposed in Gale Crater

IV. The Early Emergence of Life on Earth

Evidence of photosynthetic cyanobacteria colonies, in form of stromatolites, has now been found in the Eoarchean geologic formations of Greenland dating from 3.7 Ga, Nutman et al. (2016), Similar structures have been found in the Paleoarchean 3.5Ga formations of Strelley Pool in the Pilbara Craton, in Australia, Clarke and Stoker (2013). This early appearance of evidence of biology suggests that the laws of physics favor the emergence of photosynthetic life on Earthlike planets even soon after their formation. In particular warm temperature and abundant liquid water appear most favorable for the appearance of life.

On Earth, mechanisms for producing oxygen were obviously overwhelmed by various environmental sinks, Kasting et al. (1979), and remained low in the early Earthly record until the GOE (Great Oxygen Event) at approximately at 2.3 Gya . This would include various UV driven photolysis processes, Holland (2006). In the GOE it appears photosynthetic life reached some sort of "critical mass" and oxygen levels grew exponentially. Apparently, after approximately 1.5 billion years of very low oxygen levels Earth experienced then an explosive increase to nearly present levels in roughly 10 million years Luo, G. M. et al. (2016). Therefore, we have seen on Earth that warm, wet conditions appear to foster biology even on young rocky planets, and that once photosynthetic biology becomes established it is capable of explosive growth.

V. The Martian Gaia

The conditions of warm temperatures and abundant liquid water evident on Early Mars, empirically, would have led to biology as they did on Early Earth. The strong oxygen component in the atmosphere that would have to be present on Mars to stabilize its CO_2 greenhouse, would have been generated photosynthetically, that is, by biology. Photosynthesis, relying primarily on visible wavelengths to which water and oxygen are transparent can become a self-feeding process, uninhibited by its "waste gas" oxygen.

Alternatively, models for formation of a photolytically sourced oxygen component, based on the UV breakdown of CO_2 and water, are self-limiting due to the fact that the ultra-violet wavelength bands that power them, are blocked by the same oxygen they generate. Wavelengths shorter than 185nm, are seen in experiments to cause photolysis of water, Bar-Nun, and Hartman (1978)and UV bands shorter than167nm are seen to cause photolysis of CO_2, Schmidt et al. (2013) , that can lead to free oxygen. However, these same UV bands are then blocked by the strong UV absorption of the same O_2 they create. These UV photolytic wavelengths are absorbed by free oxygen absorption in the Schuman-Runge bands, Thomas, and Stamnes, (1999.), (see Figure 6) which begin at wavelengths shorter than 242nm, which marks the onset of ozone production. Therefore, UV Photolysis as a method of creating free oxygen is self-limiting. Also, by breaking down water and methane, such hard UV would destroy the two most efficient greenhouse gases in the atmosphere, leading to rapid greenhouse collapse on Mars as it lost its efficiency.

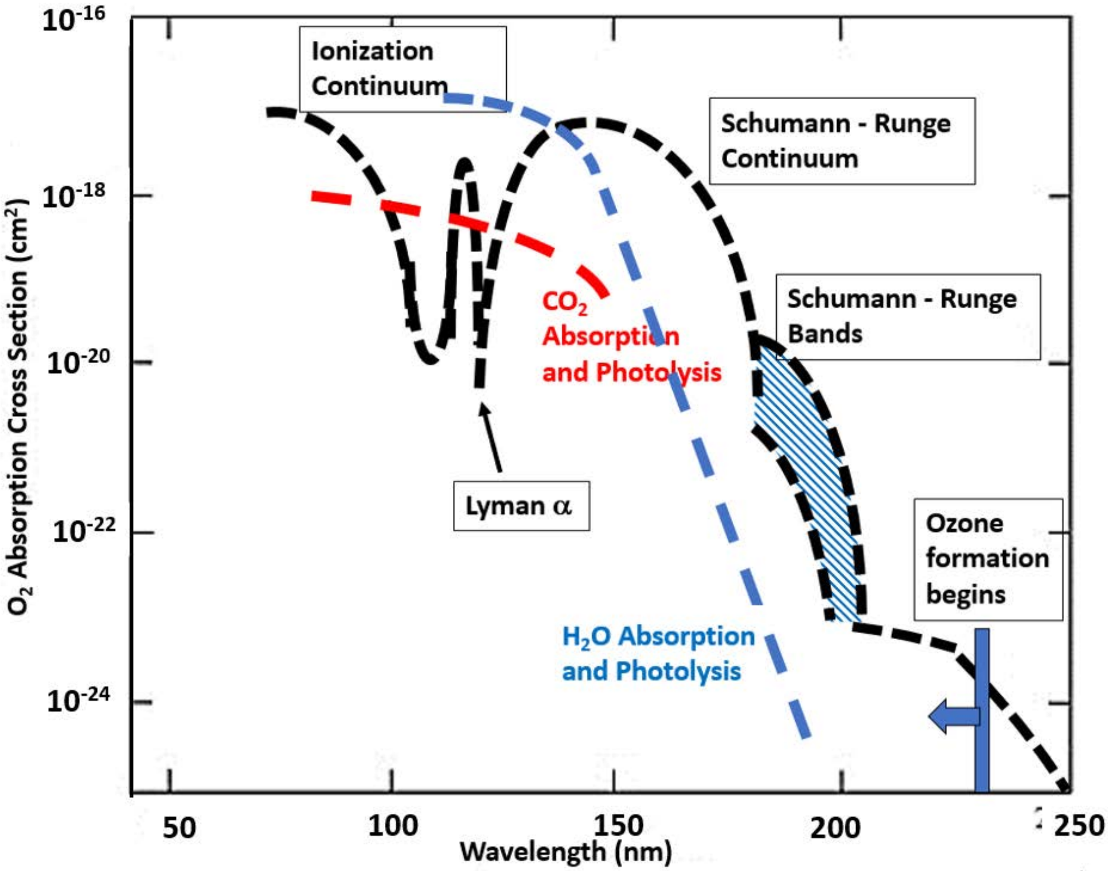

Figure 6: The UV absorption cross section of oxygen with the approximate ranges of UV causing photolysis of water vapor and CO_2 processes thought to create free molecular oxygen abiotically. Graph adapted from with additional data from Thomas, and Stamnes, (1999), with CO_2 and H_2O data from Venot, O. et al. (2018) and Warren, S. G., and R. E. Brandt (2008), respectively. As can be seen, absorption of UV by O_2 created by photolysis blocks the same UV bands that could create more of it from CO_2 and H_2O photolysis, choking off the process.

In contrasts, photosynthesis by wavelengths in the visible range is self-promoting, since it functions in the wavelengths, to which water and oxygen are transparent, rather than the UV which absorbed by free oxygen. Photosynthesis also and creates an ozone layer by its oxygen, which then blocks UV that is harmful to plants, allowing plant life to spread from the water to the land. Photosynthesis, then done by biology would overwhelm abiotic photolysis on Mars, as it obviously did on Earth. That life would create an environment that would be conducive to yet more life, is in keeping with the Gaia principle, Lovelock and Margulis (1974, which is seen operating on Earth. Thus, a Martian Gaia would promote oxygen and by this stabilize the same atmospheric greenhouse which allow more oxygen to be produced. Accordingly, the existence and duration of the liquid water epoch on Mars can be ascribed to biology as part of a Martian Gaia.

VI. The Fall of Mars

Sadly, life is not only very effective in in creating conditions favorable to more life, but it is also fragile. Earth has experienced several major mass extinction events, some of them from known causes, like the Chixulube impact, and others like the great Permian extinction, which was much more severe and also much more mysterious. Some massive mass extinction event afflicted Mars in recent geologic time, and this apparently destroyed that planet's ability to sustain a large biosphere. However, life is also tenacious and adaptable, and consistent with the Mars Gaia hypothesis, there exists evidence from Mars rover measurements that a residual biosphere, producing both oxygen and methane in the spring and summer on northern Mars, is still operating, Trainer, et al. (2019). (see Figure 7).

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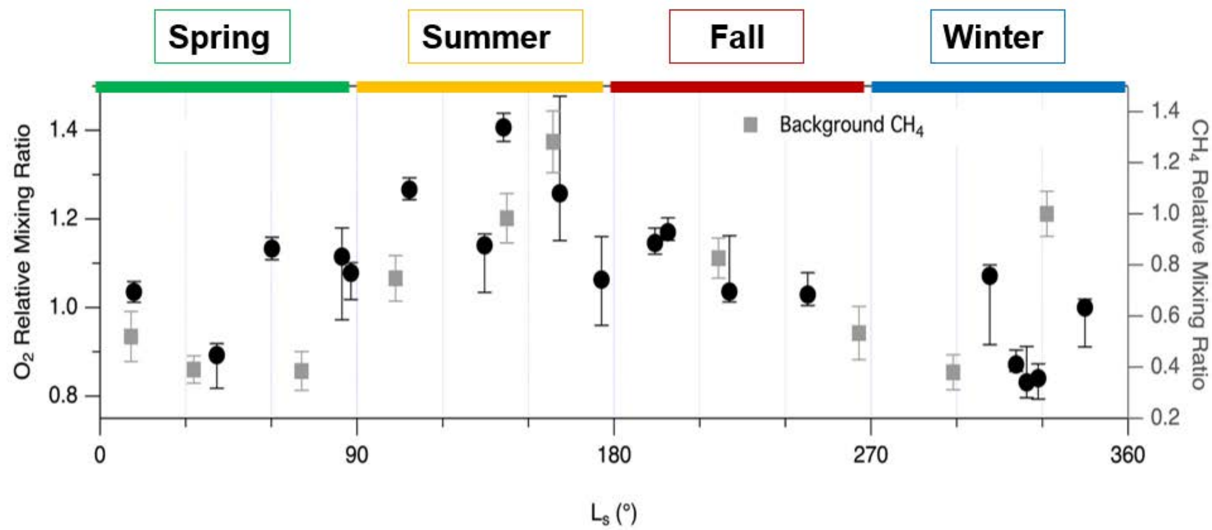

Figure 7: Seasonal Variations in Molecular Oxygen and Methane on Mars consistent with a residual biosphere. Figure adapted from Trainor et al. (2019)

VII. Summary and Dicussion

In summary: the revised geochronology on Mars, making many terrains, and the water channels on them, date from recent geologic time, requires a persistent CO_2 greenhouse on Mars. In order to have persistent greenhouse without formation of massive carbonate deposits, one requires massive amounts of persistent free oxygen. The source for this oxygen must be biology, due to the fact that free oxygen blocks the UV required for photolysis, thus making abiotic oxygen production self limiting. Photosynthesis, from biology that would thrive in a warm-wet greenhouse environment on Mars, is self-feeding and thus would thus overwhelm any abiotic photolytic mechanism for generating oxygen. Accordingly, biology explains what is found on Mars, a highly oxidized surface, dominated by hematite, with liquid water channels on terrains of all ages, and a paleo-ocean bed, on the recently resurfaced northern plains. This is The New Mars Synthesis, drawn from the vast store of Mars. Lunar and Terrestrial data now available from a variety of sources. Mars was apparently the home of a Gaia, as Earth has been.

Sadly, the fragility of life, due to dramatic changes in environment induced by outside events, also explains the present state of Mars, as a site of a mass extinction event, like those seen on Earth, but far more severe. The evidence for a residual biosphere still producing small amounts methane and free oxygen is consistent with this scenario. Therefore, the main features of Mars past and present can be explained by a past Gaia scenario.

The key to understanding Mars climatic evolution is therefore biology, possibly leading, ironically, to paralysis in the scientific investigation of that planet.

If NASA, is in fact, "biophobic", in unspoken policies even while giving public lip-service to the search for life, then suggestions of past biosphere on Mars become "forbidden" in a "conspiracy of silence" in the Mars community. Suspicion of an unspoken policy against finding evidence of life is reinforced by the reluctance of NASA to repeat, with improved technologies, Stoker (2023), the life experiments of Viking, in 1976, even after a half-century, and despite many opportunities. However, that is the past, let us look to the future.

We can understand Mars past by understanding that was alive. This conclusion can be tested by more data from Mars, conducted by scientists not afraid to find evidence of life and publish it. That this understanding may mean a deeper mystery in the universe as a whole is something we must, as a people, face boldly.

If a past Gaia on the Red Planet is confirmed, this answers deep questions on Mars, but it raises profound questions about the cosmos and our place in it, chief of which is Fermi's Paradox. If our Solar System hosted two vigorous biospheres then this indicates biology is a common phenomena in the universe. Such a lively cosmos would be expected to betray itself by leading to noisy intelligent species such as ourselves in nearby stellar systems. However, the nearby universe is as quiet as a ghost town. However, we must press ahead boldly. In particular, the reason for a Mars mass extinction, destroying the Gaia that existed there, should be urgently investigated, in order to ensure it does not happen here.

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Math-Phys-Chem-Virology

By Stanislav Ordin

Abstract- The general fragmented state of modern Science could not but affect virology, which lost its “upper sense” and dug into numerous scattered experimental data. Therefore, a general analysis of both the description/definition of the virus itself and its position in the interval between Inanimate Nature and LIFE was required. At the same time, in order to build the phenomenology of viruses, it is necessary to take into account the modern provisions of related sciences.

Keywords: *"game of life", viruses, proto-viruses, "life" of viruses, nano-scale, death of a living cell.*

GJSFR-A Classification: *DDC: 579.2*

MATHPHYSCHEMVIROLOGY

Strictly as per the compliance and regulations of:

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I. Introduction

The unconscious struggle of a person with pathogenic viruses began, one might say, back in the cave age. And it began with the use of fire, which not only allowed to warm up, but also cleansed the air of viruses, including air with infrared radiation [1]. And the conscious struggle against viruses and bacteria began by trial and error, which our ancestors made for many centuries. And this conscious struggle resulted in empirical recipes for traditional medicine. With the development of science, the possibilities of influencing both identified viruses and humans have expanded. Due to the increase in the effectiveness of impacts, the time for accumulating positive results has been reduced. BUT! But at a very high price - they try not to advertise, but also to quickly obtain predominantly negative results. And this empirical method of finding positive influences continues to this day.

Now more than 6 thousand types of viruses have been described in sufficient detail [2]. Although some researchers suggest that there are more than a hundred million of them [3]. Viruses are found in almost every ecosystem on Earth [4]. They are the most numerous biological form [5]. The study of viruses is an independent science of virology, a section of microbiology. But even she, with a purely empirical approach, according to the above data, has not mastered even one ten thousandth of the estimated number of viruses and, in fact, does not yet have a strict and sufficiently complete phenomenology. And for lack of a better one, the bureaucratic medical machine uses it, based, in fact, only on such meager knowledge, recommendations. Uses as the most reliable?! Taking into account the UNSTUDY proto-viruses, the situation looks even worse. And the purely empirical accumulation of data on consequences-diseases continues. And, as the pandemic showed, virology actually ended up at the tail end of its development. So much in the tail that decisions on mass treatments were made not at all by virologists, but by clerks, starting from the highest level and ending with the lowest. But even without a pandemic, there is a high probability that many common genetic diseases are determined by UNCOVERED and unidentified viruses and proto-viruses.

Obviously, without FINDING and ACCOUNTING exactly the Fundamental Laws of the "Sea of Viruses", the CAUSES and many diseases, and the occurrence of pandemics cannot be found. And humanity will continue to swim in this "sea" at the behest of the waves, as in the cave age, consciously reacting only to a tiny part of pathogenic influences.

The fundamental approach with the awareness (Theory) of Infinite Sets (Viruses) and the presence of viral INVARIANTS in them, and using the methodological achievements of related sciences in Virology, will make it possible to break away from bare empiricism and build Fundamental Virology. And this is what will provide mankind with a "higher sense" in identifying viral Problems and in finding ways to solve them. And the fact that the virus problem is coming was shown half a century ago in his works carried out in the Antarctic expedition, my friend, Doctor of Biological Sciences Vyacheslav Krylenkov - his results demonstrated an exponential increase in the concentration of biomass in the air. And the exhibitor is a harbinger of disaster.

II. Phenomenological Aspects of the Emergence of Viruses

The first phenomenological aspect is the "Game LIFE" [6] founded by the English mathematician John Conway in 1970, which is based on Statistics with the Accumulation of Information, which catastrophically reduces the TIME of the purely Statistical Occurrence of LIFE and removes the prohibition itself within the framework of traditional thermodynamics, on ITS Occurrence over time. the existence of the universe. This "GAME" has, in principle, the beginning at the most elementary, molecular level and, as follows from the works of Sergei Kozeev - on the cosmic "sperm" - fullerenes. It is customary to tie viruses to the other end of the NON-LIVING-LIVING Nature range, to LIFE already formed at the cellular level. Thus, in principle, the "living" particles of Conway-von Neumann, which are not yet fragments of cells, but are their building material, are excluded from consideration. But even this limited approach made it possible to clarify the "Game of LIFE" itself, which considers the development of "LIFE"

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regardless of the properties of the development environment. In principle, taking into account the properties of the environment gives a variety of different forms of life. And this is what manifests itself and is observed by us precisely at the lowest level available to us - at the viral level, in the form of the presence of their "bricks". More complex forms of LIFE are clearly limited by the halo of "Habitat". So the Living Cell is the habitat of viruses, but the "bricks" of viruses are present in it with necessity.

The second - genealogically related to the first aspect, is the specific chemical thermodynamics of the "living" environment, which manifests itself in endothermic chemical reactions that occur during the development and reproduction of LIFE. Like primitive "bricks" - fullerenes, such a macroscopic proto-living medium is the polymeric state of matter. It is in the polymer environment that one should look for the next stage in the selection of the "Habitat of LIFE" [7, 8, 9].

And the third fundamentally important, but practically not taken into account yet, is the Dynamic ELEMENT OF LIFE - LIFE NOTES, reliably registered even on a separate Living Cell [10, 11]. Roughly speaking, by influencing a dead polymer with Mozart's Music, we can provoke the emergence of both Elementary "bricks" of viruses in it, and already quite large fragments of a Living Cell. As well as vice versa, by influencing HER on a Living Cell, we can destroy viruses in it that have turned off the Road of LIFE - disharmonious with it.

III. Structure

Fragmented viral phenomenology naturally exists. Thus, it is described that while the virus is outside its range - in the extracellular environment or in the process of infecting a cell, it exists as an independent particle. Virus particles (virions) are known, which consist of two or three components: genetic material in the form of DNA or RNA (some, such as mimiviruses, have both types of molecules); a protein shell (capsid) that protects these molecules, and, in some cases, additional lipid shells. The presence of a capsid distinguishes viruses from virus-like infectious nucleic acids called viroids. Depending on the type of nucleic acid represented by the genetic material, DNA-containing viruses and RNA-containing viruses are isolated.

But, in isolation from the above aspects, it does not give a strict and complete, correct description of the nature of viruses. So their structural characterization does not even take into account the fact that not fragments of LIFE, but fragments of the ashes of LIFE were observed experimentally, which apparently makes it ambiguous whether viruses are classified as living or inanimate objects. After all, the "ashes" of viruses only make it possible to say that fragments of large specific DNA or RNA molecules are present, but it does not even allow them to be systematized - whether the completed DNA / RNA is evidence of the completion of the "growth" of an individual virus.

After all, starting from the first results of DNA measurements, the biologists working in the Brega laboratory did not understand that the results of Bragg scattering, strictly speaking, are applicable only to DEAD physical objects, and even then only to those that correspond to the adiabatic expansion in order of low energy. The use of X-ray and electron-microscopic techniques does not even give the structure of a living particle, but the structure of the ash remaining from it. Not to mention that the Dynamic Element of Life is completely destroyed and thus drops out of the results of experiments.

Viruses show a huge variety of shapes and sizes. As a rule, viruses are much smaller than bacteria. Most of the studied viruses have a diameter ranging from 20 to 300 nm. Some filoviruses are up to 1400 nm long, but only 80 nm in diameter. In 2013, Pandoravirus was considered the largest known virus, measuring $1 \times 0.5\ \mu m$, but in 2014, Pithovirus was described from permafrost from Siberia, reaching 1.5 μm in length and 0.5 μm in diameter. It is currently considered the largest known virus.

The very fact of the existence of a micron virus necessarily raises the question of its growth and the possibility of classifying it as a virus at intermediate stages of its growth. But, in principle, these questions naturally apply to viruses of any size. And, as we see, there is not even a purely structural characterization of the difference between virus fragments and a complete virus.

Moreover, the fragmentary description of viruses used does not take into account the contribution of the Dynamic Element of LIFE. Whereas modern IR spectroscopy (in a sparing mode) and neutron scattering (during the destruction of a virus-like NANO-object) make it possible to identify not only the structure (Stradivarius violin), but the vibrations of atoms allowed for LIFE (NOTES of this violin).

IV. Gaps and Fundamental Questions of Virology

As can be seen from the initial cumulative phenomenology of viruses, despite numerous scattered data on (known) viruses, there are large gaps in their understanding, which leads to a number of fundamental questions.

Viruses are traditionally viewed as a Life Form. And the fact that they added the clause - NON-LIVING (independently), was, in fact, only as an amendment to "LIFE". Therefore, their research and systematization is carried out within the framework of microbiology exclusively "on the right" - according to the similarity and likeness of Living Cells, their structural studies, as shown above, are not actually systematized and do not give a MEASURE OF VIRALITY, but only its indication.

In this case, the General Dimensional Effect falls out of consideration, with the necessity following from NANO-Physics and Chemistry [12].

