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New Properties of Photons

Martian MY29 Atmospheric Data

Highlights

Osmos-Life-Consciousness V

Cabibbo-Kobayashi-Maskawa Matrix

Discovering Thoughts, Inventing Future

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The Dust Planet Clarified Modelling Martian MY29 Atmospheric Data Using the Dynamic-Atmosphere Energy-Transport (DAET) Climate Model

By Stephen Paul Rathbone Wilde & Philip Mulholland

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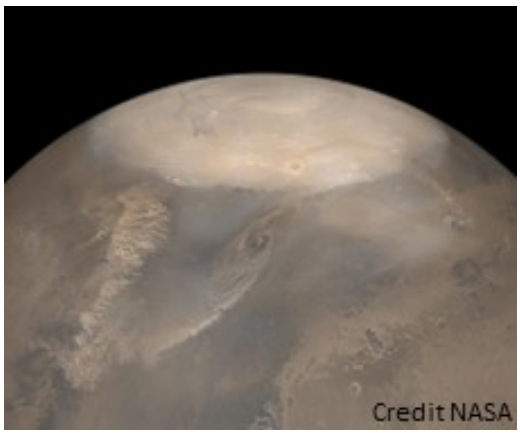
Keywords: mars, MY29, atmospheric dynamics, dust opacity, climate modelling.



The daytime lit surface reflectance for the planet Mars is postulated to provide an energy boost to the dust-prone boundary layer at grazing-angle latitudes. This backlighting process of quenched solar energy capture ensures that the Martian climate operates as a black-body system and provides an explanation for the apparent negative greenhouse effect in the Martian atmosphere, whereby the lit surface is observed to be colder than the overlying air in the near surface boundary layer.

Figure

I. Introduction

The terrestrial planet Mars is the focus of extensive and continuing scientific study. This paper deals with the topic of climatic modelling and is informed by the atmospheric observations of various authors who have made studies in this field (Table 1).

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Table 1: Selected Prior Studies of the Atmosphere of Mars

Item	Observation	Year	Source
Polar Cap: Northern Winter Polar Frost	At the current obliquity,~0.3 mm of ice might sublimate away during the summer	1990	[1] Haberle, R.M. and Jakosky, B.M., 1990. Sublimation and transport of water from the north residual polar cap on Mars
Northern Water Icecap	Summer temperatures ~205 Kelvin	1990	[1] Haberle, R.M. and Jakosky, B.M., 1990. Sublimation and transport of water from the north residual polar cap on Mars
CO_2 Freezing at 145 Kelvin	Wet and dry adiabats Figure 3	2000	[2] Pettengill, G.H. and Ford, P.G., 2000. Winter clouds over the north Martian polar cap
Dust Heating	Air absorbs 1% of Solar Radiation. Solar attenuation by dust is 26% at solar zenith	2005	[3] Savijärvi, H., Crisp, D. and Harri, A.M., 2005. Effects of CO2 and dust on present-day solar radiation and climate on Mars
Specific Heat Cp	cp = 736 J /kg/K	2005	[3] Savijärvi, H., Crisp, D. and Harri, A.M., 2005. Effects of CO2 and dust on present-day solar radiation and climate on Mars
Southern Icecap	Winter CO_2 Snow clouds and surface frost south of 55°S	2008	[4] McCleese, D.J., et al. 2008. Intense polar temperature inversion in the middle atmosphere on Mars
Water Clouds	Water clouds only up to 60Km	2010	[5] Heavens, N.G., et al., 2010. Water ice clouds over the Martian tropics during northern summer
Atmospheric Temperatures	Temperature profiles	2010	[6] McCleese, D.J., et al. 2010. Structure and dynamics of the Martian lower and middle atmosphere as observed by the Mars Climate Sounder
Dust Weather	Coniometeorology	2011	[7] Medvedev, A.S., et al., 2011. Influence of dust on the dynamics of the Martian atmosphere above the first scale height
Carbon Dioxide Polar Ice Clouds	Lower 20 km of atmosphere	2011	[8] Vincendon, M. et al. 2011 New near-IR observations of mesospheric CO2 and H2O clouds on Mars
Carbon Dioxide Clouds	50 to 100 Km between [13°S to 9°N] No clouds between 30-40°S	2011	[8] Vincendon, M. et al. 2011 New near-IR observations of mesospheric CO2 and H2O clouds on Mars
Convective Boundary layer	5 to 10 Km	2011	[9] Petrosyan, A., et al., 2011. The Martian atmospheric boundary layer
Global Average Temperature (GAT)	Table of results	2017	[10] Nikolov, N. and Zeller, K., 2017. New insights on the physical nature of the atmospheric greenhouse effect deduced from an empirical planetary temperature model
Albedo	Dust in the lowest 10 Km. The big Volcanoes are all taller than 10 Km	2017	[11] Venable, R., 2017. Report on the Mars Apparition of 2007-2008.
Snow	Snowfall P85.	2017	[11] Venable, R., 2017. Report on the Mars Apparition of 2007-2008.
Dust	Peak surface temperatures are close to the 260- to 270-K range	2019	[12] Heavens, N.G., et al., 2019. Dusty deep convection in the Mars year 34 planet-encircling dust event

Mars is classed by astronomers as a superior planet because it is located further from the Sun than the Earth. Mars orbits the Sun at a mean distance of 227.925 million Km and receives an average solar irradiance of 586.2 W/m^2, which is 43.97% of the Earth's insolation. Unlike the terrestrial bodies of Venus, Earth, and Saturn's moon Titan which all have a surface atmospheric pressure greater than 0.1 Bar (10,000 pascals) and therefore have tropospheric thermal radiant opacity [13], the surface atmospheric pressure of Mars is 636 pascals at the planet's mean radius. The tenuous gaseous envelope of the Martian atmosphere is highly transparent to thermal radiation and consequently the planet experiences major surface atmospheric window thermal energy loss to space.

The main constituent gas of the Martian atmosphere is Carbon Dioxide 95.1% by volume. The atmospheric pressure varies seasonally between 400 and 870 pascals due to the sequestration of solid carbon dioxide on the polar icecaps during each hemisphere's polar winter (Table 2).

Table 2: Martian Planetary Metrics.

Parameter	Value	Units	Source
Volumetric Mean Radius of Mars	3389.5	Km	[14] Williams, D.R., 2022. Mars Fact Sheet
Average Surface Atmospheric Pressure	0.636	kPa	[14] Williams, D.R., 2022. Mars Fact Sheet
Average Surface Temperature	211.8	Kelvin	This study of Martian Year 29 (MY29) Temperature Data
Average Surface Temperature	-61.35	Celsius	
Expected T_e	209.8	Kelvin	[15] Sagan, C. and Chyba, C., 1997. The early faint sun paradox
Atmospheric Thermal Effect (ATE)	2.0	Kelvin	
Surface gravity	3.71	m/s^2	[14] Williams, D.R., 2022. Mars Fact Sheet
Tropopause height	70	km	[16] Justus, C.G. and Braun, R.D., 2007. Atmospheric Environments for Entry, Descent, and Landing (EDL): Table 5.1.1
Tropospheric lapse rate	1.064	K/km	[16] Justus, C.G. and Braun, R.D., 2007. Atmospheric Environments for Entry, Descent, and Landing (EDL): Table 5.1.1
Solar Irradiance of Mars	586.2	W/m^2	[14] Williams, D.R., 2022. Mars Fact Sheet
Ratio of Irradiance to Earth	43.07%	%	[14] Williams, D.R., 2022. Mars Fact Sheet
Bond Albedo	0.25	A (Constant)	[14] Williams, D.R., 2022. Mars Fact Sheet
Average Annual Solar Insolation	219.825	W/m^2	[14] Williams, D.R., 2022. Mars Fact Sheet
Axial Tilt	25.19	degrees	[14] Williams, D.R., 2022. Mars Fact Sheet
Length of Year	686.98	Sols	
Carbon Dioxide (CO_2) Volume %	95.1%	%	[14] Williams, D.R., 2022. Mars Fact Sheet
Minimum Surface Pressure in Southern Winter	400	Pascal	[17] Haberle, R.M. 2003 Planetary Atmospheres Mars
Maximum Surface Pressure in Southern Late Spring	870	Pascal	[17] Haberle, R.M. 2003 Planetary Atmospheres Mars
Average Orbital Distance	227,925,000	Km	[14] Williams, D.R., 2022. Mars Fact Sheet

The Martian Global Average Temperature (GAT) has been variously estimated to range between 200 Kelvin and 240 Kelvin (Table 3).