It falls out as "on the left" - at the stage of formation of the simplest viruses (there are a huge number of them and it is easy to assume that at least one will be found in order to start the "Chain Reaction" of their reproduction under certain conditions).

So it falls out and "on the right." Which virus kills a Living Cell is considered, but from the Dead Nature - Living Nature scale, it fell out completely as a "Dead" virus arose. The Living Cell is not considered at all.

So the General Physico-Chemical Dimensional Effect [13] falls out, which is the DEFINING one, and only secondary, indirect effects are analyzed.

And this is a misfortune not only for virology, but also for all modern Science, which has degenerated into the industry of a compiling set of knowledge due to the neglect of Fundamental Ideas, which even concerns the exact sciences.

Therefore, it is so important to understand the level of LIFE origin, the study of purely physical and chemical aspects of the Dimensional Effect "on the left", which can be analytically continued to a certain depth "on the right".

So, in the most General terms, there are a number of the most General Questions relating specifically to virology.

1. Systematization of particles intermediate between fullerenes and viruses - systematization of proto-viruses.

   The approach used to describe "living" – incommensurate crystals [14] can be applied.
2. Systematization of vibrations, intermediate between the "dead" Harmonic Oscillations and the NOTES of the Music of Life - the proto-NOTE of Life.
3. Purely physicochemical studies of bulk and surface properties. virus-like particles

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The Mars as the Parent Body of CI Carbonaceous Chondrites Hypothesis Re-Examined in the Light of New Data

By J. E. Brandenburg

Abstract- It had been proposed that the parent body for the CI carbonaceous was the planet Mars. New data strongly supports this hypothesis. The recovery of CI-like material from the asteroid Ryugu, which orbits near Mars has confirmed the importance of CI material as a source of water for the terrestrial planets. The oxygen isotope makeup of the CI is now seen to overlap the distribution of data from the aqueously altered portions of recognized MMs (Mars Meteorites). The CI consist of completely aqueous altered ferro-magnesian silicates, carbonates and sulfates. The physical conditions that produced these materials match conditions on Early Mars, as inferred from portions of recognized ancient Mars meteorites ALH84001 and NWA 7533. Noble and Nitrogen gas isotopes match early Mars atmosphere, especially in N, Kr, Xe, and Ar isotopes with a Mars early atmosphere being composed of Chondritic Xe and Kr. The CI, despite early aqueous alteration, appear to have been, like Chassigny, preserved in a hot dry environment and have preserved entrapped Early Mars atmosphere. The CI can thus be considered to be aqueously altered remnants of a late accretion veneer that largely experienced no melt processing. Portions of this lithology have been thermally altered and formed the CY group. This Mars -CI hypothesis can be tested by chronologies of thermal alteration of the CYs. The CI are rich in organic matter, indicating that Early Mars was warm, wet, and rich in the chemical precursors of life and therefore emulated conditions that fostered life on Early Earth.

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THEMARSASTHEPARENTBODYOFCICARBONACEOUSCHONDRITESHYPOTHESISREEXAMINEDINTHELIGHTOFNEWDATA

Strictly as per the compliance and regulations of:

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❖ *Plain Language Summary*

The GRL published hypothesis *[Brandenburg 1996a]* that Mars is the parent body of the CI CCs (carbonaceous chondrites) with CI source rock being a late accretion veneer on Mars. This hypothesis is re-examined in the light of subsequent data, especially the recent recovery of CI like material from the asteroid Ryugu regolith by Hayabusa 2. Data for hydrous MM (Mars Meteorite) material overlaps that of CI hydrous material. Indications of exotic chromium isotopes in MM rock match with the concept of a LAV (late accretion veneer) formed by CC material on Mars which contributed water to Mars. Iron and Xe and Kr isotopes also show a match between CI and Mars. Chemical and morphological data is also examined. It would appear the 1996 hypothesis is now well supported by data. This suggests early Mars was warm, wet, and rich in organic chemicals and thus, like early Earth, favorable for life.

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❖ *Main points*
- *points*

#1 The CI parent lithology on Mars is a late accretion veneer formed when the planet acquired its water by Carbonaceous Chondrite impactors.

#2 CI Materials recovered from Ryugu are consistent with a Martian origin. Some materials were thermally altered by Mars vulcanism and formed CY material.

#3 The CI-are rich in organic matter indicating Early Mars was warm, wet and rich in precursors for life. CI-Mars means life on Mars.

I. Introduction: The Hypothesis that CI have a Martian Sourced Lithology

The hypothesis that Mars as the parent body of the very ancient, approximately 4.5 billion years old, *[Fujiya et al. 2013]* CI carbonaceous chondrites, in the sense of Mars being the last source lithology for CI before they were recovered on Earth, was first proposed in by the author *[Brandenburg 1996a]* on the basis of oxygen isotopes data and the heavy aqueous alteration of the CI materials. The CIM (CI from Mars) hypothesis was discounted however, based on the, then perceived, difference between CI oxygen isotopes and the MM (Mars Meteorites)materials *[Franchi et al. 1997]* plus disputes over the difference between chondritic noble gases in CIs and those known in some MMs [*Treiman 1996, Brandenburg 1996b]*

However, as will be seen these objections have been now been answered from the greatly expanded data sets acquired since the CIM hypothesis was first proposed.

It now appears that a LAV (late accretion veneer) formed from the in-fall of water rich CC (Carbonaceous Chondrite) material required to supply Early Mars with water*. [Erkaev et al. 2014, Alexander 2017]*

It has now been proposed that Earth, the next terrestrial planet inward from Mars, received its volatiles from CI meteorites, as a LAV, based on the similar oxygen and iron isotopes between the CI and Earth *[Greenwood, et al. 2023]*. Similar arguments can now be made for a LAV formed by CI-like CC material, on Mars. This view is supported by analysis of Mo and Cr

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isotopes of Mars versus CI, which indicate the contribution to Mars mantle composition by CC material was small and occurred late in Mars accretion. *[Burkhardt et al, 2021]*. Conversely, based on analysis of Zn isotopes it is found that inner solar system, lower volatile, non-CC material, also could have contributed the observed water inventories to Mars and Earth *[Kleine et al 2023]*. However, much of this early accretion, Non-CC material- water would been lost due to high temperatures experienced by the terrestrial planets in early accretion. Conversely, the volatile rich CI, arriving late in accretion, even at the small inferred contributions to Mars mantle, could provide ample water for early Mars and Earth *[Burkhardt et al, 2021]*.

When the added constraint imposed by the oxygen isotopes of the Mars water, discussed later in this article, is applied, the dominant CI role in delivering Mars volatiles seems even more likely. This scenario would have not only given Mars its volatiles, but also formed a regolith lithology that would serve as a source for CI materials recovered on Earth, and could also be a source of the veneer sampled on Ryugu.

Under this hypothesis, the LAV on Mars was not fully melt processed, and thus made only a small contribution to the bulk composition of Mars mantle *[Kleine et al 2023]*, but instead became a chondritic veneer, and was instead heavily aqueously altered, then became a desiccated regoltih, was mildly brecciated due to the velocity buffering of Mars atmosphere, and, along with pieces of other lithologies on Mars, perhaps thermally metamorphized in some locations by Mars vulcanism, and was then ejected into space by impacts and was recovered as meteorites on Earth as either CI or the thermally metamorphosized CY meteorites. The CI and CY are linked both chemically and isotopically *[Nakamura 2005, King et al. 2019].*

Support for this CIM hypothesis has recently appeared because on the stunning collection of pristine samples from the asteroid Ryugu, *[Ito et al 2022]* a body whose orbit has a aphelion between the perihelion and aphelion of Mars and thus spends much orbital time in that region. (see Supplemental Figure, p51) Since MMs are ejected from Mars by impacts, and then diffuse, after millions of orbits around the Sun, into orbits that carry them eventually to Earth, a torus of Martian ejection debris must exist with a centroid at Mars orbit around the Sun. An asteroid such as Ryugu, which has an aphelion within this torus, and is therefore spending more time there than near Earth, must then collect Mars material on its surface. The surface samples collected by the Hayabusa2 probe and returned to Earth, have been found to match CI meteorite material, indicating either that CI material is either quite common in the asteroid belt, or else that a torus of fine CI material has been ejected from Mars, along with recognized more massive MM material. Since the material found on Ryugu is hydrated, in contrast to expectations based on spectral observations *[King et al. 2019]* and because hydrated regolith on an asteroid regolith must lose its water over time *[Nakamura 2005]*, the regolith hydrated material must be geologically fresh, and the nearest and therefore most likely source of hydrated material, is Mars. Thus, under the CIM hypothesis, Ryugu is collecting CI material ejected from Mars even as the Earth does. Mars is therefore, based on the most likely interpretation of Ryugu results, the source of CI material.

Isotopic, chemical, and morphological data relating to this CIM hypothesis will be discussed in the following sections. The importance of the CIM hypothesis to the question of life on Early Mars will also be discussed.

Figure 1: Ryugu Asteroid from which pristine samples were returned by the Hayabusa2 spacecraft

II. The Detailed CIM Hypothesis

It is a widely accepted scenario that Mars accreted out of the inner SN (Solar Nebula), then lost its initial water inventory due to Solar and thermal conditions on a magma ocean that most likely made up the newly accreted planet's surface. *[Erkaev et al. 2014, Alexander 2017]*. Meanwhile, the outer SN, beyond the "ice-line" where water could condense and freeze out of the SN gases, a large number of CC parent bodies formed. The formation of Jupiter also apparently formed a dichotomy in chromium isotopes found between rocky bodies and the CC-like bodies*[Klein et al. 2020]*.

The newly formed Jupiter then scattered these volatile-rich CC material bodies into the inner Solar System, with their signature chromium isotopes, where they could supply volatiles to the newly formed and cooling terrestrial planet surfaces. These CC like bodies then also partially melting and thereby contributing some "exotic chromium" to their mantle rocks, as analyzed by *[Zhu et al. 2022]*.

The present water inventory of Mars is then believed to have been delivered by a this late CC body bombardment, giving rise to an approximately 300 meters deep planet wide layer of water, on top of a LAV (late-accretion veneer) of highly aqueously altered CC material *[Zhu et al. 2022]*. If this scenario is correct then this LAV, having never completely melted into the initial magma ocean of Mars, would preserve many chemical and isotopic traits of its originating CC bombardment lithology even while contributing some exotic chromium isotopes to the Mars crustal rocks. The water of Mars, having arrived with the LAV would also carry with it the chemical and isotopic signatures of the original CC bombardment material. Consistent with this scenario, the very ancient MM NWA 7533, a primordial breccia, has been found to contain 5% CI material by *[Humayun et al.2013]*.

Following this scenario to more recent epochs, a LAV derived lithology would then have become desiccated and, in some locales of Mars, would be thermally metamorphized by surface vulcanism forming CY (Carbonaceous-Yamato) material. The LAV derived lithologies would became part of the spectrum of surface lithologies on Mars, especially on its most ancient parts. Accordingly, Mars could be thought of as the "adopted home" of lithologies that formed originally in the outer solar system. Like other regolith lithologies on Mars, we would expect fragments of this CC derived lithology would be ejected into space like fragments of other Mars lithologies, orbit near Mars and then diffuse inward and become MM(Mars Meteorites) recovered on Earth. Accordingly, we would expect, among the MMs, both heavily aqueous altered CC materials and similar materials that have undergone first aqueous and then thermal alteration due to later surface vulcanism on Mars. The thermally altered CCs, the CY type *[Nakamura 2005, King et al. 2019]* recovered on Earth, would thus be, for the most part, thermally altered CI material ejected from Mars.

Accordingly, under this full CIM hypothesis, CI and CY meteorites would also have a primarily Martian origin. It must be emphasized that not all CY may be Martian, since local heating due to impacts even on small bodies is possible, however, thermal alteration on a large body water-rich body like Mars would seem more probable, given the evidence of extensive prior aqueous alteration in most of them, and the oxygen isotopes of the CY group.

The possibility of CIs possibility having a Martian origin was first suggested by *[Toulmin et al 1977]* who analyzed the soils a the Viking landing sites and noted that the Martian soil composition could be simply duplicated by a "50-50 mixture of CI meteorite and Tholeiitic basalt"

However, no known meteorite was known to have originated from Mars at the time, and CI were also considered too fragile to survive the shock of ejection from Mars into space. So the compositional finding was regarded as merely a remarkable curiosity. However, since then, many MMs have been found, some of which show no evidence of shocking on departure from Mars.

The full CIM hypothesis, modified from its original publication, is then: the CI and CY meteorites, hypothetically being part of a volatile rich LAV that was not melted incorporated, for the most part, into the crust, but instead aqueously altered, was then, in some locales, thermally metamorphosized on by later vulcanism on Mars and then ejected to end up on Earth as meteorites. Thus, on Earth we would recover a mixture of CI and CY meteorites.

Since the present water inventory of Mars owes its source to this CI and CI-CY (CY material derived from CI materials), along with other volatiles, we would expect that the CI and CI-CY oxygen isotopes would strongly reflect their Martian origin, being very similar isotopically to water altered materials in other MMs, along with other volatiles.

III. Oxygen, Iron and Chromium Isotope Evidence MMs and CIs

It has now been proposed that Mars received its water from a late shower of CC materials based on "exotic chromium" isotopes found in identified MMs and tentatively associated with CR type CCs by *[Zhu et al. 2022]*. The CI and CR both exhibit high values of $\varepsilon^{54}Cr$ and can thus be considered candidates. As can be seen in Fig. 2. However, the CI have both higher $\varepsilon^{54}Cr$ and an $\Delta^{17}O$ valuemore consistent with Mars than CR, and also more water content, 22%, by weight, as determined by *[Garenne et al. 2014]*.

This means less CI material than CR is needed to both supply Early Mars estimated volatiles and affect the MM Cr isotopes in the observed way. Therefore, by "economy of hypothesis" CI type CC appear more likely to have formed a LAV on Mars than CR. This veneer would then have been the source for CI and CY meteorites recovered on Earth. This is consistent with the details of Fe and O isotopes in both CI and MMs.

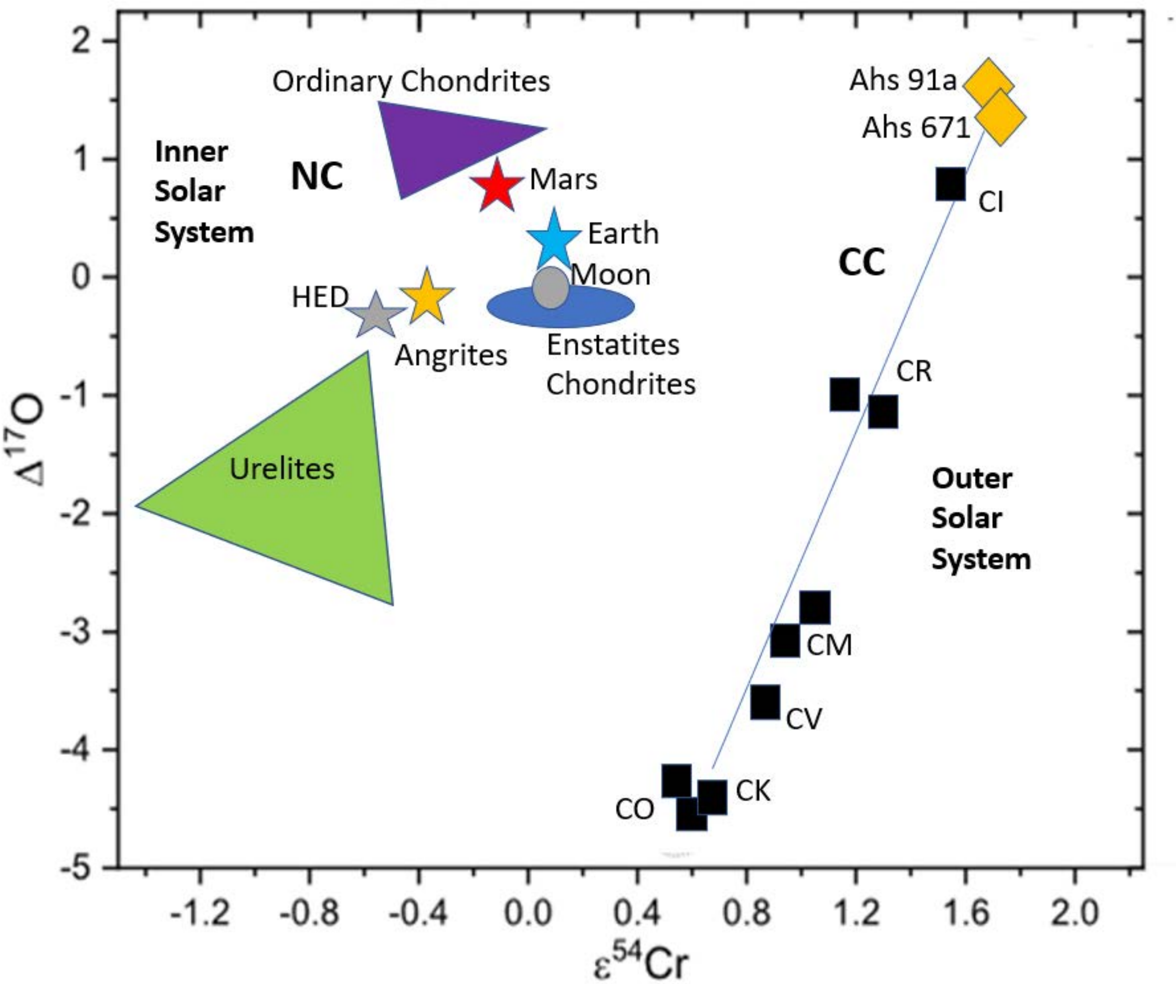

Figure 2: The Dichotomy, adapted from *[Sanborn et al. 2014, Goodrich et al. 2021]*

The oxygen isotopes of the minerals of Mars match CI, far better than CR type CCs, as can be seen in Figure 2.

The major method of determining if a meteorite is an MM is now O isotopes. However, Mars is a complex place and it has been discovered that Mars hydrosphere is out of equilibrium with its lithosphere and this is reflected in a higher $\Delta^{17}O$ for aqueously altered materials, as reported by *[Farquhar et al. 1998].* Here in Fig. 3, CI materials are compared with aqueously deposited carbonates in the ancient MM ALH84001, and other data, including that from CY. As can be seen, CI data and aqueous altered MM data fields overlap.

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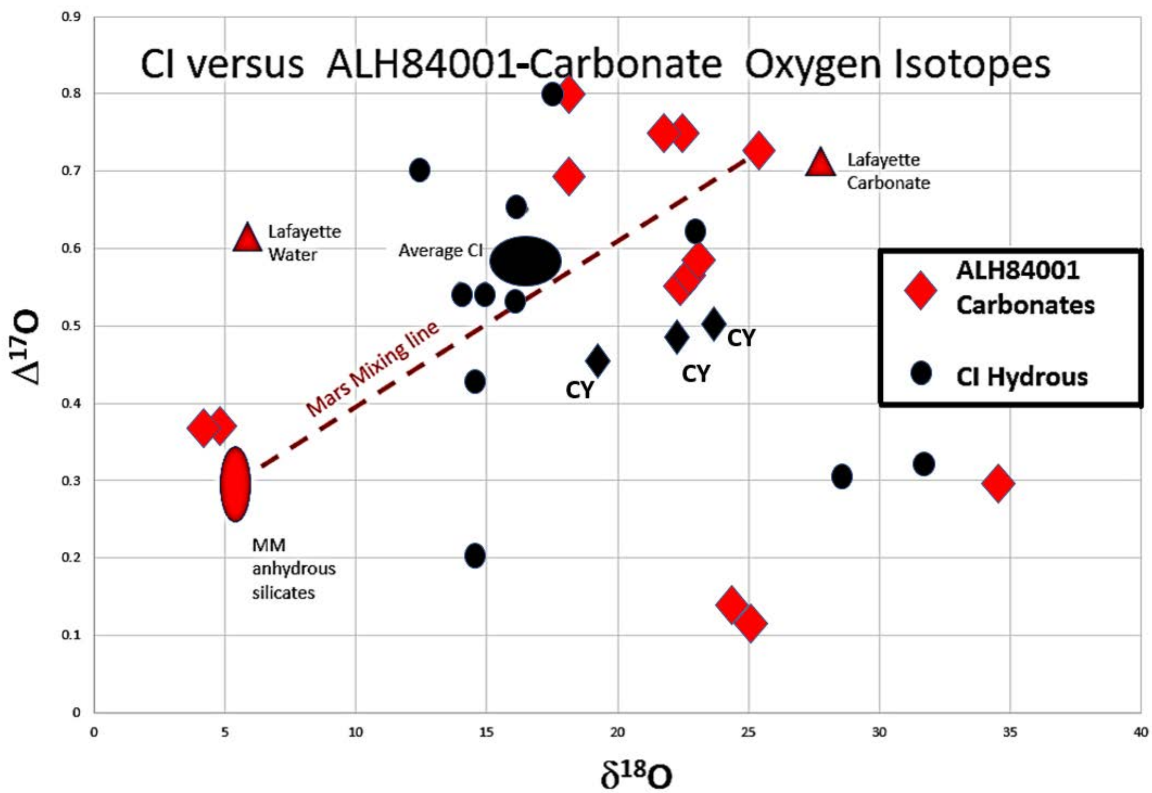

Figure 3: A comparison of O isotope data for aqueously altered CI-CY materials and the aqueously deposited carbonates from the very ancient MM ALH84001. As can be seen the fields of data overlap. See Table 1 and 2 for data and source references

Table 1: CI O data including CY data

CI aqueously altered minerals	$\delta^{18}O$	$\Delta^{17}O$
[Franchi I et al. 1997] CI data	17.5	0.8
"	16.5	0.65
"	23	0.62
"	16	0.6
"	14.5	0.2
"	12.5	0.7
"	28.5	0.3
[Ito et al. 2022] CI data	16.5	0.6
"CI	16	0.53
"CI	14.5	.42
"CI	14	.55
" CI AV	15	.55
*[Ito et al. 2022]*CY data	23.5	0.5
"CY	22.3	0.48
" CY	19.5	.45
"CY	14	.55

Table 2: Alh84001 Carbonate O data

ALHA 84001 carbonates	$\delta^{18}O$	$\Delta^{17}O$
"[Shaheen et al. 2014]"	25.6	0.73
"	21.46	0.75
"	4.17	0.36
"	22.93	0.57
[Farquhar et al.1998]	18.3	0.8
" Layfayette water	6.0	0.62
" Layfayette carbonate	27.5	0.71
"[Ireland and Jaiman 2014]"	22.5	0.75
"	25.3	0.73
"	18	0.70
"	22.5	0.56
"	23	0.58
"	4.8	0.37
"	34.5	0.3

In Fig. 4 below, oxygen isotope data for CI anhydrous silicate grains discussed in *[Leschin et al. 1997]* are compared with those of the MM Chassigny.