Table 3: Martian Global Average Temperature (GAT) Estimates

Temperature (Kelvin)	Year	Title	Reference	Source
218	2006	Vázquez, M. and Hanslmeier, A., 2006. Ultraviolet radiation in the solar system	[18]	(Vol. 331). Springer Science & Business Media.
202	2007	Fenton, L.K., Geissler, P.E. and Haberle, R.M., 2007. Global warming and climate forcing by recent albedo changes on Mars.	[19]	Nature, 446(7136), pp.646-649.
200	2008	Rapp, D. 2008 Human missions to Mars: enabling technologies for exploring the red planet. Back Matter.: Appendix C Water on Mars pp 445-511.	[20]	Springer Germany
214	2010	Taylor, F.W. 2010. The scientific exploration of Mars	[21]	Cambridge University Press, 2010. ISBN978-0-521-82956-4
215	2010	Lacis, A.A., Hansen, J.E., Russell, G.L., Oinas, V. and Jonas, J., 2013. The role of long-lived greenhouse gases as principal LW control knob that governs the global surface temperature for past and future climate change.	[22]	Tellus B: Chemical and Physical Meteorology, 65(1), p.19734.
227	2011	Schulze-Makuch, D., Méndez, A., Fairén, A.G., Von Paris, P., Turse, C., Boyer, G., Davila, A.F., Antonio, M.R.D.S., Catling, D. and Irwin, L.N., 2011. A two-tiered approach to assessing the habitability of exoplanets.	[23]	Astrobiology, 11(10), pp.1041-1052.
202	2013	Haberle, R.M., 2013. Estimating the power of Mars' greenhouse effect.	[24]	Icarus, 223(1), pp.619-620.
240	2014	Barlow, N., 2014. Mars An Introduction to its Interior, Surface and Atmosphere	[25]	by Nadine Barlow, Cambridge, UK: Cambridge University Press, 2014
210	2022	Williams, D.R., 2022. Mars Fact Sheet	[14]	NASA Online

The surface diurnal temperature range measured at the Viking 1 lander site is between a nighttime low of 184 Kelvin and a daytime high of 242 Kelvin [14]. The climate modelling study presented here is informed by the Martian Year 29 (MY29) atmospheric temperature profile data first published in 2010 by McCleese et al. [6] and kindly supplied for use in this work [26, 27].

II. MY29 Data Analysis and Presentation

The Dynamic-Atmosphere Energy-Transport (DAET) climate model is predicated on a design protocol that ensures the computational existence of the dual planetary surface environments of a lit daytime hemisphere of net energy gain and a dark nighttime hemisphere of net energy loss [28].

In order to appropriately constrain the temperature data and to ensure that polar circle zones of continuous lit surface (summer) and continuous dark surface (winter) are appropriately binned, the MY29 source data was regrouped into two separate lit and dark data sets [26,27]. These two datasets incorporate the illumination effect of the seasonal axial tilt of Mars in the binning process (Table 4).