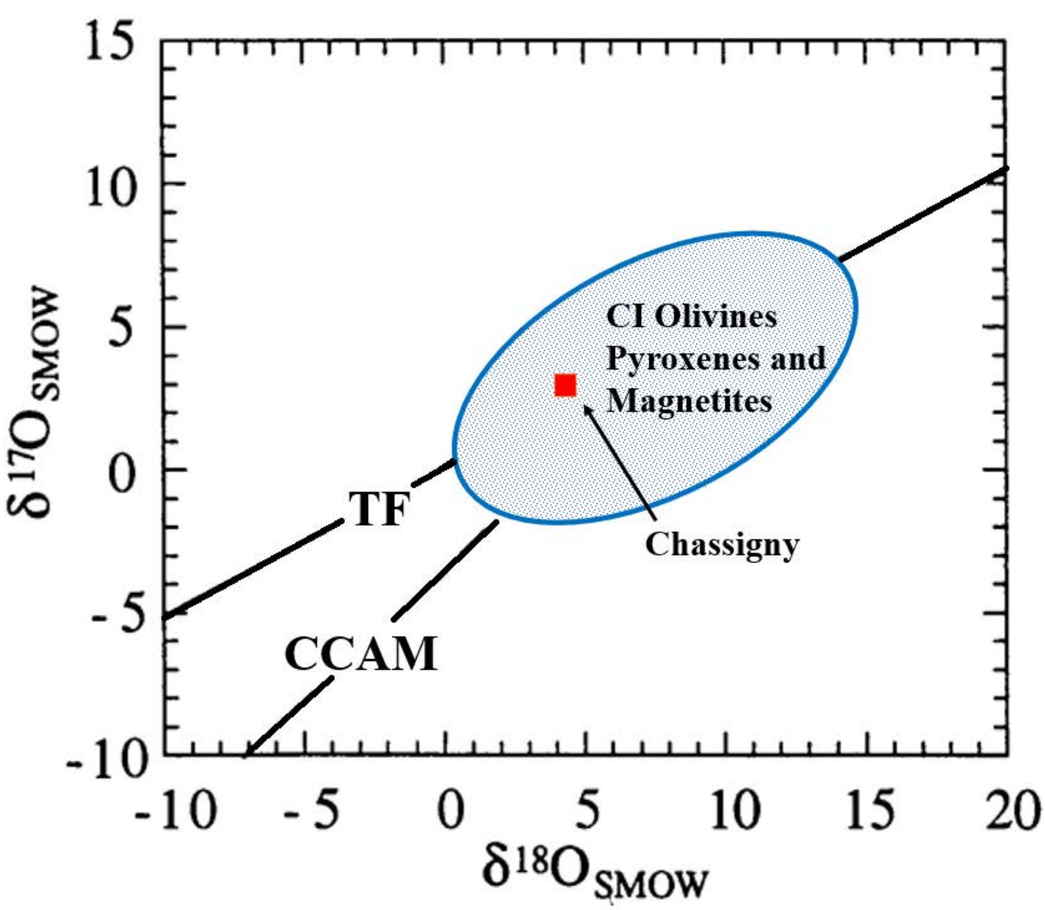

Figure 4: Oxygen Isotope data from olivine and pyroxene grains found CI meteorites Orgueil and Ivuna compared to the Martian olivine Chassigny. Figure adaped from *[Leschin et al. 1997]* TF (Terrestrial Fractionation line) and CCAM (Carbonaceous Chondrite Anhydrous Mineral line). Chassigny data from *[Franchi et al. 1999]* Despite large data scatter, the Oxygen isotopes of the anhydrous CI ferromagnesian silicate grains are consistent with a Martian origin for the CIs and are similar to those of the primordial MM Chassigny

Iron is the most abundant multi-valent element in Solar System materials and is thus a unique isotopic/chemical tracer of planetary processes. It is therefore reasonable to compare the CI and MM iron isotopes.

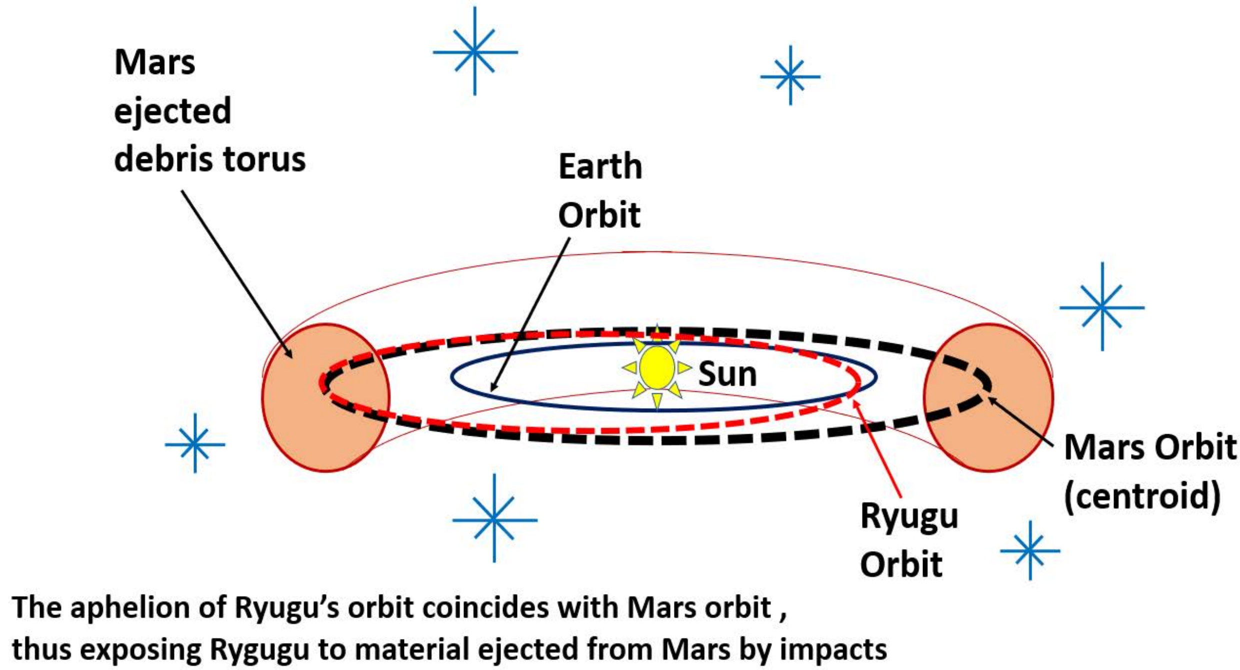

Figure 5: Iron isotope data for Mars, Earth and CI, adapted from *[Schiller et al. 2020]* Supplemental Figure Showing Orbits

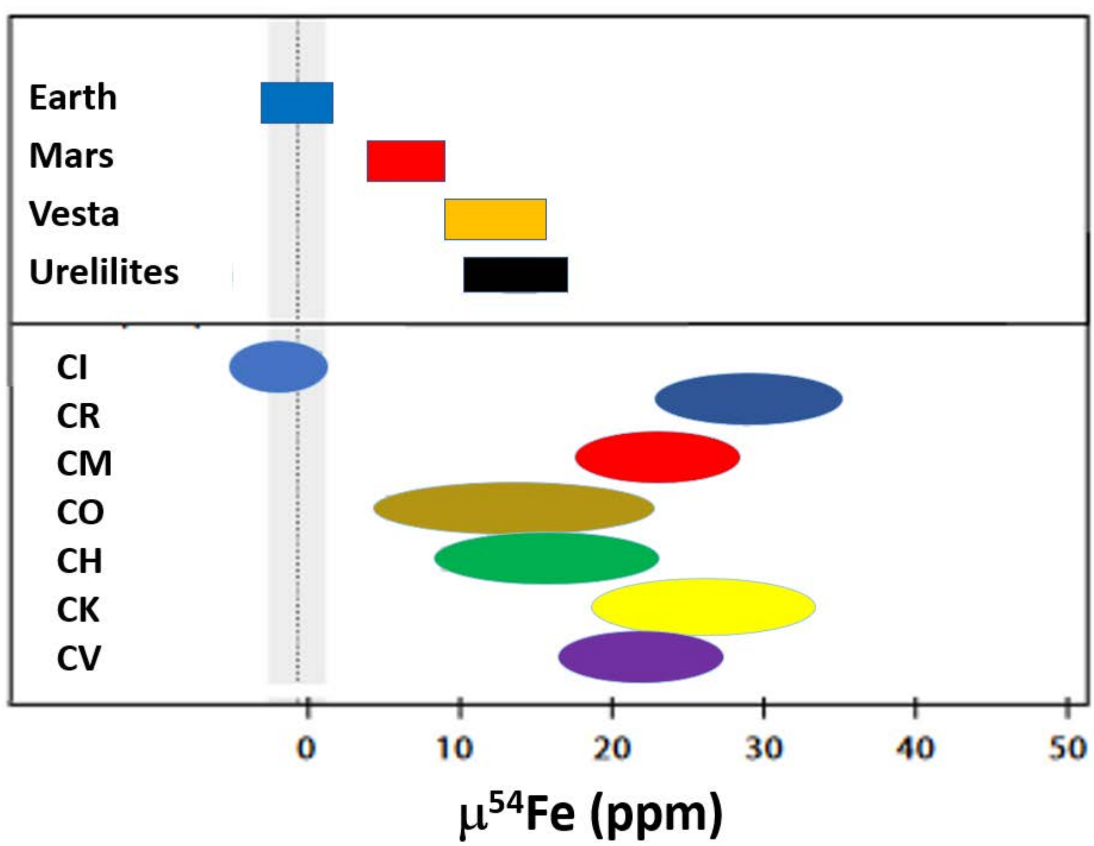

Figure 5: Iron isotope data for Mars, Earth and CI, adapted from *[Schiller et al. 2020]*

As can be seen Figure 5, Mars and Earth are closest in the array of Fe54 data. In general, CI iron isotopes from Earth's mantle basalts and Mars are nearly identical *[Sossi et al. 2016]*

IV. Nobel Gas and Nitrogen Data Linking the CI to Mars

Noble gases provide important bodies of data used to confirm the Martian origin of the MMs, these methods of analysis can now be applied to the CI meteorites.

Mars has undergone extensive evolution of its atmosphere and surface over time, and this is reflected in the makeup of trapped noble gases and nitrogen found in MMs. The CI are of a composition easily destroyed by water and are very ancient. If the CI are indeed part of the MM group of meteorites, because of their absence of aqueous exposure since their formation 4.5 million years ago, consistent with being a "hot, dry, desert" on Mars, they should be expected to share properties with the group of MMs displaying primordial Mars atmosphere features and lack of recent aqueous alteration.

Since it is widely accepted that water was the main transporter of Mars atmosphere into MMs, the most obvious candidate for comparison with the CI in terms of primordial noble gas data is not the oldest meteorites of Mars, but instead Chassigny, since being an olivine, it would have disintegrated on contact with water containing carbonic acid, as any water on Mars in contact with the atmosphere would include. Accordingly, the recognized MM Chassigny, being an olivine, and thus very susceptible to aqueous alteration, is recognized to have avoided significant contact with water during its time on Mars, and is considered to contain primordial Mars gas isotopic inventories. Therefore, Chassigny will be our main focus for comparisons between the CI and Mars. To a lesser extent, we will also look at comparisons of CI and the very ancient MM ALH84001 materials.

The isotopic makeup of trapped xenon in Chassigny is thought to represent the primordial "mantle" component of Mars xenon and consists, as would be expected, of a primarily chondritic component, reflecting accretion from mostly solid bodies. Thus, the Chassigny mantle component, would represent the result of full melt-accretion of solid Solar Nebula materials. Likewise the CI, or un-melt-accreted chondritic component, would represent a similar xenon component. This can be seen in Fig.6. Where the xenon isotope inventory of the CI Orgueil is compared to that of Chassigny. Source data is from and Frick and Monoit et al. *[1977]* and Ott *[1988]* is shown in Table 3.

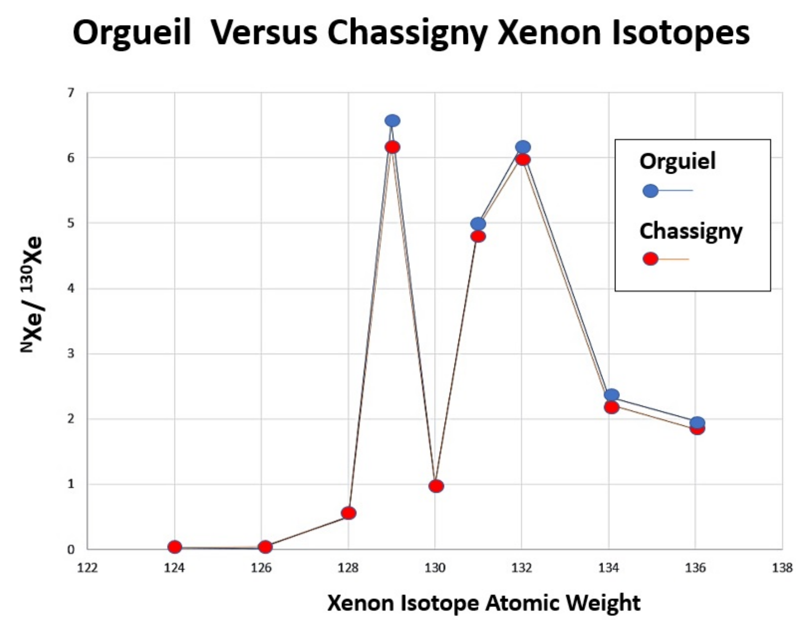

Figure 6: Orguiel xenon isotopes compared to those found in Chassigny. Data found in table 3. As can be seen, the Orgueil xenon is a good approximation to that found in Chassigny

Table 3: Relative Xenon Isotope Abundance (^{130}Xe=1) for Chassigny and Orgueil

Xe Isotope	124/130	126/130	128/130	129/130	130 =1	131/130	132/130	134/130	136/130
Chassigny	0.0344	0.0383	0.498	6.20	1.0	4.951	6.019	2.22	1.831
Orgueil	0.0286	0.0260	0.512	6.554	1.0	5.103	6.179	2.354	1.971

Therefore the xenon isotopes of the MM Chassigny, thought to represent primordial Mars isotopes, are well approximated by the xenon isotopes of the representative CI Orgueil. Mars present atmosphere, as measured by the SAM instrument and reported by [Mahaffey et al. 2013] is quite different, particularly for xenon 129 levels which are approximately 2 times the level of xenon 132.

Similarly the krypton found in CIs, or AVCC (Average Carbonaceous Chondrites), can be found to closely approximate Chassigny krypton as shown in Fig.7.

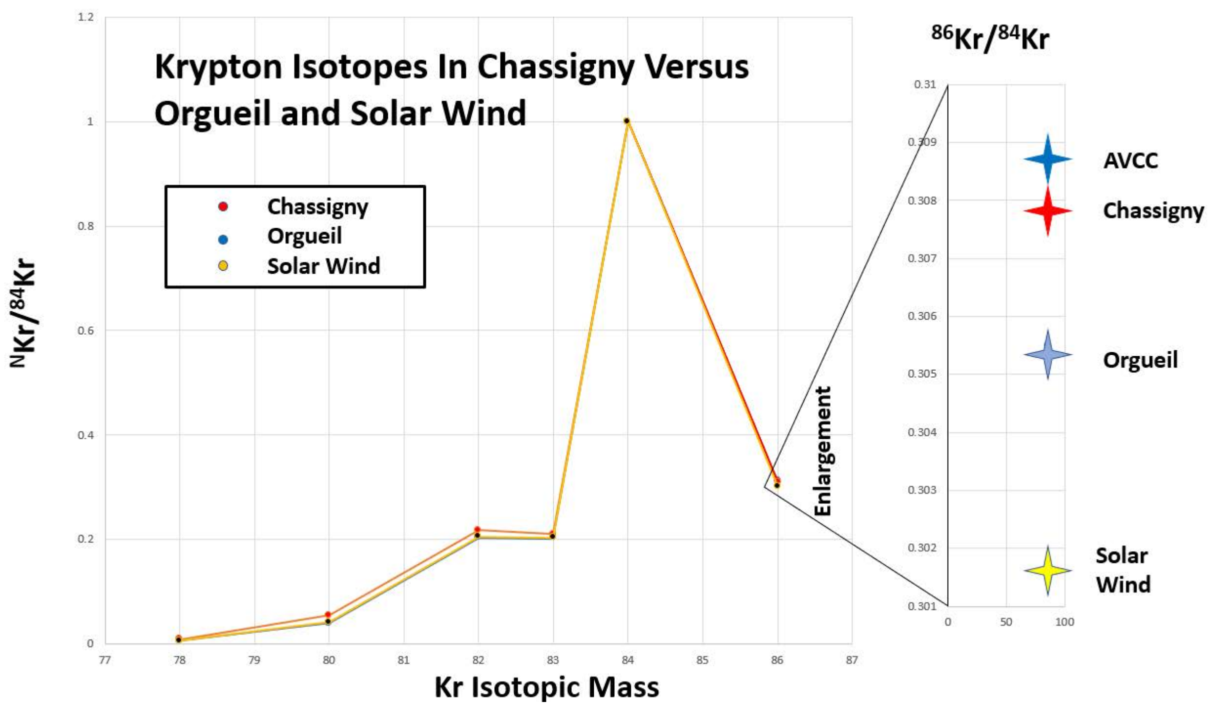

Figure 7: ALH84001 Krypton compared to Orgueil. Data take from Ott *[1988]* and AVCC data from *[Broadley 2022]*: 86Kr/84Kr ≅ 0.3088. Data shown and sources is shown in table 4

The Kr isotopes are very similar, however, subtlebut important differences are present at the parts per thousand level. In particular, the chondritic source for the primordial Chassigny krypton isotopes, proposed by *[Péron and Mukhopadhyay, 2022]* appears supported.

Table 4: Chassigny and Orgueil krypton isotope data

Kr isotope	^{78}Kr/^{84}Kr	^{80}Kr/^{84}Kr	^{82}Kr/^{84}Kr	^{83}Kr/^{84}Kr	^{84}Kr/^{84}Kr	^{86}Kr/^{84}Kr
Solar wind	.00642	0.0412	0.2054	0.2034	1.00	0.301
Mars Chass	.00919	0.0548	0.2176	0.2100	1.00	0.310
Orgueil	0.006	0.0397	0.2037	0.2034	1.00	0.313

Krypton data for Orgueil and Chassigny taken from *[Frick and Monoit 1977]* and *[Ott et al. 1988]* respectively. A Solar Wind data taken from *[Meshik et al, 2014]*.

The CI, here represented by Orgueil, are found to compare favorably with primordial MM argon and neon isotopes, as see in Fig. 8.