Table 4: Solar Zenith with the Associated Latitude and Locus of Equivalent Meridian Angle for the North Polar Cap Terminator

Octon	Sol	Scaled Sol	Solar Zenith Latitude	Latitude of Polar Cap Terminator	Terminator Meridian Angle Equivalent	Northern Hemisphere Season
0	0	0.00	0.00	90.00	0.00	Northern Spring Equinox
45	84	45.27	17.90	72.10	17.90	Northern Spring
90	167	90.00	25.19	64.81	25.19	Northern Summer Solstice
135	251	135.27	17.73	72.27	17.73	Northern Summer
180	334	180.00	0.00	90.00	360.00	Northern Autumn Equinox
225	418	225.27	-17.90	72.10	342.10	Northern Autumn
270	501	270.00	-25.19	64.81	334.81	Northern Winter Solstice
315	585	315.27	-17.73	72.27	342.27	Northern Winter

To achieve this re-binning the latitude of each zonal cell was converted into a 360-degree equivalent meridional angle with the North Pole 90-degree latitude as the zero-angle datum. For this meridional great circle, the far side surface latitudes are calibrated between 0 and 180 degrees and the near side (sun facing) latitudes are calibrated between 180 and 360 degrees. This data re-organisation ensures that the planet's zonal latitudes track the seasonal axial tilt illumination, consequently only lit surface latitudes were used to compute average daytime temperatures and correspondingly only dark surface latitudes were used to compute average nighttime temperatures (Table 5).

The MY29 temperature data are organised by 5-degree wide latitudinal zones across the full surface area of the Martian globe. Because of the standard geometric effect on surface area of zonal latitude bands, whereby zonal latitude area has a maximum value at the equator and decreases towards the poles, it is necessary to compute the temperature data using an areal weighted algorithm. This process ensures that high-latitude polar zones of small surface area are not overrepresented in the calculation of global temperature averages.

In addition to the areal weighted averages of global temperature, similar calculations were made of the average tropopause height for the two polar and one tropical convection cell. Using these tropopause heights as the upper boundary, a surface to tropopause lapse rate was calculated for each zonal latitude component of the planetary meridional atmospheric transect. (Table 5).

Table 5: Martian MY29 Atmosphere Temperature Metrics

Martian Atmosphere Metrics			
Item	Kelvin	Celsius	Flux Averaging W/m^2
North Pole Day Temperature	192.2	-80.94	77.4
North Pole Night Temperature	177.9	-95.23	56.8
North Pole Flux Average Annual Surface Temperature	185.5	-87.68	67.1
Tropical Day Temperature	226.7	-46.50	149.6
Tropical Night Temperature	210.8	-62.32	112.0
Tropical Flux Average Annual Surface Temperature	219.2	-53.98	130.8
South Pole Day Temperature	181.1	-92.03	61.0
South Pole Night Temperature	176.3	-96.83	54.8
South Pole Flux Average Annual Surface Temperature	178.8	-94.38	57.9
Both Poles Day Temperature	188.4	-84.79	71.4
Both Poles Night Temperature	183.6	-89.53	64.5
Polar Flux Average Annual Surface Temperature	186.0	-87.11	67.9
Global Octon Day Temperature	220.0	-53.15	132.8
Global Octon Night Temperature	202.5	-70.65	95.3
Mars Global Flux Average Surface Temperature (MY29)	211.8	-61.36	114.1
Tropical Tropopause Height Day (m)	61,977		
Tropical Tropopause Height Night (m)	59,281		
Polar Tropopause Height Day (m)	24,817		
Polar Tropopause Height Night (m)	29,606		
Tropical Lapse Rate Day (K/km)	1.25		
Tropical Lapse Rate Night (K/km)	1.10		
Polar Lapse Rate Day (K/km)	0.95		
Polar Lapse Rate Night (K/km)	0.96		

An additional benefit of the re-binning of the latitudinal transects to a great circle meridian calibration is that it facilitates the presentation of the seasonal global atmosphere transects into an Octon set of polar plots organised from the perspective of the solar zenith (Figures 1 and 2).