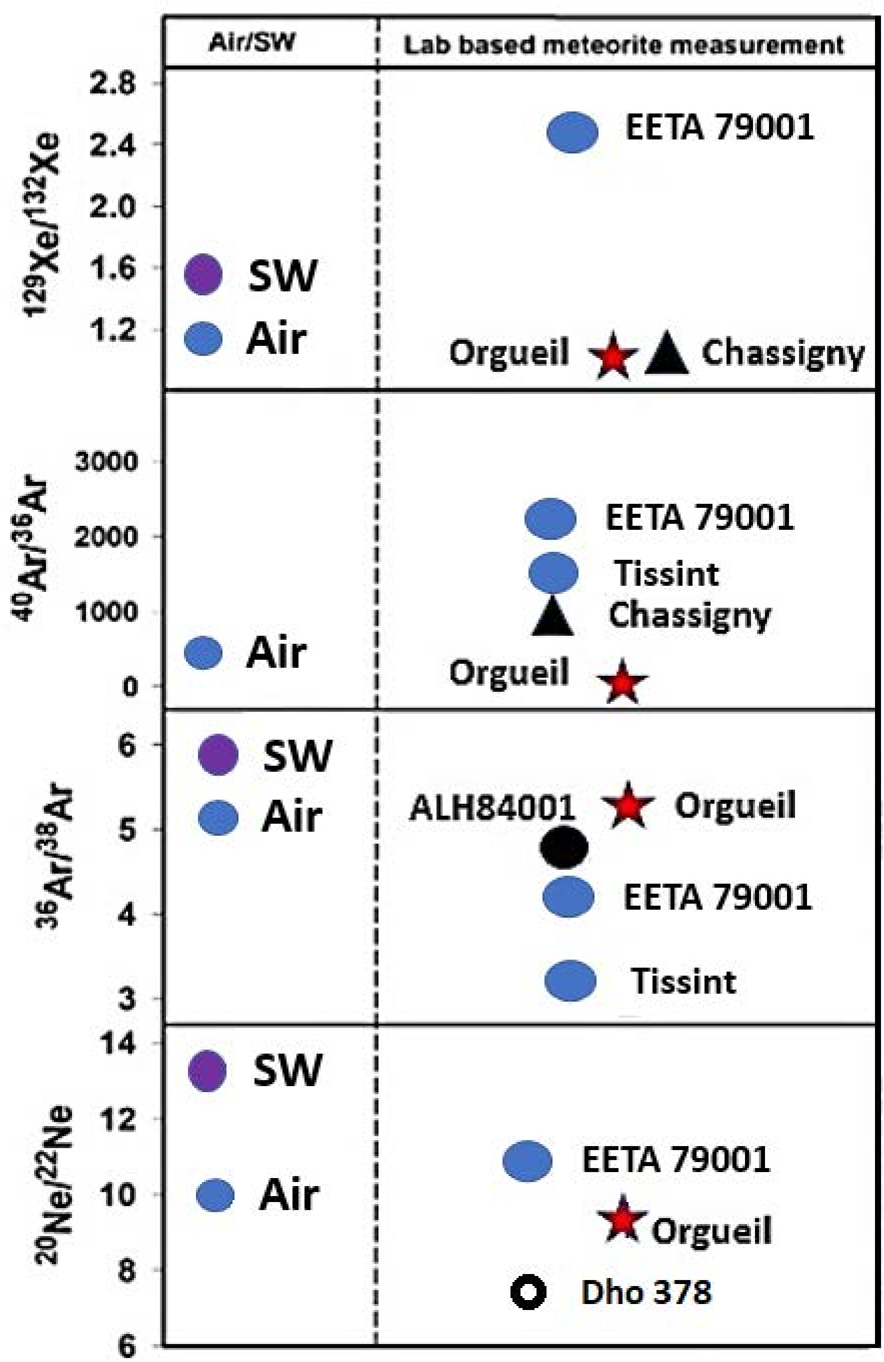

Figure 8: MM isotopes compared to Orgueil, as can be seen the CI data is consistent with a Martian origin for the CI. Graph adapted from *[Smith et al. 2020]* with data from *[Frick and Monoit 1977]* and *[Ott et al. 1988]*

Mars nitrogen isotopic fractionation, if one accepts the ancient MM ALH84001 value found by *[Mathew et al. of $\delta^{15}N \cong +46$, 1998]* as primordial, the matches well with that found in the also ancient CIs by [Pillinger 1984] at $\delta^{15}N \cong +43$.

Therefore, there is abundant isotopic data linking CIs and Mars. This includes the standard oxygen isotope from recognized MM materials, which links the heavily (primordially) aqueously altered CI, and aqueously altered MM materials, and also iron. In addition, the primordial nature of the aqueous alteration of the CI materials, and anhydrous existence afterwards, is found to contain noble gases that compare well with primordial xenon and krypton in primordial MMs, especially with Chassigny, which like the CIs was not exposed to water since its initial formation. However, isotopic comparisons are not, by themselves sufficient to establish a CI-MM connection. We will now consider the chemical data from both MMs and CIs, to see if they are consistent with this CI-MM connection.

V. Chemical Data Comparing CI with MM Materials

The CI are recognized to have formed from aqueously altered parent rock, some of which originated as fine olivine and pyroxene grains, falling from space into a water rich environment. However, the CI parent rock apparently dried up before the in-fall of the olivine and pyroxene grains ended, preserving some of the grains from aqueous alteration. Thus, the CI contain samples of their source anhydrous rock *[Kerridge and MacDougall 1976],* and this can be readily compared with the mostly anhydrous rock of the MMs. If Mars late accretion received CI like material, in the form of olivine and pyroxene grains, then this should be manifest in a chemical similarity between MM Mars mantle lithologies and the CI olivine and pyroxene grains, which would represent a final late in-fall portion of the late accretion of Mars. We begin with a chemical comparison of the CI olivine grains with the Chassigny olivine, as seen in Fig.9 below. As can be seen, the Chassigny olivine appears to fall on a trend line formed by the CI olivine grains in Ca and Fe content.

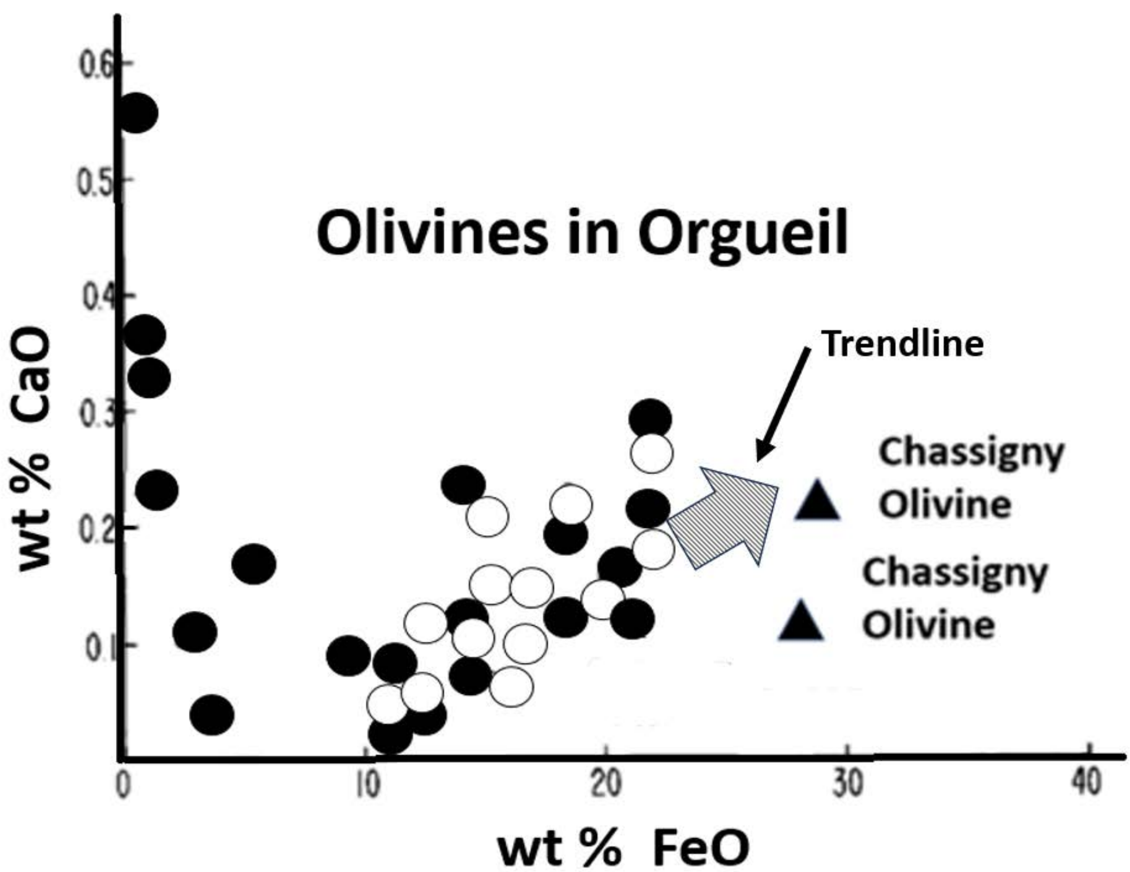

Figure 9: Calcium versus iron in Orgueil silicate grains. Note that Chassigny olivine lies at the end of a trend line formed by Orgueil data. Graph adapted from *[Kerridge and MacDougall 1976],* Chassigny data from *[Smith et al. 1983]* and *[Lorand et al. 2018]*

The CI olivine and pyroxene grains are unique in having melted embayment's, *[McSween 1977]*, as if they fell through a dense atmosphere under the influence of strong gravity. The CI grains also demonstrate that they were regolith materials at one time, with some being marked by solar flare tracks.

The CI are very ancient , and composed of highly aqueous-altered materials and therefore would have sampled the same geochemical environment as the ancient recognized Mars meteorite ALH84001, which also contains aqueously altered materials. If the CI are from Mars, we would expect chemical similarities between the aqueously altered minerals in CIs compared to ALH84001. We can therefore, also compare aqueously altered materials, ferroan carbonates, in the primordial MM, ALH84001, chemically, with similar aqueously altered minerals found in CIs, as is done figure 10. Consistent with the CIM Hypothesis, the comparison is good, with the CI ferroan carbonates appearing to lie close to an array of low Ca ALH84001 ferroan carbonate data.

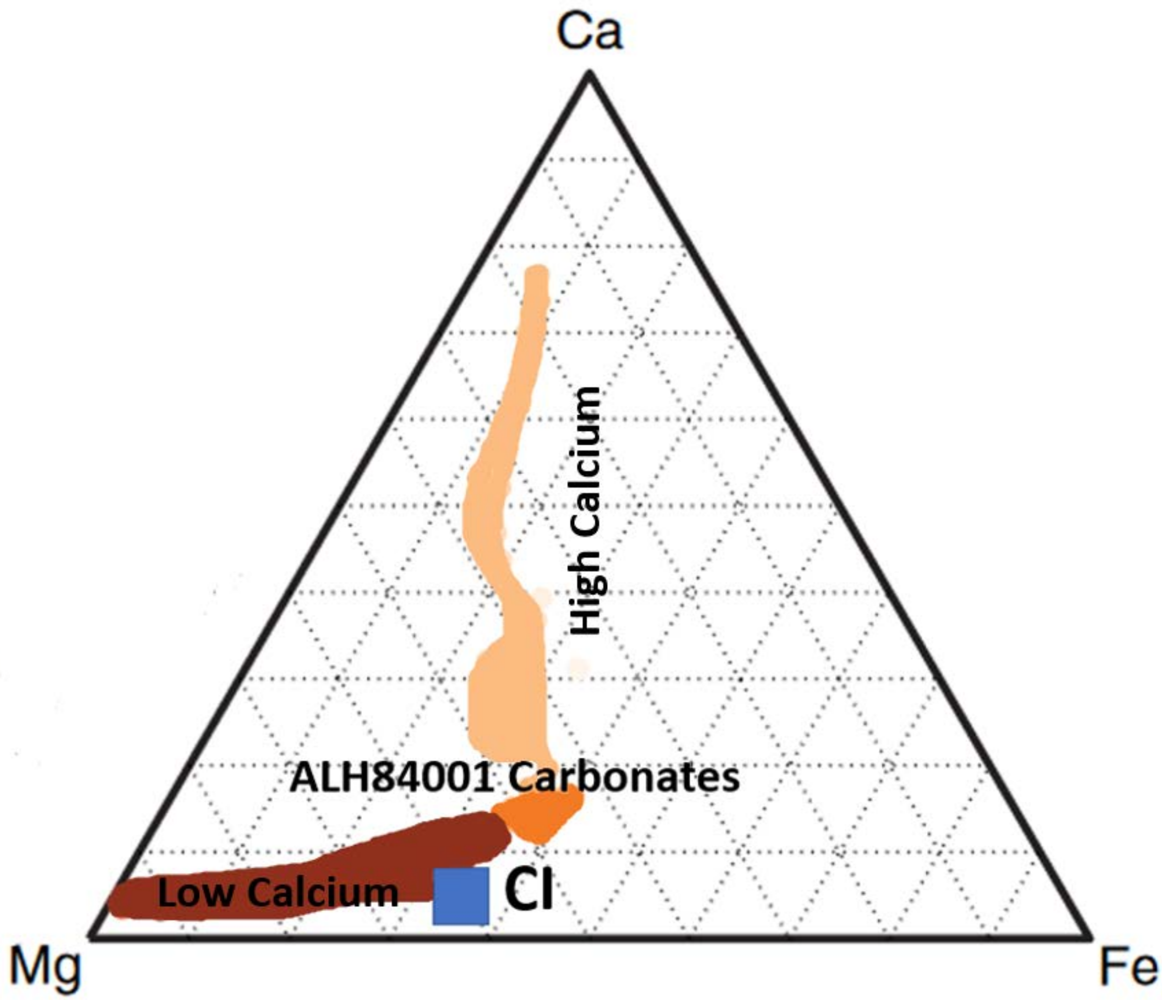

Figure 10: Comparison Mg, Fe, and Ca content in ALH84001 carbonates and those found in CI matrix. As can be seen the CI data appears to lie on a mixing line defined by the ALH84001 data. Graph adapted from *[Halevy et al. 2011]* CI data from *[Richardson 1978]*.

VI. Morphology of CI Minerals Compared to those Expected in Mars Materials

Finally, we must ask, are the physical morphologies of minerals found in the CIs consistent with formation in a planetary, as opposed to an asteroid-like environment, in the Early Solar System? The CI consist of clay clasts, formed in an environment of abundant warm water, apparently then drying, then broken up by low velocity impacts and then welded together by ferroan carbonates before drying again. The CI are unique among chondrites in showing absolutely no sign of hypervelocity impacts *[Kerridge and Bunch 1979],* they thus formed in a "velocity-buffered" environment, either under a dense atmosphere or buried deeply on an asteroid. We, however, also know the CI parent rock formed as a regolith, because they contain olivine and pyroxene grains containing solar flare tracks, hence falling from outer-space. Accordingly, it appears far more likely they were not buried deeply on a asteroid but formed under a dense planetary atmosphere. The simplest explanation, then, for all these features, the velocity-buffered environment, the essentially complete water alteration of the parent olivine and pyroxene grains, simultaneous with being regolith "exposed beneath the sky," is that the CI formed as a regolith on a planetary sized parent body with strong gravity, able to hold an atmosphere Earthlike both in pressure and temperature.

This atmosphere allowed liquid water to exist on the CI parent body on its surface, the atmosphere also supplied velocity buffering, shielding regolith from small hypervelocity impacts. Do other morphological features in the CI minerals support this concept of a dense atmosphere held in place by a strong gravity field?

The clay clasts of the CI are unique amongst those found in Carbonaceous Chondrites in that they contain coherent laminations consistent with aqueous deposition in planetary scale gravity field. These laminations are seen in Fig.11.

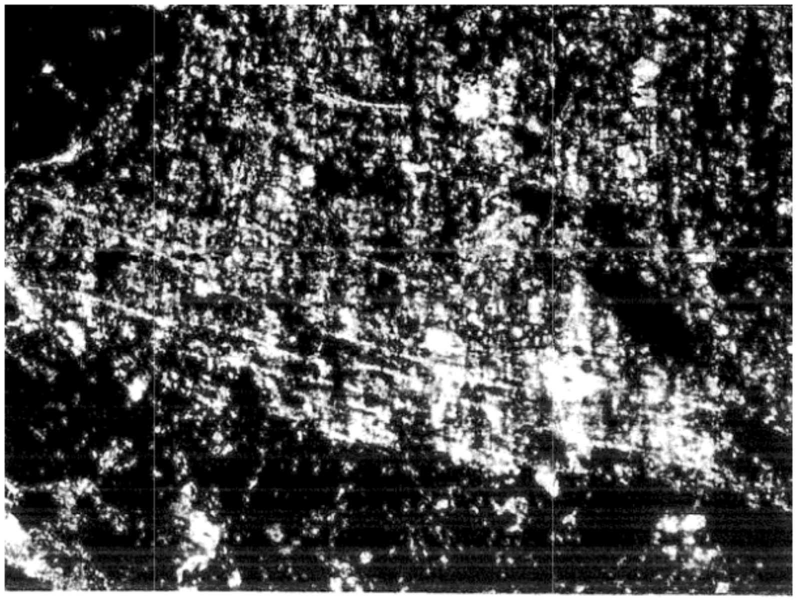

Figure 11: Lamellar features in a CI clast, consistent with formation in a planetary gravity field. Image take from *[Kerridge and Bunch 1979]*

In addition to these features, consistent with the parent body of the CIs being a large planetary body like Mars with a dense warm atmosphere allowing liquid water, and preventing small hyper-velocity impacts, we also have the morphologies of the olivine grains in the CI that are unique in that olivine grains contain embayment features *[McSween 1977]* centered on the high iron-lower melting point regions. Olivine is composed of a mixture of forsterite, high magnesium-high melting point, and fayalite, high iron-lower melting point minerals. Thus, when exposed to high heating, the high-iron portions of an olivine grain will melt preferentially. This means the embayment features seen on the CI olivine grains are consistent with the olivine grains falling from space under the influence of a strong gravity field, into a dense atmosphere and being ablated as they slowed down, with the high Fe surfaces suffering the most damage. A typical embayed olivine grain is shown in Fig.12.

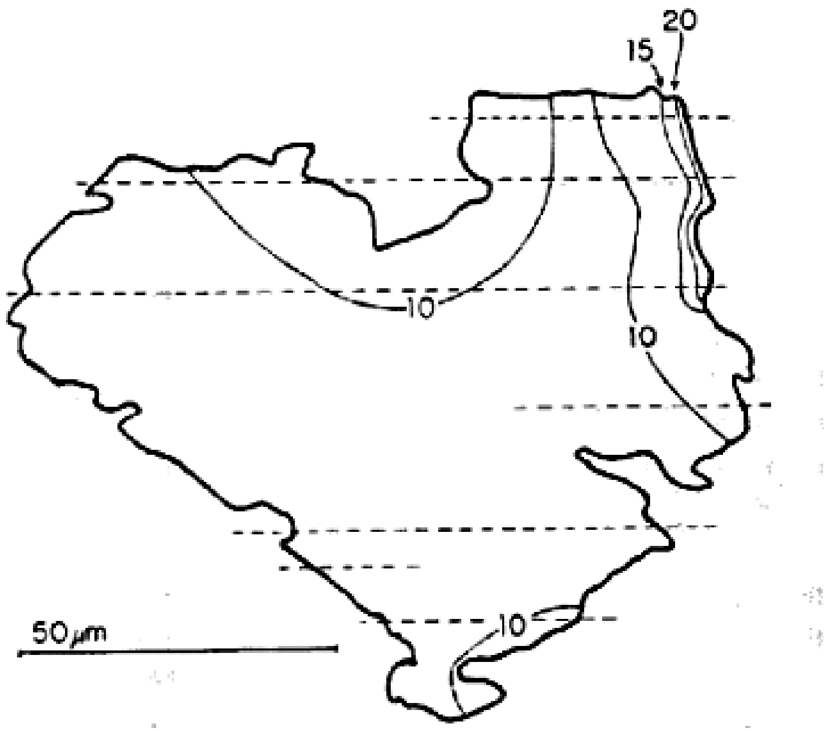

Figure 12: An olivine grain showing embayment features conforming to higher iron, (iron % shown by numbered contours) and therefore lower melting point regions, consistent with thermal ablation while falling through a dense atmosphere from space. Image taken *from [Kerridge, and MacDougall 1976]*

VII. A Test for the CIM Hypothesis of CI-CY Martials

It is readily conceivable that sub-planetary bodies of CC martial accreted in the Early Solar System outside the ice-line, it is also reasonable to expect that heating by ^{26}Al decay , with half-life of 0.72 milllion years, together with gravitational accretion energy would heat the icy CC material. If this occurred, at least in buried layers, the icy material it could undergo extensive aqueous alteration into phyllosilicates, as described by *[Bischoff 2010]*. However, what seems highly unlikely is that following the aqueous alteration, a new phase of heating could occur at temperatures above 500C *[Nakamura 2005 and King el al. 2019]* to meta-morphosize the phyllosilicates back into olivine, on such sub-planetary bodies. One would expect that temperature of such a body to decrease monotonically in time due to the rapid decay of the Al 26 and radiative cooling. Also, the presence of abundant water adds great complications. As was carefully modeled by *[Grim and McSween 1989]* the high water content of phyllosilicates greatly constrains the temperatures achieved in such heating scenarios.

Water at high temperatures exerts high pore pressures and is very mobile. Water freed by heating of phyllosilicates to above 500C would be a high pressure vapor, being above the critical point of 373 C, and would and would have to be confined by sufficient hydrostatic pressure from exploding the heated body from its core. The pressure at the critical point of water is 22 Mpa (220 bars) *[Wagner and Pruss 2022]*.