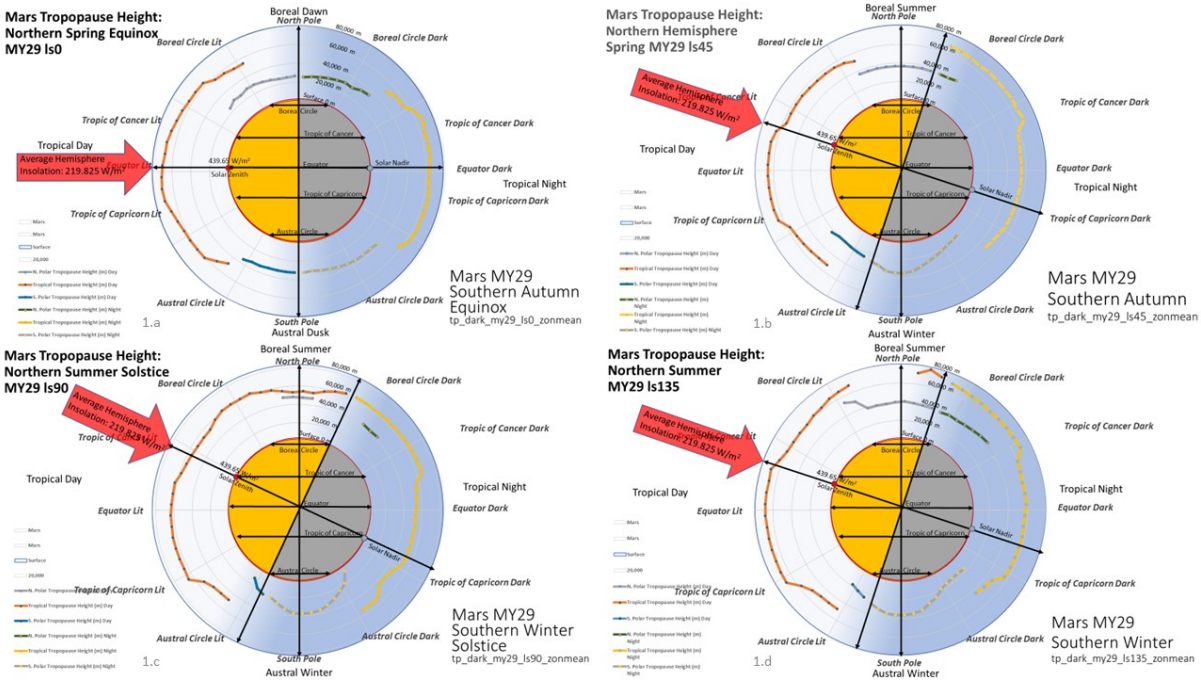

Figure 1: Mars Global Tropopause Height - Northern Hemisphere Summer

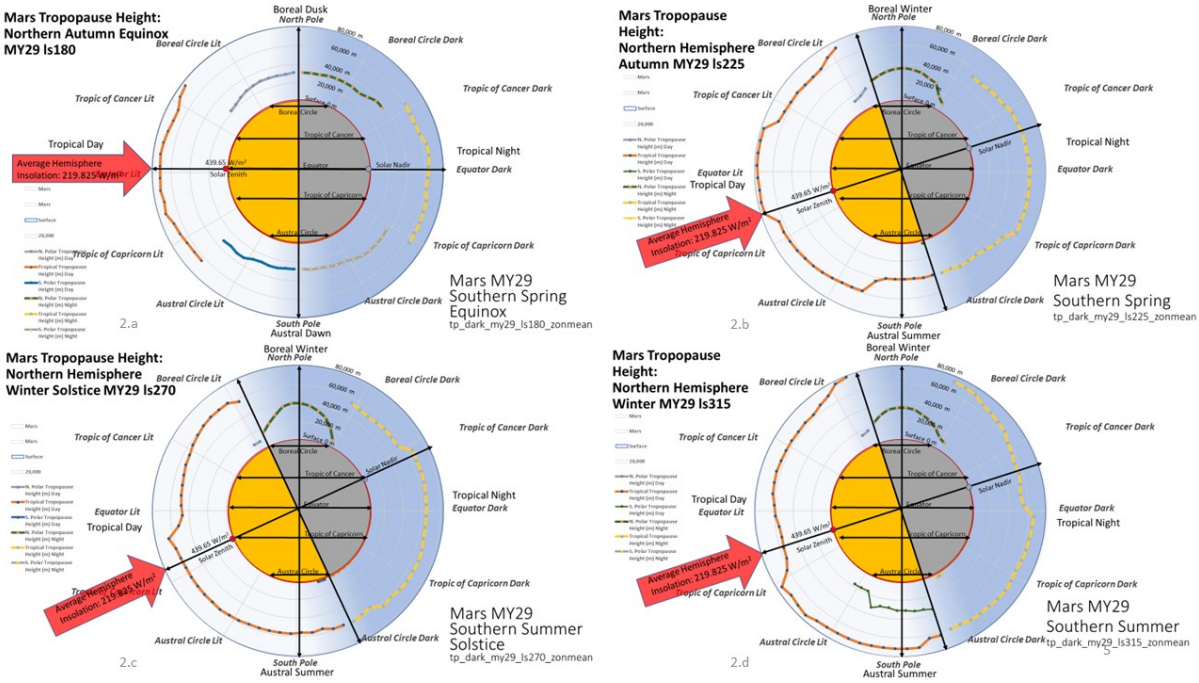

Figure 2: Mars Global Tropopause Height - Southern Hemisphere Summer

a) Data Quantity and Quality

The MY29 atmospheric data used here [6] is organised into a set of two Excel Workbooks that each contain a group of 8 Excel worksheets. These worksheets collate the daytime and nighttime polar meridional transect data across each hemisphere for the 8 seasonal octans for the Martian year MY29 [26, 27]. Each of the 16 worksheets contains 36 columns that record the atmospheric profile data in 5-degree wide latitude swathes that cover the full extent of the specific hemisphere (either lit day or dark night). For each 5-degree wide latitude band the vertical profile data is recorded at a set of 96 levels that range in height above the datum surface from 1,263 m (610 pascals) to a maximum height of 93,523 m (0.0042 pascals). Due to technical issues associated with the satellite data acquisition process [6] the physical extent of the collated temperature data varies for each of the 8 worksheets within the respective workbook [26, 27].

b) Data Analysis

Data Analysis was performed on the MY29 seasonal panels to identify the following sets of atmospheric variables:

1. The air temperature at the datum level of 610 pascals (1,263 m).
2. The tropospheric lapse rate between 10.4 km and 60.4 km of surface elevation.
3. The lapse rate between a datum level of 1.3 km and the variable tropopause height for each of the 3 regional circulation cells (North Pole, Tropical and South Pole).