High hydrostatic pressure at the center is needed to confine such pressures, even at the temperature of 373 C, which is lower than the 500C required for the observed thermal alteration of CI material to CY, as reported by *[Nakamura 2005]*. For an approximately spherical sub-planetary body of uniform density ρ, core pressure P_C is found by integration inwards from the surface at r=R of the hydrostatic equation:

$$\frac{dP}{dr} = \frac{4\pi G}{3}\rho^2 r,$$

where G is the newton Gravitation constant. When this is done we can obtain the approximate equation for the pressure in the core of such a body, P_c, of density ρ, in terms of its observed surface gravity $g_s = (4\pi G/3)\rho R$

$$P \cong \frac{3}{8\pi G} g_s^2$$

Even for water at its critical point, of 373 C, above which it cannot remain liquid, one would require confining pressures at the core of 22Mpa. This would require an asteroid body of the size of 3 Juno with radius 134km and surface gravity of g_s= 0.12m/s^2 giving

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an approximate core pressure of approximately 25 MPa. These pressures would be found at the core , and would decrease quadratically to zero at the surface of the body. This means that if water freed thermally from phyllosilicates, was to find, or make, a path into the outer layers of the asteroid-sized body it would explode its outer layers into space, a scenario discussed by *[Wilson et al. 1999]*. This would not even be the end of this catastrophic scenario, since the exposed hot core, now missing its overburden to confine it, could also then explode. Accordingly, the thermal alteration of previously aqueously phyllosilicates on an asteroid sized body by decay or accretion heat seems an unlikely scenario. Thermal alteration of CY material appears to have occurred in short duration event, and this does not seem consistent with an Early Solar system isotopic decay heating scenario *[Nakamura 2005.* Less generally, one could suppose the heating was localized by later surface impacts, however, the CI-CY material shows no evidence of direct hypervelocity impact, and the same properties of a water rich phyllosilicate, leading to the disassembly of local strongly heated materials by steam pressure, would seem far more likely to launch surface material into space with steam explosions, than allow it to be heated by heat conduction from an impact site. While it is possible such material could reform a regolith on another small body, as discussed by *[Wilson et al. 1999]*], it seems more like the matter would remain isolated and scattered in deep space.

Alternatively, it seems far more likely that the vast majority of CI-CY parent materials could have originated as LAV materials on a large planetary body, such as Early Mars, with a dense atmosphere, strong gravity, and abundant liquid water, and also abundant interior heat, giving rise to localized vulcanism to achieve thermal alteration. With the added constraint of requiring the oxygen isotopes of the CC materials and their water being above the Martian anhydrous fractionation line, the scenario for both aqueous and later thermal alteration on Mars seems far more likely than for it occurring on a small asteroid sized body. The MM NWA 7533 appears to have undergone thermal alteration only 1.7Ga years ago *[Humayun et al. 2013]* and the CI-CY, if their source lithology was on Mars, may have experienced similar thermal alteration late in geologic time there.

This CIM hypothesis, including thermal alternation of CI-CY meteorite source lithologies on Mars can be tested by finding the absolute chronology of the aqueous and thermal alternations, with the finding of thermal alterations occurring 50 million years or more after the formation of Mars crust, long after the half-life of Al 26. This late chronology of thermal metamorphosis of CI-CY material would make the Mars heating scenario much more likely.

While constraints on CY thermal chronologies, and thus tests of the CIM hypothesis, can conceivably be made using CY materials found on Earth. A sample return of surface materials from Phobos and/or Deimos, the moons of Mars, could also provide data to test this hypothesis. Like Ryugu (Kitazato et al 2019) the surface reflectance of Phobos and Deimos resembles Carbonaceous Chondrite material (Fraeman et al, 2014) and this suggests they , like Ryugu, may have received CI material as ejecta from impacts on Mars, as would be reasonable under this hypothesis. If CI material is found to dominate such returned samples then the CIM Hypothesis would be strongly supported.

VIII. Summary and Discussion

The recovery, by the Hayabusa 2 mission, of hydrated CI material from the surface of Ryugu, which orbits near Mars, and thus would intercept material from the required ejected material torus around Mars orbit, indicates that CI material comes from a source near Mars. Mars is the largest and only local source of hydrated material. Thus, based on the Ryugu results, Mars should be a considered a most likely candidate for CI material.

Lack of hypervelocity impacts and the presence of olivine grains with flare tracks indicates CI formed as regolith in a 'velocity buffered' environment, that is, under a dense atmosphere. This is also consistent with the embayment features found in olivine grains indicating ablation while falling into a dense atmosphere from space under the influence of planetary-scale gravity, allowing warm liquid surface water and the nearly complete aqueous alteration of the CI materials. The layering of the clasts is an additional sign consistent with formation in strong gravity field as required for a dense atmosphere. This is all consistent with imagery from ancient Southern Mars, showing abundant water channels.

Chromium isotope data from MMs is consistent with a late bombardment of CI like material. The oxygen isotope data of the CI materials overlap those from aqueously altered MM materials. Trapped noble gases and nitrogen are approximate matches to those found in the also ancient ALH84001 and Chassigny. The chemical makeup CI olivine grains and of the anhydrous MM Chassigny are also similar, as are the aqueously altered materials in CI and ALH84001.

The simplest explanation for this data, from Earth, Ryugu, and Mars itself, taken as a whole, is that the CI parent body is Mars, with CI parent rock most likely in the southern heavily cratered highlands. The CI can be thus considered as "old lake bottom material from early Mars" The great age of the CIs balances the statistics between young crystallization age MMs with very ancient ones, and once included in the MM collection, cause it to fully reflect the bimodal nature of

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Mars surface ages. The CI are thus the "missing old meteorites of Mars" as was first suggested by the author*[Brandenburg 2014]* The CI being recognized as Martian , then means that Mars surface is well sampled by our enhanced MM collection.

The CI are 2% organic matter indicating that the early Mars surface was warm, wet, and rich in organic precursors for biology. Empirically, life on Early Earth originated in such circumstances. Accordingly, if the CI parent rock material was deposited on Mars, it makes it appear likely, based on the Earthly record, that life began on Early Mars as it did on Earth.

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To Foundations of General Theory Relativity

By Dubrovskyi I

Abstract- It is shown that the foundations of the generally accepted theory contain a number of contradictory and unfounded statements. The geometric properties of the three-dimensional Riemannian space are successively described. It is shown that this space is locally Euclidean. The metric tensor can be algebraically diagonalized. In this case, all diagonal elements are equal to each other and differ from unity by a function of coordinates, which is called the gravitational potential. It is shown that this function is a solution of the differential equation of potential theory. If this solution is such that the potential can be represented by equipotential surfaces, then the trajectory of free motion of a material particle lies on this surface. The trajectory on the surface is a geodesic line determined by the initial conditions. The numerical value of the potential on the surface is included in the definition of the maximum possible speed on this surface, that is, a constant equal to the speed of light in vacuum is multiplied by a value less than one, determined by the value of the potential.

Keywords: general theory relativity, Riemannian space, pseudo-Riemannian space, gravitational potential, tensor Ricci, time, speed, inertial motion, geodesic line.

GJSFR-A Classification: (LCC): QC173.6

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Keywords: general theory relativity, Riemannian space, pseudo-Riemannian space, gravitational potential, tensor Ricci, time, speed, inertial motion, geodesic line.

I. Introduction

The General Theory of Relativity is based on the description of the geometry and properties of space-time [1]. The author is not an expert in this field. He worked for fifty-four years at the Institute for Metal Physics National Academy of Science Ukraine. He currently lives in the State of Israel and does not work in any research institution. Reading the monograph [1], he found that the authors point out many contradictions inherent in modern theory. Some thoughts arose on how to resolve these contradictions, and not being able to discuss them, the author outlined them in the article "Kinematics and Dynamics of a Particle in Gravitation Field" and sent it to the Global Journal with a request for a review. The reviewers did not raise any objections, recognized the article as interesting and recommended to publish it. (I do not provide links to this article, because I present all its results in this article and consistently interpret in accordance with the new theory. In particular, what was the main assumption has become a mathematically substantiated fact). Then the author decided to study the question more deeply and used for this purpose the monographs [2], in which the Riemannian geometry is presented in depth and comprehensively for the general case *n*-dimensional manifold.

The authors of works on the general theory of relativity use the results of mathematicians for the four-dimensional space-time. Sometimes attempts are made to introduce additional dimensions of space to introduce fields other than the gravitational one. But it turned out that the consistent formulation of the theory proposed by the author requires considering the Riemannian geometry of three-dimensional space and introducing the time axis additionally, just as it is done in the Special Theory of Relativity.

In the second section of this work, a brief critical review of the theories of space-time adopted in the Special Theory of Relativity and the General Theory of Relativity is given.

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In the third section, we show that in three-dimensional space the metric tensor, when diagonalized, becomes the unit diagonal matrix multiplied by a scalar function of coordinates. In the case of a Riemannian space, this function differs from unity by an amount that we have called the gravitational potential. The diagonalized Ricci tensor turns out to be the Laplacian of the gravitational potential. In a flat space, the Ricci tensor is equal to zero, then the gravitational potential does not depend on the coordinates. If a mass is distributed in some region of space, creating a gravitational field, then for the gravitational potential we obtain a field equation similar to the Poisson equation in electrostatics.

In the fourth section, the concepts of time and motion are introduced and a rigorous construction of a four-dimensional pseudo-Riemannian space is proposed based on the construction of a four-dimensional pseudo-Euclidean Minkowski space.

The fifth section considers a region of three-dimensional space in which each point is located on an equipotential surface, determined by one parameter, the value of the gravitational potential. Then the initial conditions define the trajectory as a geodesic line on this surface. In this case, the differential of the world line arc is proportional to dt and is determined by a formula similar to the formula of special relativity with the world constant c_0 replaced by the product $c_0 Q$, where Q is less than 1 and is determined by the value of the gravitational potential on the corresponding equipotential surface.

II. Space and Time in the Theory of Relativity. Critical Review

Physical space is the space of positions. In the absence of gravity, it is a three-dimensional affine space in which a three-dimensional orthogonal frame of the curvilinear coordinate system can be introduced at any point. Point coordinates determine its position and can be changed by introducing another system of curvilinear coordinates. If in an affine space a Cartesian system of orthogonal coordinates describing the entire space can also be introduced, then such a space is called Euclidean. The complete axiomatics of an affine space can be found in the monograph [2].

Changing the position of a material point in an unchanged system of spatial coordinates is called movement. A point can be in various states of motion, in particular, in a state of rest. The state is described in a three-dimensional state space, the three dimensions of which x^1, x^2, x^3 form the space of positions. A trajectory $l(\boldsymbol{r}(t))$ is a line that a point describes in position space when its coordinates are continuous functions of time. The fourth dimension of the space of states - time, has completely different physical properties, but in the modern generally accepted theory of relativity, this is described only by the fact that the time is measured by an imaginary number $\mathrm{i}c_0 t$, where c_0 is the world constant, the speed of a plane electromagnetic wave in vacuum. The coordinate axis of time is perpendicular to all three Cartesian axes of space. Such a space, called the pseudo-Euclidean rank one, was introduced by Minkowski and well described all the phenomena of Einstein's Special Theory of Relativity (STR). A detailed description of this geometry can be found in [1,2] and any other monograph where STR is described.

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Trajectory arc differential is

$$dl = dt\sqrt{v_1^2 + v_2^2 + v_3^2} = |\mathbf{v}|\,dt\,. \tag{1}$$

In Minkowski space, the history of the existence of a material particle in space and time is described by a world line, whose arc differential is

$$dS = dt\sqrt{-c_0^2 + (v^1)^2 + (v^2)^2 + (v^3)^2} = \mathrm{i}c dt\sqrt{1 - \mathbf{v}^2/c_0^2}\,. \tag{2}$$

(Here and below, we will denote by capital letters the quantities related to the four-dimensional space-time). Einstein, based on the similarity of gravitational forces with inertial forces and the equality of inertial mass and mass in the law of gravitation, suggested that gravitation is a change in the geometry of four-dimensional space-time, the replacement of pseudo-Euclidean geometry with pseudo-Riemannian one. But the sequential development of the geometry of the four-dimensional pseudo-Riemannian space was not carried out, it was assumed that the imaginary coordinate can be treated in the same way as with the real one. This led to incorrect results.

The set of elements of the four-dimensional Riemannian space, called points, is one-to-one mapped onto a connected region of change of four real variables x^i up to an arbitrary transformation of these variables into new variables according scheme $x^i = f^i(x'^0, x'^1, x'^2, x'^3)$ (Latin indices take the values 0, 1, 2, 3). This transformation must be reversible and differentiable. The special properties of the time coordinate are not considered in any way. They cannot be preserved at a certain coordinate with arbitrary transformations of all coordinates. If we determine that in some coordinate system one of the coordinates is an imaginary number, then when transforming coordinates, all coordinates become complex numbers. In a Riemannian space, an orthogonal frame leading to the differential form (2) can only be introduced locally, in a Euclidean space that is tangent at a certain point in the Riemannian space. Therefore, the four-dimensional space of general relativity is not a direct generalization of the four-dimensional space of STR, the Minkowski space. This leads to many contradictions, noted, for example, in the monograph [1].

The main contradiction, which is usually ignored, is that when the curvature tensor tends to zero, the transition of the four-dimensional space of general relativity into the space-time of Minkowski does not occur. In the monograph [1], the differential quadratic form (2) (interval) of a pseudo-Euclidean space, which is invariant under coordinate transformations, is transferred without proof to a four-dimensional pseudo-Riemannian space, the mathematical description of which is not given. In the monograph [2], a pseudo-Riemannian space is defined by the fact that the tangent spaces at each point of the Riemannian space are pseudo-Euclidean. But the tangent spaces of a Riemannian space can only be Euclidean spaces, and vice versa, pseudo-Euclidean spaces can only be tangent to a pseudo-Riemannian space, which is not defined. Therefore, in the chapter of the monograph [2] devoted to the mathematical foundations of general relativity, the change in geometry is described by introducing an $\gamma_{ij} dx_i dx_j$ where $\gamma_{ij} \ll 1$ into the differential form (2). Similar assumptions about small gravitational potential, not related to geometry, are made by other authors, in particular, in the monograph [1].

III. Gravitational Potential in Three-Dimensional Riemannian space

The positional space is a three-dimensional Riemannian space R_3, 3-manifold in which the metric tensor field $\left\| \boldsymbol{g}(x^1, x^2, x^3) \right\|$ is given. Let's consider some special properties of this matrix. Quadratic form of three-dimensional Riemannian space $dl^2 = g_{\alpha\beta} dx^\alpha dx^\beta$ can be diagonalized algebraically. The characteristic equation of the matrix of the third rank is the equation of the third degree $y^3 + ay^2 + by + c = 0$. Its coefficients are certain functions of the six components of the metric tensor at the considered point in space:

$$a = g_{11} + g_{22} + g_{33}$$

$$b = g_{12}{}^2 + g_{13}{}^2 + g_{23}{}^2 - g_{11}g_{22} - g_{33}g_{22} - g_{33}g_{11} \quad . \qquad (3)$$

$$c = g_{11}g_{22}g_{33} - \left[g_{11}g_{23}{}^2 + g_{22}g_{13}{}^2 + g_{33}g_{12}{}^2 \right] + 2g_{12}g_{23}g_{31}$$

The values of the coefficients change depending on the coordinates of the point, but from (3) it is obvious that they are always real. The roots of a cubic equation are certain functions of its three coefficients. They can be real or complex, but it is known that one of the roots of a cubic equation is real regardless of the values of the coefficients. We will further denote the only always real root of the characteristic equation $G(a,b,c,)$. Hence the matrix

$$\left\| \boldsymbol{g}(x^1, x^2, x^3) \right\| = \left[1 + G(a,b,c) \right] \begin{Vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{Vmatrix}, \; g_{\mu\nu} = \delta_{\mu\nu} \left[1 + G(x^1, x^2, x^3) \right] \quad . \qquad (4)$$

The dependence of the metric tensor on coordinates is included in the definition of $G(a,b,c,)$ through the definition of three coefficients of the characteristic equation (formula (3)). Since the components of the metric tensor in the Riemannian space are function of the coordinates, $G(a,b,c,)$ is also definite function of the spatial coordinates $G(\boldsymbol{r})$. In Euclidean space $G(\boldsymbol{r})=0$. We will further call the function $G(\boldsymbol{r})$ the gravitational potential.

The result expressed by formula (4) is a general theorem: in three-dimensional space, a bivalent symmetric tensor reduces to a scalar function of coordinates multiplied by the identity matrix. The quadratic form (arc length element) in the Riemannian space under consideration has the form:

$$dl^2 = [1+G(\mathbf{r})]\left[(dx^1)^2 + (dx^2)^2 + (dx^3)^2\right]. \quad (5)$$

Such a space is called locally Euclidean.

The metric tensor is six arbitrary and independent functions of coordinates that satisfy the differentiability condition. Therefore, the gravitational potential is still an arbitrary function. To find an equation whose solution can be the gravitational potential, let's move on to considering the Riemann tensor for three-dimensional space. Riemannian geometry asserts that a necessary and sufficient condition for a space to be flat is the equality of the Riemann tensor to zero. It is easy to show (see to [2]) that in three-dimensional space the Riemann tensor reduces to the bivalent symmetric Ricci tensor. According to the theorem proved above, such a tensor reduces to an identity matrix multiplied by a scalar function. This function is expressed in terms of the second derivatives with respect to the coordinates of the diagonal components of the metric tensor (4). As a result, we get:

$$\|R_{\mu\nu}\| = \delta_{\mu\nu}\sum_{\alpha=1}^{3}\frac{\partial^2 G}{(\partial x^\alpha)^2}\begin{Vmatrix}1&0&0\\0&1&0\\0&0&1\end{Vmatrix} = \Delta G(x^1,x^2,x^3)\begin{Vmatrix}1&0&0\\0&1&0\\0&0&1\end{Vmatrix}. \quad (6)$$

Therefore, three-dimensional space is flat if the Laplacian of the gravitational potential is identically equal to zero. This means that there is no body that creates a gravitational field.

If the mass density is not equal to zero in some region of space, then the gravitational potential is a solution of the Poisson equation.

This statement can be taken as the basis of the theory of the gravitational field.

IV. Time and Movement

Time is a physical parameter on which all physical quantities depend. Time increases uniformly from an arbitrarily chosen zero, $dt > 0$. Change in physical quantity $a(t)$ with time is determined by the speed da/dt. The physical quantity can also be stationary over a certain period of time, that is $da/dt = 0$. This article will consider only the position of a material point in space and its change in time. An example of another physical quantity, the change in which with time is studied by another section of physics, is entropy.

As shown in Section 3, the geometry of space is determined by gravity. The mass of the particle is so small compared to the mass of the body that creates the gravitational field that its influence on the field can be neglected. Motion is the change in the position of a particle over time. These changes can be divided into the change in time of the geometry of space, i.e., its

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metric tensor, and the motion of a particle in stationary space. Obviously, a change in time of the mass-energy density distribution in a body that creates a gravitational field should also cause a change in time of the gravitational potential. For example, vibrations in the body should generate gravitational waves. An important special case is the rotation of a body, which creates a gravitational field. Its influence on the field is manifested in the fact that the three-dimensional space becomes non-isotropic: the axis of rotation retains its direction.

In a four-dimensional pseudo-Euclidean space of rank 1, the time axis is perpendicular to the three spatial axes and $dx^0 = \mathrm{i}cdt$. As shown in Section 3, the three-dimensional Riemannian space is conformal to the Euclidean space only locally, in a small neighborhood of the chosen point. For the time axis to remain perpendicular to the spatial axes, it must be perpendicular to the three-dimensional Euclidean tangent space at the point in question. Therefore, the four-dimensional event space is not just a four-dimensional Riemannian space. It must be locally conformal to a four-dimensional pseudo-Euclidean space of rank 1.

A four-dimensional pseudo-Riemannian space is an essentially new concept in mathematics. Therefore, for clarity, we describe a simple three-dimensional pseudo-Riemannian space. A two-dimensional Riemannian space is also locally Euclidean [2]. An example of such a space is the surface of a sphere. At each point of this surface, we introduce the time axis on the continuation of the radius, measured by the imaginary coordinate. The result is a three-dimensional pseudo-Riemannian space.

Next, consider the motion of a particle in space and time in a stationary gravitational field. The laws of motion of particles in the absence of gravity, confirmed by experiments, were formulated by Einstein. Their convenient formulation in the form of the geometry of a four-dimensional pseudo-Euclidean space was proposed by Minkovski. An attempt to formulate such a theory for a four-dimensional Riemannian space, the geometry of which changes under the action of gravity, should be recognized as unsuccessful, as shown in Section 2.

An event is the presence of a particle at a certain point at a certain moment in time. Let a material point pass for some time a path in a three-dimensional Riemannian space (a trajectory) $l\left[x^1(t), x^2(t), x^3(t)\right]$. In the four-dimensional pseudo-Riemannian space, each point of the trajectory corresponds to the time axis, perpendicular to the tangent three-dimensional Euclidean space at this point. On this axis, the time interval elapsed from the beginning of the movement to the moment of reaching this point is plotted. The space of events must be four-dimensional, consisting of a three-dimensional space of places and coordinate axes of time, orthogonal at each point to the three-dimensional tangent space.

V. Equations of Motion of a Particle in a Gravitational Field

The main task of mechanics in the macroworld is to determine the world lines of particles in various conditions. In pseudo-Euclidean space, in the absence of forces, this is always a straight line determined by the initial conditions: the starting point and the velocity vector. This is formulated in Newton's first law - the law of inertia: "A particle maintains a state of rest or uniform, rectilinear motion, if no an external force acts on it." In the pseudo-Riemannian event space in this law, only the words "uniform, rectilinear motion" should be replaced by "movement with constant speed."

The transfer of the laws of motion to the pseudo-Riemannian space requires a consistent generalization of concepts and definitions. As shown above, no consistent introduction of the time axis has been made. Therefore, it was believed that the element of the arc ds is proportional dt and built a theory of geodesic lines, along which a point in the absence of acting forces moves at a constant speed. This is unfounded and, as will be shown, incorrect. Next, we correct this theory by using the notion of a pseudo-Riemannian space.

The differential equation of a geodesic curve in a Riemannian space was mathematically rigorously derived [2]. In this case, the parameter that determines the position of the point on the curve is the length of the arc of the curve, counted from the starting point. A geodesic line is a line on which the modulus of the tangent vector with components dx^{α}/ds remains constant along the line. The arc length is called the canonical parameter [2] and it is proved that another parameter can be canonical only if it is associated with s by a linear transformation with constant coefficients.

To consider physical problems, it is necessary to use time as a parameter. In pseudo-Euclidean space (in the special theory of relativity) in curvilinear coordinates, taking into account the fact that the metric tensor is diagonal and does not depend on the coordinates, the world line length differential

$$dS = \mathrm{i}dt\sqrt{c_0{}^2 - g_{kj}dv^k dv^j} = \mathrm{i}c_0 dt\sqrt{1-|\mathbf{v}|^2/c_0{}^2}\,. \quad (7)$$

In this case, dt differs from dS by a constant factor if $|\mathbf{v}|$ is preserved during movement. If we substitute the metric tensor in the gravitational field (4) into formula (7), then we obtain

$$dS = \mathrm{i}dt\sqrt{c_0{}^2 - [1+G\ \boldsymbol{r}\ ]|\mathbf{v}|^2}\,. \quad (8)$$

This formula makes sense if we assume that the movement occurs along an equipotential surface.

Let us consider a region of three-dimensional space in which each point is located on an equipotential surface, determined by one parameter P, the value of the gravitational potential in the point of the initial conditions. Then the initial conditions define the trajectory as a geodesic line on this surface. In this case, the differential of the world line arc dS is proportional to dt and is determined by a formula similar to the formula of special relativity

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$$G(\boldsymbol{r}) = P = \text{const},\ (1+P)^{-1/2} = Q < 1.\quad dS = \frac{\mathrm{i}dt}{Q}\sqrt{(c_0 Q)^2 - |\boldsymbol{v}|^2} \qquad (9)$$

with the world constant c_0 replaced by the product $c_0 Q$, where $(1+P)^{-1/2} = Q < 1$.

Then the assignment of this surface, the initial point and the initial velocity vector completely determine the world line.

Recall that the gravitational potential is a solution to the Laplace equation, which is determined by the shape of body that creates the gravitational field, and the mass-energy distribution in it. The origin of coordinates is at the center of mass of the body, the point $\boldsymbol{r}$ is outside the body and $|G(\boldsymbol{r})|$ decreases with increasing $|\boldsymbol{r}|$. Such a correction seems to be quite reasonable: the speed of light increases with distance from the center of gravity, tending to the limit c_0.

$$\frac{dS}{dt} = \sqrt{c_0 Q^{\,2} + |\boldsymbol{v}|^2}\ . \qquad (10)$$

“For $|\boldsymbol{v}| < c_0 Q$ the arc element of the world line is an imaginary number. This means that the world line is time like. But it is possible that $|\boldsymbol{v}| > c_0 Q$. Then the world line is space like and the particle cannot move away from the center that creates gravity. This means that particle is in a black hole”.

The transition from kinematics to dynamics, that is, the introduction of the mass of the particle and the replacement of velocities by impulses, is carried out in the same way as in STR.

For $|\boldsymbol{v}| < c_0 Q$ the arc element of the world line is an imaginary number. This means that the world line is timelike. But it is possible that $|\boldsymbol{v}| > c_0 Q$. Then the world line is spacelike and the particle cannot move away from the center that creates gravity. This means that particle is in a black hole”.

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Thinking about the Wave-Particle Duality with Plasma Theory and Explaining it based on the Oscillator and Qseudo-Oscillator Models

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Abstract- It is the first time for us to observe the quantum world with the plasma theory. Meanwhile, many new concepts, such as the discrete quantum, precise quantum and the non-linear quantum, etc., and new horizons, i.e., cutting off the connection of interaction, or equivalently introducing destructive disturbance, are supposed into the quantum mechanics at the first. The normal and pseudo- oscillator models are introduced and used to explain the wave and particle duality of quantum field. By adding such new content, it is hoped that people can understand the physics behind the quantum mechanics, rather than recognizing it with the pure mathematic knowledge. It is suggested that the quantum world is better to consider the influence of outside environment, and then the quantum mechanics is turned into the quantum dynamics. The establishment of quantum dynamics is helpful for people better understand and hence utilize the quantum mechanics, such as the quantum optics, quantum communication and quantum computer, etc.

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THINKINGABOUTTHEWAVEPARTICLEDUALITYWITHPLASMATHEORYANDEXPLAININGITBASEDONTHEOSCILLATORANDQSEUDOOSCILLATORMODELS

Thinking about the Wave-Particle Duality with Plasma Theory and Explaining it based on the Oscillator and Qseudo-Oscillator Models

Shuxia Zhao

Abstract- It is the first time for us to observe the quantum world with the plasma theory. Mean-while, many new concepts, such as the discrete quantum, precise quantum and the non-linear quantum, etc., and new horizons, i.e., cutting off the connection of interaction, or equivalently introducing destructive disturbance, are supposed into the quantum mechanics at the first. The normal and pseudo- oscillator models are introduced and used to explain the wave and particle duality of quantum field. By adding such new content, it is hoped that people can understand the physics behind the quantum mechanics, rather than recognizing it with the pure mathematic knowledge. It is suggested that the quantum world is better to consider the influence of outside environment, and then the quantum mechanics is turned into the quantum dynamics. The establishment of quantum dynamics is helpful for people better understand and hence utilize the quantum mechanics, such as the quantum optics, quantum communication and quantum computer, etc.

I. Research Background

a) *The blackbody radiation issue in the history: Rayleigh-Jeans formula and oscillator model*

In the classic statistical theory, the thermal radiation is thought to be the electromagnetic wave. Accordingly, the thermal radiation energy in different frequency in the black-body cavity is given. The Maxwell equations in the vacuum is written as follows,

$$\nabla \cdot \vec{E} = 0, \nabla \times \vec{H} - \frac{1}{c}\frac{\partial \vec{E}}{\partial t} = 0, \tag{1}$$

$$\nabla \cdot \vec{H} = 0, \nabla \times \vec{E} + \frac{1}{c}\frac{\partial \vec{H}}{\partial t} = 0. \tag{2}$$

Here, $\vec{E}, \vec{H}$ are the electric and magnetic fields, respectively, and c is the velocity of light in vacuum.

Utilizing the curl of electromagnetic fields, the above four electromagnetic field equations are combined into the following two vector-type wave equations.

$$\nabla^2 \vec{E} - \frac{1}{c^2}\frac{\partial^2 \vec{E}}{\partial t^2} = 0, \tag{3}$$

$$\nabla^2 \vec{H} - \frac{1}{c^2}\frac{\partial^2 \vec{H}}{\partial t^2} = 0. \tag{4}$$

In total, six scalar equations are included in the above two vector wave equations, representing the six components of electromagnetic fields, i.e., $E_x, E_y, E_z,\ H_x, H_y, H_z$, re-

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spectively. Correspondingly, each scalar equation can be written into one standard equation that is used to solve a representative variable, φ.

$$\nabla^2\varphi - \frac{1}{c^2}\frac{\partial^2\varphi}{\partial t^2} = 0. \tag{5}$$

Assume the boundaries of the cavity that surrounds the thermal radiation fields consists of three pairs of planar surfaces, i.e.,

$$x = 0, \alpha; y = 0, \beta; z = 0, \gamma. \tag{6}$$

Then, the volume of blackbody cavity is given as

$$V = \alpha\beta\gamma. \tag{7}$$

For a simple computation, the vector potential, $\vec{A}$, is introduced based on the Coulomb gauge. Then, the following formulae are obtained.

$$\vec{H} = \nabla \times \vec{A}, \vec{E} = -\frac{1}{c}\frac{\partial\vec{A}}{\partial t}. \tag{8}$$

It is noted that the vector potential satisfies the wave equation as well.

$$\nabla^2\vec{A} - \frac{1}{c^2}\frac{\partial^2\vec{A}}{\partial t^2} = 0. \tag{9}$$

Next, the electromagnetic wave is decomposed into the superposition of vibrations of different frequencies. Concretely, the wave equation of one component of vector potential, e.g., A_x, is solved by means of the method of variable separation. The vector potential A_x is written into the formula below based on the principle of separation.

$$A_x = f(t)X(x)Y(y)Z(z). \tag{10}$$

At the separation, the following four sub- equations of A_x are obtained.

$$\frac{1}{X}\frac{d^2X}{dx^2} = -p^2, \frac{1}{Y}\frac{d^2Y}{dy^2} = -q^2, \frac{1}{Z}\frac{d^2Z}{dz^2} = -r^2, \frac{1}{f}\frac{d^2f}{dt^2} = -\omega^2. \tag{11}$$

And, the four separating constants satisfy the relation below.

$$p^2 + q^2 + r^2 = \frac{\omega^2}{c^2}. \tag{12}$$

The detail is omitted here (see Ref. [1]). Through the similar procedure, the three components of vector potential deduced are achieved as below.

$$A_x = \sum_{l,m,n} f(t) A cos\frac{l\pi x}{\alpha} sin\frac{m\pi y}{\beta} sin\frac{n\pi z}{\gamma}, \tag{13}$$

$$A_y = \sum_{l,m,n} f(t) B sin\frac{l\pi x}{\alpha} cos\frac{m\pi y}{\beta} sin\frac{n\pi z}{\gamma}, \tag{14}$$

$$A_z = \sum_{l,m,n} f(t) C sin\frac{l\pi x}{\alpha} sin\frac{m\pi y}{\beta} cos\frac{n\pi z}{\gamma}. \tag{15}$$

Here, A, B, C are undetermined coefficients. The values of parameters, l, m, n, can only be positive integer or zero. Besides, the two set of parameters, p, q, r and l, m, n satisfy the following relation.

$$\mathrm{p} = \frac{l\pi}{\alpha}, q = \frac{m\pi}{\beta}, r = \frac{n\pi}{\gamma}. \tag{16}$$

Inserting Eq. (16) into Eq. (12), the below equality is obtained.

$$\frac{l^2}{\alpha^2} + \frac{m^2}{\beta^2} + \frac{n^2}{\gamma^2} = \frac{\omega^2}{\pi^2 c^2} = \frac{4\nu^2}{c^2}. \tag{17}$$

The above identity is related to the ellipsoidal function. Then, according to the volume of ellipsoid, the freedom number of vibrations between ν and $\nu + d\nu$, i.e., $g(\nu)d\nu$, is given.

$$\mathrm{g}(\nu)\mathrm{d}\nu = \frac{8\pi V}{c^3} \nu^2 d\nu. \tag{18}$$

According to the classic electrodynamics, the energy of radiation field, i.e., electromagnetic wave, which is defined as EN, is

$$\mathrm{EN} = \frac{1}{8\pi} \int (\vec{E}^2 + \vec{H}^2) d\tau. \tag{19}$$

Here, $d\tau = dx \cdot dy \cdot dz$, is the volume element.

According to Eq. (8), the electromagnetic fields can be calculated through the vector potential that is expressed in Eqs. (13-15). Inserting the electromagnetic fields into the above integral, and after integration, the energy EN, is written as

$$\mathrm{EN} = \frac{V}{64\pi c^2} \sum_{l,m,n} \left\{ \left(\frac{df}{dt}\right)^2 + \omega^2 f^2 \right\} (A^2 + B^2 + C^2). \tag{20}$$

It is seen from the above formula that the energy of radiation can be expressed as the sum of each vibration freedom. Assume the energy of one vibration freedom is ε, and it equals to

$$\varepsilon = \frac{V}{64\pi c^2}(A^2 + B^2 + C^2)\left\{\left(\frac{df}{dt}\right)^2 + \omega^2 f^2\right\}. \tag{21}$$

Then, we define one new parameter, Q, and express it as follow.

$$Q^2 = \frac{V}{32\pi c^2}(A^2 + B^2 + C^2)f^2, \tag{22}$$

The following relation can be achieved.

$$\varepsilon = \frac{1}{2}\dot{Q}^2 + \frac{1}{2}\omega^2 Q^2. \tag{23}$$

This is the same with the energy expression of linear oscillator model (with the mass of oscillator set as m = 1). Here, Q represents the displacement of oscillator and is one equivalent generalized coordinate. Correspondingly, the generalized momentum is $P = \dot{Q}$. As seen, the radiation field can be treated as the mechanic system that consists of many harmonic oscillators. So, the radiation energy in the interval between ν and ν + dν can expressed as below.

$$E_\nu d\nu = \bar{\varepsilon}g(\nu)d\nu = \frac{8\pi V}{c^3}kT\nu^2 d\nu. \tag{24}$$

This is the famous Rayleigh-Jeans radiation formula. Here, $\bar{\varepsilon} = kT$, which represents the mean energy of oscillator and is given through the law of energy equipartition in the classic statistical mechanics.

b) Linear fluid wave theory of plasma: continuum and "small" disturbance[2]

In plasma physics, the ionic fluid momentum equation when excluding the effects of magnetic field and collision can be expressed as

$$Mn\left[\frac{\partial \vec{v_i}}{\partial t} + (\vec{v_i}\cdot\nabla)\vec{v_i}\right] = en\vec{E} - \nabla p = -en\nabla\phi - \gamma_i K T_i \nabla n. \tag{25}$$

Utilizing the linear approximation, i.e., ignoring the quadratic (nonlinear) disturbance of convection which is the second term of Eq. (23) left, and the planar wave of small disturbance, we have

$$-i\omega M n_0 v_{i1} = -en_0 ik\phi_1 - \gamma_i K T_i ik n_1. \tag{26}$$

At the assumption of electric neutrality and the Boltzmann equilibrium of electron with electric potential, the relation between the disturbed density and potential is obtained.

$$n_1 = n_0 \frac{e\phi_1}{KT_e}. \tag{27}$$

Here, n_0 is the undisturbed background ion density.

Furthermore, the continuity equation of ion fluid is expressed below.

$$\frac{\partial n}{\partial t} + \nabla \cdot n\vec{v_i} = 0. \tag{28}$$

Similarly, at the linear approximation and planar wave of small disturbance, we have

$$\mathrm{i}\omega n_1 = n_0 ikv_{i1}. \tag{29}$$

Last, the ionic acoustic speed is achieved based on the above three disturbance formulae, Eqs. (24, 25, 27).

$$\frac{\omega}{k} = \left(\frac{KT_e+\gamma_i KT_i}{M}\right)^{1/2} \equiv v_s. \tag{30}$$

c) The dispersion relation of ionic acoustic wave[2]

The electric neutrality assumption is discarded, and the Poisson's equation at the linear and small wave approximations is considered as below.

$$\varepsilon_0 \nabla \cdot \vec{E_1} = \varepsilon_0 k^2 \phi_1 = e(n_{i1} - n_{e1}). \tag{31}$$

Here, the disturbed electron density is still given by the Boltzmann relation, i.e.,

$$n_{e1} = \frac{e\phi_1}{KT_e} n_0. \tag{32}$$

The disturbed ion density is still given by its continuity equation, which couples the disturbed ion velocity.

$$\mathrm{i}\omega n_{i1} = n_0 ikv_{i1}. \tag{33}$$

And, the disturbance relation given by the momentum equation is still existed, i.e.,

$$-i\omega M n_0 v_{i1} = -en_0 ik\phi_1 - \gamma_i KT_i ikn_{i1}. \tag{34}$$

Accordingly, the above four disturbance relations at the more exact condition, i.e., the quasi-neutrality of plasma is not applied, cooperatively give rise to the dispersion of ionic wave.

$$\frac{\omega}{k} = \left(\frac{KT_e}{M}\frac{1}{1+k^2{\lambda_D}^2} + \frac{\gamma_i KT_i}{M}\right)^{1/2}. \tag{35}$$

Here, $\lambda_D = \left(\frac{\varepsilon_0 KT_e}{n_0 e^2}\right)^{1/2}$ and is the famous Debye constant of plasma that shields the non-neutral region in plasma.

d) Planar wave and oscillator at small disturbance

$$\overrightarrow{v_{i1}} = v_{i1}\exp(ikx - i\omega t)\,\hat{\vec{x}}, \tag{36}$$

$$n_1 = n_1 \exp(ikx - i\omega t), \tag{37}$$

$$\overrightarrow{E_1} = E_1 \exp(ikx - i\omega t)\,\hat{\vec{x}}. \tag{38}$$

As seen, the planar wave of small disturbance can be treated as oscillator.
All the above contents summarize the wave characteristic of mass. Namely, it fluctuates at small disturbance. This is caused by the oscillator model at the continuum, or more precisely when the interaction of mass is continuative.

II. Innovation and Breakthrough

a) The blackbody radiation: The Planck's formula

It is well-known that the prediction of Rayleigh-Jeans formula for the blackbody radiation is in good agreement with experimental measurement at low frequency terminal but fails at the high frequency terminal, even diverging. To solve this so- called ultraviolet disaster, Planck put forward to the idea that the energy of oscillator in the blackbody cavity is quantized, i.e., the energy of each oscillator can only be the integer times of one minimum, which is expressed as

$$\varepsilon = h\nu. \tag{39}$$

Here, the parameter h is thereby called the Planck's constant.

Then, at certain temperature T and the Boltzmann distribution, the appearing probability of modulus with the energy, $\varepsilon_n = nh\nu$, is expressed as

$$p_n = \frac{\exp(-\beta\varepsilon_n)}{\sum_{n=0}^{\infty}\exp(-\beta\varepsilon_n)}, \beta = \frac{1}{kT}. \tag{40}$$

At the proposal of energy quantization, the mean energy of oscillators now becomes

$$\bar{\varepsilon} = \sum_{n=0}^{\infty} p_n\varepsilon_n = \frac{\varepsilon}{\exp(\beta\varepsilon)-1} = \frac{h\nu}{\exp\left(\frac{h\nu}{kT}\right)-1}. \tag{41}$$

Replacing the old mean energy formula of oscillator in the Rayleigh-Jeans formula with the above new one, we get the Planck's formula below, which is in accord to the experiments at both the low- and high- frequency terminals.

$$E_\nu = \frac{8\pi V\nu^2}{c^3}\frac{h\nu}{\exp\left(\frac{h\nu}{kT}\right)-1}. \tag{42}$$

It is noted that the Planck's formula can return to the Rayleigh-Jeans formula at the limit of high temperature or equivalently at the limit of low frequency, i.e., when KT ≫ hν, the quantized mean energy of oscillator approximates to the continuum one, as illustrated below.

$$\bar{\varepsilon}=\frac{h\nu}{exp\left(\frac{h\nu}{KT}\right)-1}\approx\frac{h\nu}{0+\frac{h\nu}{KT}+\frac{1}{2!}\left(\frac{h\nu}{KT}\right)^2+\cdots}\approx KT\left(\frac{1}{1+\frac{1}{2!}\frac{h\nu}{KT}}\right)\approx KT\left[1-\frac{1}{2!}\left(\frac{h\nu}{KT}\right)+\cdots\right]\approx KT. \quad (43)$$

According to Eq. (43), it can be concluded that the blackbody radiation at the low frequency limit that is presented by the Rayleigh-Jeans formula exhibits the wave characteristic while at high frequency limit, it behaves more like particles.

b) Nonlinear solitary wave theory of plasma, i.e., KdV equation[3]

Considering the continuity and momentum equations of ion fluid that couple the nonlinear terms, the Poisson's equation and the Boltzmann distribution of electron fluid, we have the following partial differential equation set.

$$\frac{\partial n}{\partial t}+\frac{\partial}{\partial x}(nu)=0, \quad (44)$$

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}=-\frac{e}{M}\frac{\partial \phi}{\partial x}, \quad (45)$$

$$\mathrm{k}T_e\frac{\partial n_e}{\partial x}=en_e\frac{\partial \phi}{\partial x}, \quad (46)$$

$$\varepsilon_0\frac{\partial^2\phi}{\partial x^2}=e(n_e-n). \quad (47)$$

For the convenience of derivation of the formula, the non-dimensional process toward the above equation set is needed, by means of the below characteristic quantities, i.e., the normalized undisturbed density n_0, normalized ionic acoustic speed, $(kT_e/M)^{1/2}$, normalized plasma Debye length, $\lambda_D=\sqrt{\frac{\varepsilon_0 kT_e}{e^2 n_0}}$, normalized electric potential, $\frac{kT_e}{e}$, and the normalized plasma collective vibration time scale, ${\omega_{p,i}}^{-1}=\sqrt{\frac{\varepsilon_0 M}{e^2 n_0}}$. After this process, we obtain the normalized fluid model below.

$$\frac{\partial n'}{\partial t'}+\frac{\partial}{\partial x'}(n'u')=0, \quad (48)$$

$$\frac{\partial u'}{\partial t'}+u'\frac{\partial u'}{\partial x'}=-\frac{\partial \phi'}{\partial x'}, \quad (49)$$

$$\frac{\partial {n_e}'}{\partial x'}={n_e}'\frac{\partial \phi'}{\partial x'}, \quad (50)$$

$$\frac{\partial^2\phi'}{\partial x'^2}=({n_e}'-n'). \quad (51)$$

Utilize the stretched coordinate, i.e., $\xi=\varepsilon^{1/2}(x'-t'), \tau=\varepsilon^{3/2}t'$. Here, ε is the small magnitude expanding parameter of all normalized quantities. Next, we rewrite the above fluid equations in the $(\xi,\ \tau)$ coordinate space, by means of the following derivative relations,

$$\frac{\partial}{\partial t'} = \frac{\partial}{\partial \xi}\frac{\partial \xi}{\partial t'} + \frac{\partial}{\partial \tau}\frac{\partial \tau}{\partial t'} = -\varepsilon^{\frac{1}{2}}\frac{\partial}{\partial \xi} + \varepsilon^{\frac{3}{2}}\frac{\partial}{\partial \tau}, \tag{52}$$

$$\frac{\partial}{\partial x'} = \frac{\partial}{\partial \xi}\frac{\partial \xi}{\partial x'} + \frac{\partial}{\partial \tau}\frac{\partial \tau}{\partial x'} = \varepsilon^{1/2}\frac{\partial}{\partial \xi}. \tag{53}$$

The new fluid model equation after the space transformation is

$$-\frac{\partial n'}{\partial \xi} + \varepsilon\frac{\partial n'}{\partial \tau} + \frac{\partial}{\partial \xi}(n'u') = 0, \tag{54}$$

$$-\frac{\partial u'}{\partial \xi} + \varepsilon\frac{\partial u'}{\partial \tau} + u'\frac{\partial u'}{\partial \xi} = -\frac{\partial \phi'}{\partial \xi}, \tag{55}$$

$$\frac{\partial n_e{}'}{\partial \xi} = n_e{}'\frac{\partial \phi'}{\partial \xi}, \tag{56}$$

$$\varepsilon\frac{\partial^2 \phi'}{\partial \xi^2} = (n_e{}' - n'). \tag{57}$$

Utilize the reduced disturbance method, and expand the normalized variables, such as density, velocity and potential at their equilibrium state with respect to the small quantity, ε, as illustrated below.

$$n' = 1 + \varepsilon n'_1 + \varepsilon^2 n'_2 + \cdots, \tag{58}$$

$$u' = \varepsilon u'_1 + \varepsilon^2 u'_2 + \cdots, \tag{59}$$

$$n_e{}' = 1 + \varepsilon n_{e1}{}' + \varepsilon^2 n_{e2}{}' + \cdots, \tag{60}$$

$$\phi' = \varepsilon \phi'_1 + \varepsilon^2 \phi'_2 + \cdots. \tag{61}$$

As seen further, after the expansion, each disturbed quantity is balanced by their respective nonlinear terms and the dispersion term.

Applying the boundary condition, i.e., $\xi \to \infty, n_e{}' = n' = 1, \phi' = u' = 0$, we can get the below famous Korteweg-de Vries Equation, abbreviated as KdV equation, by means of both the first and second order approximations of fluid model.

$$n_1{}' = n_{e1}{}' = u_1{}' = \phi_1{}', \tag{62}$$

$$\frac{\partial \phi_1{}'}{\partial \tau} + \phi_1{}'\frac{\partial \phi_1{}'}{\partial \xi} + \frac{1}{2}\frac{\partial^3 \phi_1{}'}{\partial \xi^3} = 0. \tag{63}$$

In the above Eq. (63), the second term is nonlinear, which is arisen from the nonlinear terms of fluid model, such as the convection and drift etc. The third term, i.e., the three-order derivative, represents the dispersion relation of ion acoustic wave. In the section (1.3), when the ion temperature is zero the dispersion relation of ion acoustic wave becomes

$$\frac{\omega}{k} = c_s \left(\frac{1}{1+k^2{\lambda_D}^2}\right)^{1/2}. \tag{64}$$

Doing the Taylor's expansion to the right side of Eq. (64), we have the following relation, Eq. (65), which can explain why the three- order derivative term of KdV equation represents the dispersion term.

$$\omega = \mathrm{k}c_s - \frac{1}{2}k^3 c_s {\lambda_D}^2. \tag{65}$$

Here, $c_s = \sqrt{\frac{KT_e}{M}}$, and is the ionic acoustic speed.

The KdV equation can be used to describe the soliton, which is one impulse and can propagate in continuum medium at fixed velocity and meanwhile sustain its shape and magnitude[2]. Correspondingly, a new variable, $\zeta = \xi - \mathrm{c}\tau$, is introduced and a new derivative relation, $\frac{\partial}{\partial\tau} = -c\frac{d}{d\zeta}, \frac{\partial}{\partial\xi} = \frac{d}{d\zeta}$, is obtained. Here, c is the propagating velocity of soliton. It is because the dependent variable that is used to describes the soliton (assuming it is now represented by a new symbol, e.g., U) only depends on such a type of independent variable, ζ. Accordingly, the KdV equation in Eq. (63), after the variable ϕ_1 replaced by U, is reformed into

$$-\mathrm{c}\frac{dU}{d\zeta} + U\frac{dU}{d\zeta} + \frac{1}{2}\frac{d^3U}{d\zeta^3} = 0. \tag{66}$$

Similarly, at the boundary condition that U, $U_\zeta{}'$both vanish when $[\zeta] \to \infty$, we get the solution of Eq. (66), i.e.,

$$\mathrm{U}(\zeta) = 3c\,sech^2\left[(c/2)^{1/2}\zeta\right]. \tag{67}$$

As seen, this analytic solution characterizes the propagating soliton, e.g., its velocity is c, height magnitude is 3c, and its full width at half maximum (FWHM) is $(2/c)^{1/2}$. It is noticed that the KdV equation describes a stable soliton propagating process. Namely, after the new round of coordinate transformation, the KdV equation does not contain the time variable anymore and the equation becomes the stationary problem now. So, it is said that the initial disturbance at proper phase condition, which defines the boundary, determines the soliton properties, such as its shape, velocity and kinetic energy etc., through the introduced parameter, c.

c) Solitary wave analysis: novel quantum prototype concept

i. *Initial destructive and large magnitude disturbance, also called impulse*

In our opinion, the wave characteristics of quantum world are exhibited when the interaction in the continuum is continuative or more directly when the medium is continuative. It is like exerting small external force to one spring oscillator. Fix the initial displacement of it to a small value and so the elasticity of spring is not broken. As known, this is the oscillator model and in the proper continuum, the disturbance given by the oscillator can induce wave. For the particle property of quantum world, we propose to define it by means of the soliton model, or solitary wave. It is a very new concept to the quantum mechanics and is also very prototype. The soliton, as mentioned above, is arisen from the initial disturbance as well. Nevertheless, this disturbance needs to be very large and is destructive, i.e., it can cut off the connection of interaction or more directly the mass connection. Or more concretely, it exceeds over the elasticity of spring. We can furthermore envisage, did the soliton represent the particle property of quantum world, the collision or impulse concepts from the classic mechanics can be immigrated into the quantum mechanics to describe the soliton. The physics picture is that an impulse, i.e., destructive disturbance, is suddenly imposed onto a wave that is normally propagating in the continuum. It cuts offs the interaction of vibration and furthermore, at the balance of nonlinear term, such as advection or drift, and the dispersion of wave, the continuative wave is evolved into one soliton, i.e., one discrete particle that propagates alone. The impulse that gives rise to soliton can be often felt in our normal life, e.g., the strike of large ship onto the dam that causes the water solitary wave. The soliton propagating along the rope is triggered by a successive motion, i.e., first the swift lifting of our hand and then the sharp halting of hand. The swift lift creates the intense advection which is nonlinear term and the sharp halt creates the impulse. As seen further, this impulse of soliton that is destructive disturbance and the origin of the particle property of quantum world, can be described via a pseudo- oscillator model. This is closely related to the wave characteristic of quantum world that is given by the small disturbance at the normal oscillator model, which does not damage the background environment.

ii. *Pseudo- oscillator model[4]*

First consider the normal oscillator model expressed below,

$$m\frac{d^2x}{dt^2} = -k'x, \tag{68}$$

Here, k' is defined as the elastic coefficient of oscillator. The above equation can be reformed into

$$\frac{d^2x}{dt^2} = -\omega^2 x, \tag{69}$$

among which, $\omega = \sqrt{\frac{k'}{m}}$ and is the angular frequency of harmonic vibration. The general solution of Eq. (51) can be expressed as

$$x(t) = A'cos\omega t + B'sin\omega t. \tag{70}$$

As seen, it is a typical vibration solution. In the continuum, this vibration caused by the small disturbance can excite the trigonometric wave. As analyzed above, it exhibits the wave characteristics.

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The pseudo- oscillator we designed is evolved from the normal one, written as

$$m\frac{d^2x}{dt^2} = kx. \tag{71}$$

It is seen that the only difference between the normal and pseudo- oscillators, i.e., the Eqs. (68) and (71), is one sign. In the oscillator model of Eq. (68), the right side is called the restoring force, in which the direction of force is opposite to the displacement direction. Correspondingly, in the pseudo- oscillator model of Eq. (71), the right side is called as dispersing force, in which the direction of force is the same with the displacement. It implies that once a small displacement (disturbance) is created in the pseudo-oscillator, it grows up fast at the function of dispersing force, which is clearly a positive-feedback process (different to the restoring force which is a negative-feedback process). As seen, if the pseudo- oscillator model is imposed onto a system, it creates the destructive disturbance, which is essentially distinct to the oscillator model that creates small disturbance. Nevertheless, the Eqs. (68) and (71) are similar (except for one sign) and that's why the Eq. (71) is called pseudo- oscillator. Correspondingly, the parameter, k, in Eq. (71) is defined as dispersing ability coefficient. We next solve this equation and reform it into

$$\frac{d^2x}{dt^2} = \gamma^2 x. \tag{72}$$

Here, $\gamma = \sqrt{\frac{k}{m}}$ is defined as growing factor of system disturbance. The general solution of Eq. (72) is

$$x(t) = Aexp(\gamma t) + Bexp(-\gamma t). \tag{73}$$

Furthermore, assume the two undetermined constants equal and moderately adjust the general solution expression in Eq. (73) as follow

$$x(t) = \beta\cosh(\gamma t). \tag{74}$$

This is due to the definition of hyperbolic cosine function, $\cosh(x) = \frac{\exp(x)+\exp(-x)}{2}$. At proper selection of β, γ values, we can obtain one infinite potential well model when fixing the range of time variable into a very small interval, i.e., $|t| < \varepsilon$. Here, ε is set as a small quantity, which embodies the instantaneous characteristics of impulse. For instance, we set $\beta = 1, \gamma = 100, \varepsilon = 0.1139$, and obtain the picture of $x(t)$ in Fig. 1.

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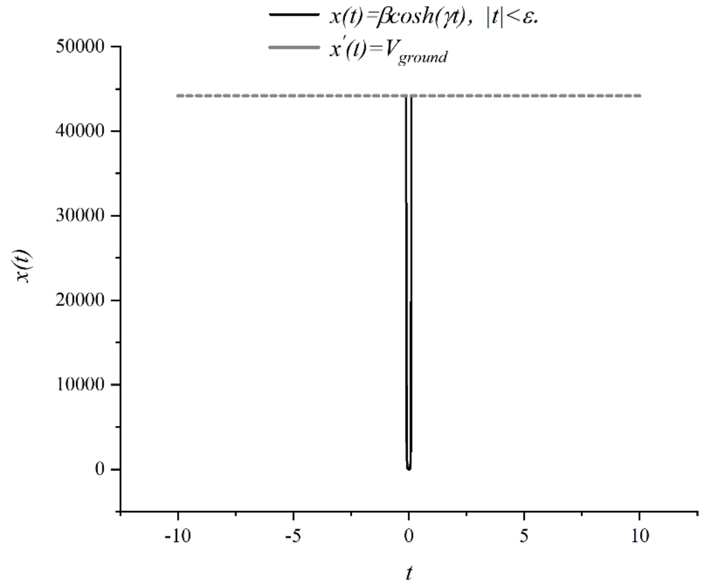

Figure 1: The infinite potential well obtained by the pseudo- oscillator model solution at proper parameter conditions, e.g., $\beta = 1, \gamma = 100, \varepsilon = 0.1139$.

It is seen from Fig. 1 the ground of the infinite potential well is determined by the parameter equation, $x'(t) = V_{ground}$. At the present conditions set, $V_{ground} = 44200$. The prime here in the parameter equation, which just represents a different function, is not a derivative operation, the same as in the Figs. 2 and 3. Besides, it is noticed that the infinite potential well obtained by the pseudo- oscillator (at a moment) needs to be observed in the whole-time domain, i.e., it is a truncated solution. This is logic and understandable, since the impulse or quasi- impulse behaviors embody their instantaneous characteristics only when they are seen in the whole time and space. By means of special linear combination, e.g., $y(t) = V_{ground} - x(t)$, we can turn the infinite potential well into an infinitely high potential barrier, as shown in Fig. 2.

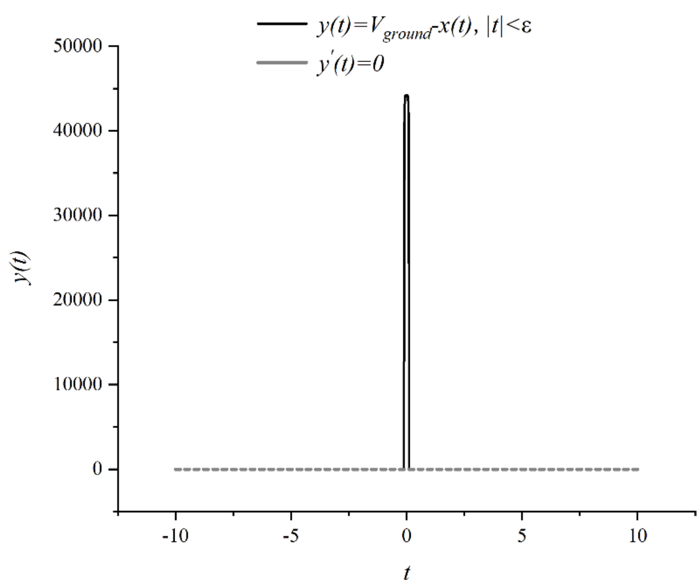

Figure 2: The infinitely high potential barrier obtained from the infinite potential well, by means of the linear combination, $y(t) = V_{ground} - x(t)$. It is noted that the ground of the potential barrier here is the real ground, i.e., $y'(t) = 0$.

Both the infinite potential well and barrier are quasi- impulse behavior, which can be described by an instant force of either *pull* or *push*. These behaviors cut off the connection of interaction and can be uniformly defined as one impulse, $\vec{F}_{pull\ or\ push}\delta(t-t_0)$. The potential well and barrier can both shift along the time axis. At the fixed β, γ values, reform the original function, Eq. (74), into $x(t-t_0)=\beta cosh[\gamma(t-t_0)]$, and draw its picture in a new interval, $|t-t_0|<\varepsilon$. Meanwhile, observe it in the whole-time domain and we obtain a shifted potential well in Fig. 3, at the selected parameter value, $t_0=5$. Considering the shift property, the Delta function we introduced in the above impulse formula is general, i.e., $\delta(t-t_0)$, other than $\delta(t)$.

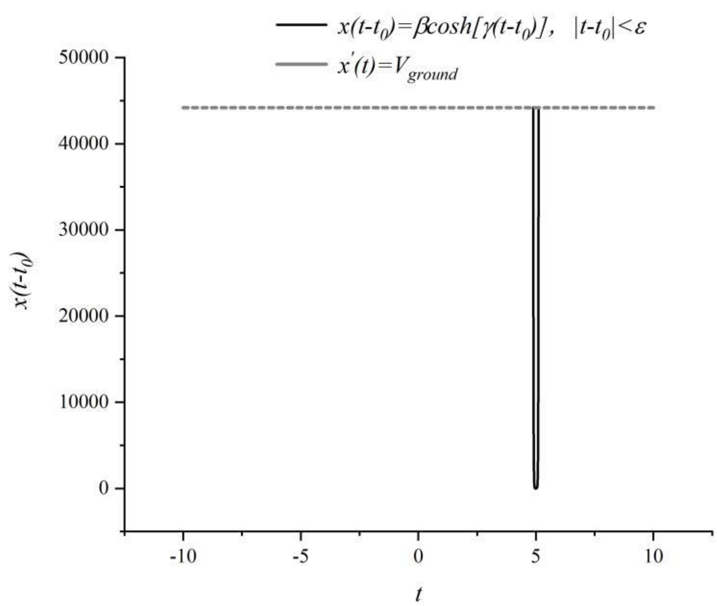

Figure 3: The general infinite potential well scheme. It shifts the original function along the time axis to the right side about a distance of $t_0=5$. Correspondingly, draw the new potential well in a new infinitely small interval, $|t-t_0|<\varepsilon$, and meanwhile display it in a large time scale, e.g., $t\in[-10,10]$.

III. Insights on the Development of Present Quantum Mechanics Framework

a) New concepts: discrete quantum, precise quantum, and nonlinear quantum

i. *Loose- bound of particle by potential and discrete quantum*

In Fig. 4, the one-dimensional infinite potential well with a finite width, which is the classical bound of particle in the present quantum mechanics textbook, is shown. The potential is written in Eq. (75) below.

$$V(x)=\begin{cases}0, |x|\le\frac{a}{2},\\ \infty, |x|>\frac{a}{2}.\end{cases} \quad (75)$$

Substitute the above potential expression into the famous Schrodinger's Equation in Eq. (76) and we get the discrete eigen functions of the particle in Eq. (77), as well as its eigen energy set in Eq. (78).

$$\frac{d^2\psi(x)}{dx^2} + \frac{2m}{\hbar^2}[E - V(x)]\psi(x) = 0. \tag{76}$$

$$\psi_n(x) = \begin{cases} \sqrt{a/2}\sin\frac{n\pi x}{a}(n = 2,4,6 \ldots), \\ \sqrt{a/2}\cos\frac{n\pi x}{a}(n = 1,3,5 \ldots). \end{cases} \tag{77}$$

$$E_n = \frac{\hbar^2\pi^2 n^2}{2ma^2}, \quad (n = 1,2,3,4, \ldots). \tag{78}$$

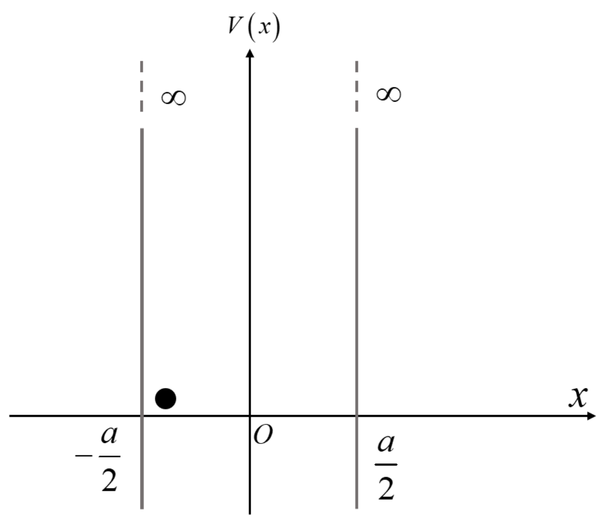

Figure 4: The one-dimensional infinite potential well model, which has a finite width characterized by the parameter, a.

As seen further, we call the bound of particle by means of infinite potential well with finite width as *loose bound*, since the particle has limited free space given by the parameter, a, and accordingly the solution of Schrodinger equation at the potential of Fig. 1 is called as *discrete quantum*.

ii. *Equivalent spatial periodicity and the Fourier's series expansion*

In our understanding, the reason why the solution of Schrodinger equation is discrete is because the space is discretized by the wide potential well. It can be imagined that the whole space is cut into a set of discrete regions by the well, which implicitly represents the spatial periodicity and hence the solution is discretized into the sum of trigonometric functions. This is very like the expansion of a sawtooth wave, which is shown in Fig. 5 and expressed in Eq. (79), into the Fourier series in Eq. (80). The correlation of solving the Schrodinger's equation at bound potential to the Fourier's series expansion, we discovered, inspires us to put forward to the novel concept, *discrete quantum*. It is noted that at discrete quantum, i.e., in the limited real space, the abstract Hilbert's space is established based on the eigen vectors. As seen next, this is different with the case of tight bound of particle, where only one eigen state is existed.

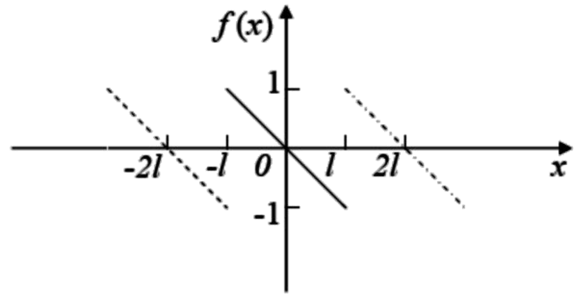

Figure 5: The picture of sawtooth wave, which represents the spatial periodicity. As known, it can be expanded into the Fourier's series, which is essentially discrete and thereby related to the definition of *discrete quantum*.

$$\mathrm{f}(x) = \begin{cases} -\frac{x}{l}, -l \leq x \leq l \\ f(x+2l) \end{cases}. \tag{79}$$

$$\mathrm{f}(x) = \sum_{n=1}^{\infty} \frac{2(-1)^n}{n\pi} sin\left(\frac{n\pi x}{l}\right), \quad (-l \leq x \leq l). \tag{80}$$

iii. *Tight- bound of particle by potential and Single eigen state*

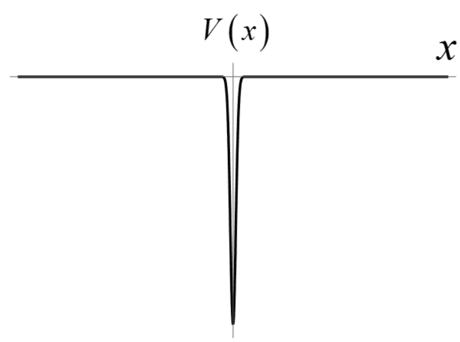

Figure 6: The picture of one-dimensional delta potential well, one example of tight bound of particle.

In this section, the one-dimensional delta potential well is plotted in Fig. 6 and written in Eq. (81). It represents the example of tight bound of particle. It is seen from Fig. 6 that the particle is so tightly bounded that it does not have any free space anymore. So, the solution of the Schrodinger's equation of Eq. (82) at the delta potential is only one eigen function, illustrated in Eq. (83). The only eigen energy is given in Eq. (84). Since the single eigen state is obtained at the tight bound of potential, the Hilbert space cannot be constructed.

$$\mathrm{V}(x) = -V_0\delta(x), \; V_0 > 0. \tag{81}$$

$$\frac{d^2\psi(x)}{dx^2} + \frac{2m}{\hbar^2}[E + V_0\delta(x)]\psi(x) = 0. \tag{82}$$

$$\begin{cases} \psi(x) = \sqrt{k} exp(-k|x|) \\ k = \frac{mV_0}{\hbar^2} \end{cases}. \tag{83}$$

$$\mathrm{E} = -\frac{mV_0{}^2}{2\hbar^2}. \tag{84}$$

iv. *Precise quantum and quasi- soliton*

We plot, in Fig. 7, the wave function of the Schrodinger's equation at the delta potential bound, i.e., Eq. (83), against the parameter, k, which determines the eigen value, and the soliton solution of KdV equation, i.e., Eq. (67), against the parameter, c, which determines the eigen value as well. It is seen that with the increase of the parameter value, both the wave and soliton functions tend to exhibiting the delta shape, which represents the *precise quantum*, as we defined, since only one eigen state is existed. Regarding to the similarity between them, the wave function can be called as the quasi- soliton. Note that the soliton shown in Fig. 7(d-f) is a moving soliton, with the constant velocity, c.

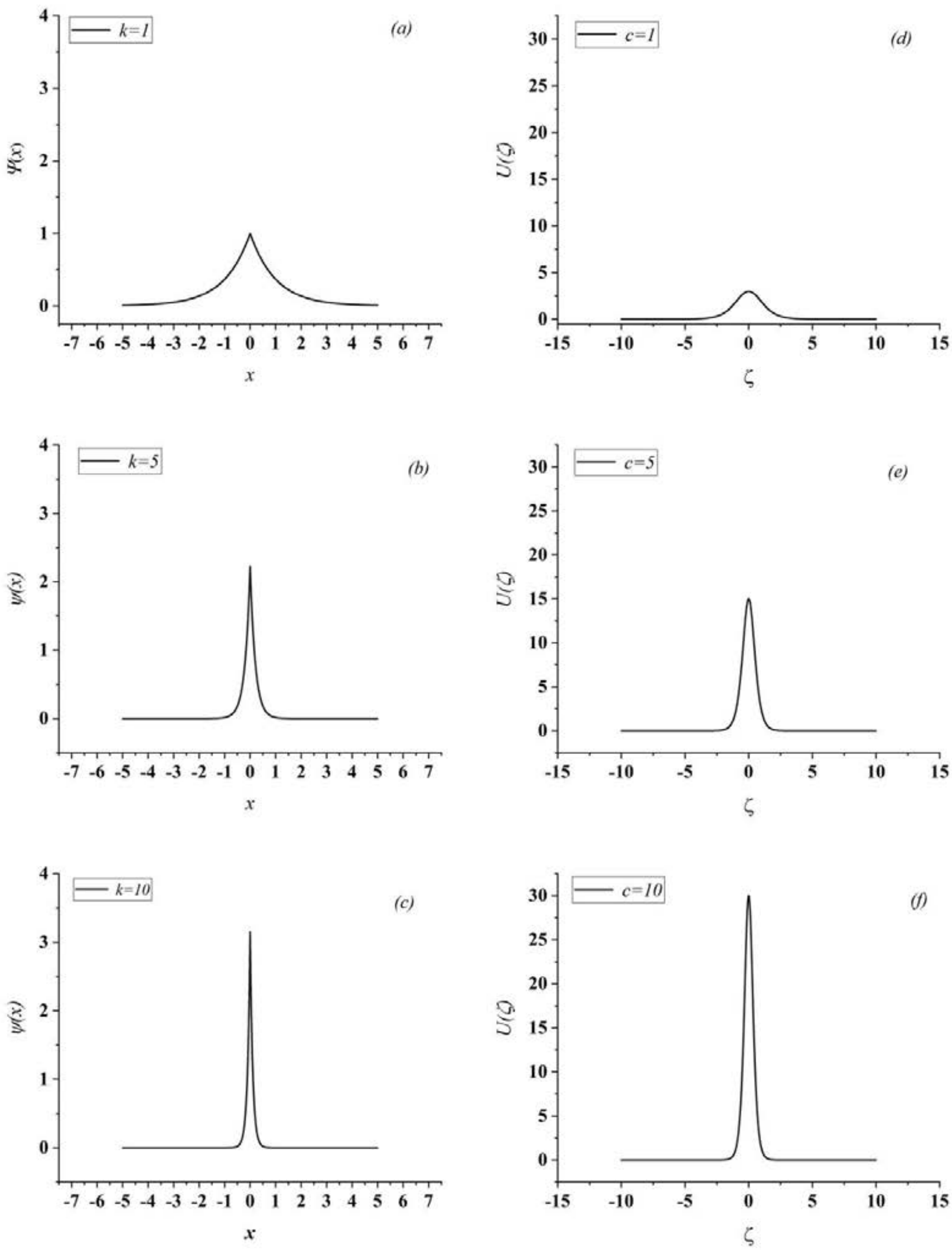

Figure 7: Comparison and the similarity between the solutions of Schrodinger's equation and KdV equation, at the different eigen values, respectively. The former is therefore called as precise quantum, or quasi- soliton, which is determined by the eigen value k or V_0, more precisely. While the latter is the realistic moving soliton, which is determined by its eigen value, c.

v. *Stationary soliton and pseudo-oscillator set*

In the section, we demonstrate that with a set of pseudo- oscillators, a stationary soliton can be constructed, which behaves more like a wave function of delta type. With the model that consists of a set of pseudo- oscillators, the general reason for the quantization is revealed, e.g., the normal Coulomb force, gravitation force, and the chemical force, etc. The detail of this process is illustrated through the Eqs. (85-91) and the Figs.

8-9. Concretely, in the Eqs. (88-90) set, both the Coulomb and gravitation forces are expanded into the Taylor's series, and furthermore in the Eq. (91) set, each power term of the Taylor's expansion can be treated as a quasi- pseudo- oscillator. Correspondingly, all expanded terms of the two types of force are transformed into a sum of different pseudo- oscillators, which comprises the pseudo- oscillator set.

$$\mathrm{m}\frac{d^2x}{dt^2} = kx. \tag{85}$$

$$\sum_i m_i \frac{d^2\vec{r_i}}{dt^2} = k_i\vec{r_i}, \tag{86}$$

$$\vec{a}_{\tau i} = 0\ (Tangetial\ acceleration) \tag{87}$$

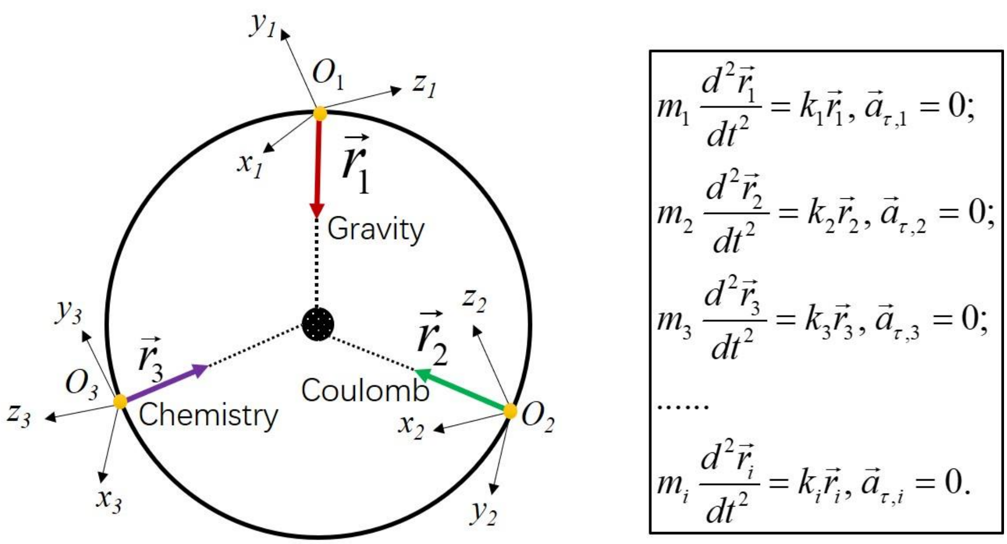

Figure 8: The stationary soliton given by the set of pseudo- oscillators

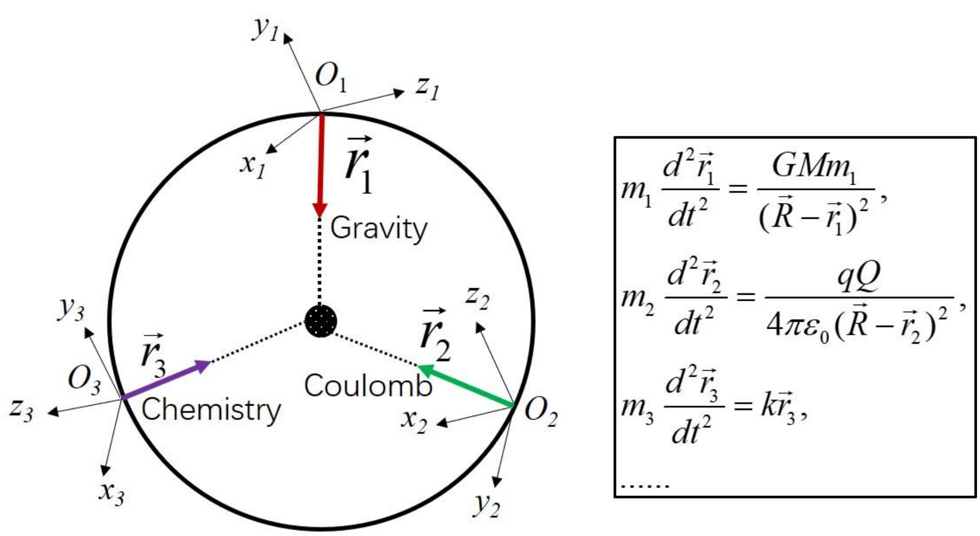

Figure 9: The transformation of Coulomb, gravitation, and chemistry forces into the pseudo- oscillator model

$$\frac{GMm_1}{\left(R-r_1\right)^2}\sim\frac{A_{const}}{R\left(1-{r_1}/{R}\right)^2}\sim\frac{1}{R\left(1-\xi_1\right)^2},0<\xi_1<1, \tag{88}$$

$$\frac{qQ}{4\pi\varepsilon_0\left(R-r_2\right)^2}\sim\frac{B_{const}}{R\left(1-{r_2}/{R}\right)^2}\sim\frac{1}{R\left(1-\xi_2\right)^2},0<\xi_2<1, \tag{89}$$

$$\frac{1}{\left(1-\xi\right)^2}=d\left[\frac{1}{1-\xi}\right]/d\xi=d\left(1+\xi+\xi^2+\xi^3+\ldots+\xi^n+\ldots\right)/d\xi \tag{90}$$

$$=1+2\xi+3\xi^2+\ldots+n\xi^{n-1}+\ldots.$$

$$\begin{cases} m\dfrac{d^2\xi}{dt^2}=2k\xi,\text{ Pseudo oscillator,} \\ m\dfrac{d^2\xi}{dt^2}=3k\xi^2,\text{ Quasi pseudo oscillator,} \\ \ldots \\ m\dfrac{d^2\xi}{dt^2}=nk\xi^{n-1},\text{Quasi pseudo oscillator.} \end{cases} \tag{91}$$

vi. *Homogeneity between the moving soliton and single pseudo- oscillator that re -lates the impulse*

$U(\zeta) = 3csech^2\left[(c/2)^{1/2}\zeta\right]\sim c\sim\vec{F}\delta(t-t_0) = \Delta P = mc$ (The momentum law). (92)

As seen from the Eq. (92), the moving soliton given by Eq. (67) is determined by the value of parameter, c. Furthermore, the constant velocity of soliton, i.e., the parameter c, is again determined by the impulse given by the single pseudo- oscillator as shown in Fig. 3, through the momentum law. So, the moving soliton and the single pseudo-oscillator that represents the impulse are essentially the same.

vii. *A pair of conjugate complex solutions for the oscillator and pseudo-oscillator [5, 6]*

Next, we solve the normal and pseudo- oscillators in the complex domain. In the Eq. (93), the complex solution of normal oscillator is given as a vibration solution. While in the Eq. (94), the complex solution of pseudo- oscillator is a type of instability, as defined in Eq. (95) by means of the planar wave theory of plasma.

$$\begin{cases} m\dfrac{d^2x}{dt^2}=-kx, \\ \dfrac{d^2x}{dt^2}=-\omega^2x, \\ x=x_0\exp(i\omega t). \end{cases} \tag{93}$$

Here, $\omega = \sqrt{\frac{k}{m}}$, and is one real number.

$$\begin{cases} m\frac{d^2x}{dt^2} = kx, \\ \frac{d^2x}{dt^2} = -\omega'^2 x, \\ x = x_0 \exp(i\omega' t). \end{cases} \quad (94)$$

Here, $\omega' = i\omega$, and is one pure imaginary number.

$$\begin{cases} x = x_0 \exp[i(kx - \omega t)], \\ If\ \omega = \omega_r + i\omega_i,\ then \\ x = x_0 \exp[i(kx - \omega_r t)] exp(\omega_i t). \end{cases} \quad (95)$$

Here, x_0 is the vibration amplitude and is one real number. In Eq. (95), the planar wave is expressed. Once the angular frequency is a complex number, it is seen that the vibration amplitude will be changed by means of the term, $\exp(\omega_i t)$. And if the imaginary part of angular frequency is positive, the vibration amplitude, $x_0 exp(\omega_i t)$, diverges. This is called the instability of wave, according to the plasma theory. Moreover, the plasma theory still predicts that once an instability is occurred, the free energy is applied onto the system. Here, in the discussion of the origin of quantization, we propose the free energy is meant either the limited bound potential, which induces the discrete quantum, or the impulse (strong bound potential) that induces the precise quantum. Both the two types of free energy lead the system to form the self-organized structure that dissipates the free energy applied, which might be the deep meaning of quantization. Note that the angular frequency of pseudo- oscillator is a pure and positive imaginary number. It implies none of a little vibration is happened in the pseudo- oscillator, which describes well the meaning of quantization that is against the vibration.

viii. *Linear and nonlinear quantum dynamics VS. Schrodinger equation and KdV equation (or pseudo oscillator model)*

In Fig. 10, one discrete eigen sine function versus the time variable, given by the loose bound of potential, is plotted. As seen, it is near the linear regions, represented by the set of red dash lines. This is different with the case of Figs. 1-3 and 7, where the pseudo-oscillator is plotted, which is far away from the linear region. This fact is supported by the function expansion of them, as illustrated in the Eqs. (96, 97). Regarding to this point, the quantum dynamics can be divided into the linear and nonlinear types, which are determined by the Schrodinger Equation and the KdV equation, respectively. As seen from the Sec. (f), the KdV equation is essentially the same as the pseudo- oscillator model that predicts the impulse. Note that the near linear property is also applied to other discrete eigen wave functions, such as the Hermite's polynomial, since they can be expanded into the Fourier's series.

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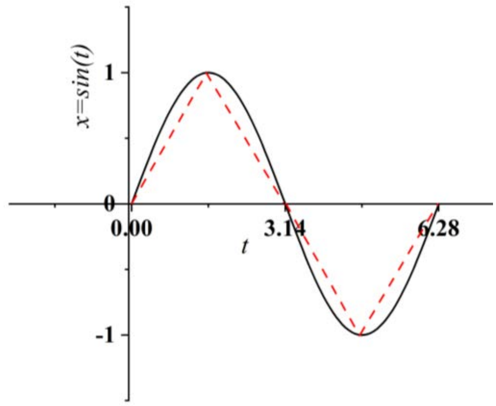

Figure 10: The picture of one discrete eigen sine function. As seen, it is near the linear region, which is represented by the set of red dash lines.

$$\sin(t) = \sum_{n=0}^{\infty} \frac{(-1)^n t^{2n+1}}{(2n+1)!} = t - \frac{t^3}{3!} + \frac{t^5}{5!} - \frac{t^7}{7!} + \cdots \tag{96}$$

$$\begin{cases} \exp(t) = \sum_{n=0}^{\infty} \frac{t^n}{n!} = 1 + t + \frac{t^2}{2!} + \frac{t^3}{3!} + \cdots \ (t > 0), \\ \exp(-t) = \sum_{n=0}^{\infty} \frac{(-t)^n}{n!} = 1 - t + \frac{t^2}{2!} - \frac{t^3}{3!} + \cdots \ (t < 0), \\ \exp(t) = \sum_{n=0}^{\infty} \frac{|t|^n}{n!} = 1 + |t| + \frac{|t|^2}{2!} + \frac{|t|^3}{3!} + \cdots \ (for\ any\ t). \end{cases} \tag{97}$$

ix. *New recognition on the bound significance of quantum mechanics, i.e., cutting off the connection*

We have mentioned this point in the Sec. 2. Here, we want to stress that in all the examples of quantum mechanics listed in the Sec. 3, the bound significance is just to cut off the connection of interaction.

b) *Discussion on the completeness of quantum mechanics*

i. *About the EPR paradox[7] and non-local property*

The Einstein-Podolsky-Rosen (abbreviated as EPR) paradox discussed the quantum entanglement issue and the non-local property of quantum mechanics. Although it is proven by the Bell inequality experiment and has been applied in the field of quantum communication, the physics behind is not revealed yet. With the idea we presented in this article, i.e., the quantization is originated from the action that cuts off the connection of interaction, the non-local property of quantum entanglement can be easily explained. After the action of truncation, all the interaction is localized into one small region that is characterized by the bound potential and so the space out of this region has no meaning onto the quantum event that is happened inside the region. Here, we are talking about the completeness of quantum mechanics. As seen, it is complete only when we further consider the influence of outside environment. Namely, the quantum mechanics are not always the unitary transformation that is reversible. It can be inversible, especially when it is measured by introducing disturbance.

ii. *About one underlying assumption of quantum mechanics, measurement principle*

In our understanding, when measuring the discrete quantum states, the destructive disturbance is introduced into the Hilbert space. If one eigen state is probed, it means that the particle is trapped into one delta type potential. According to the content of Sec. (3.1c), at delta potential bound, only one eigen state is existed. This means that the Hilbert space must collapse due to the disturbance of this delta potential. As seen, our ideas about the quantization, i.e., destructive disturbance and impulse, underlines the physical basis for the important measurement assumption of quantum mechanics.

iii. *Reconsider the blackbody radiation issue of history*

By means of the disturbance theory, we can explain well the experiment trends of blackbody radiation. At the low frequency limit, $h\nu \ll kT$, the radiation energy is small and it can be treated as small disturbance to the air molecule in the blackbody cavity. It behaves more like a wave. While at high frequency limit, $h\nu \gg kT$, the radiation is so strong that it now becomes destructive disturbance. The air molecules are now more like transparent to the radiation, and so the radiation can penetrate through the air background and interact directly with the inner boundary of cavity. So, the cavity is now the bound potential to the radiation, and that's why it exhibits the quantum characteristic at high frequency limit.

IV. Conclusion

In this article, the pseudo- oscillator model is introduced. Together with the normal oscillator model, the wave and particle duality of quantum mechanics is interpreted, based on the wave theory of plasma, e.g., planar wave, solitary wave and the instability. Many new concepts, such as discrete quantum, precise quantum and nonlinear quantum are introduced, which paves the way of development of quantum mechanics. The disturbance theory is first correlated to the quantum mechanics, which can be classified into the small and destructive types. The origin of quantization is revealed, i.e., by means of introducing the destructive disturbance that discretizes the space and cuts off the connection of interaction, which forms either the loose or tight bound. At loose bound, the discrete eigen states are obtained and the Hilbert space is established, which is essentially the Fourier's series expansion. While at tight bound, the single eigen state is obtained, which can be well described by the concepts such as soliton, whether moving or stationary, and the impulse. In our opinion, the discrete quantum is near linear region, which can be described by the Schrodinger's equation, while the precise quantum is far away from the linear region, which is therefore more suitable to be described by either the KdV equation or the single pseudo- oscillator, i.e., the impulse. In the last, the completeness of quantum mechanics is discussed based on the PRE's paradox and the assumption with respect to the measurement principle of quantum states, through our new opinion on the origin of quantization, i.e., cutting off the connection of interaction or, equivalently, introducing destructive disturbance.

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Data availability statement

Data available on request from the authors.

Conflict of interest
The author has no conflicts to disclose.

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Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- o Single section and succinct.
- o An outline of the job done is always written in past tense.
- o Concentrate on shortening results—limit background information to a verdict or two.
- o Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

CRITERION FOR GRADING A RESEARCH PAPER (COMPILATION) BY GLOBAL JOURNALS

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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Global Journal of Science Frontier Research

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