4. The tropopause height in metres for each of the 3 regional circulation cells (North Pole, Tropical and South Pole).
5. The tropopause temperature in Kelvin for each of the 3 regional circulation cells (North Pole, Tropical and South Pole).
6. Near-surface temperature inversions associated with anomalous energy capture in the boundary layer were recorded when observed in the data.

The results of this analysis are presented in data supplemental files located online at Research Gate [29].

c) A Comparison between the Tropospheres of Venus and Mars

The two terrestrial planets Venus [30] and Mars have a significant number of environmental differences and some very interesting atmospheric similarities (Table 6).

Table 6: Mars Venus Planetary Atmospheric Comparisons

Comparison	Mars	Venus
Planetary Surface Pressure (Pascal)	636	9,321,900
Planetary Surface Temperature (Kelvin)	211.8	699
Scale Height (Atmospheric thickness) (m)	10,900	15,080
Atmospheric Composition: CO_2 by Volume %	95.1%	96.5%
Height of the Planet's Lit side Tropical Tropopause (Km)	62.0	63.43
Equation Temperature of the Planet's Tropopause (Kelvin)	134.4	224
Equation Pressure of the Planet's Tropopause (Pascal)	0.592	8,042
Planet's Vacuum Planet Equation Emission Height (Km)	1.6	71.06
Planet's Vacuum Planet Equation Emission Pressure (Pascal)	548.3	1,868
Venus Atmosphere to Mars Surface Pressure Equivalence Height (Km)	0	76.23
Venus Atmosphere to Mars Surface Pressure Equivalence Temperature (Kelvin)	211.8	208.27
Venus Atmosphere to Mars Tropopause Pressure Equivalence Height (Km)	62	>100

i. *The Planetary Differences*

- Venus is closer to the Sun than Mars and therefore receives a greater solar radiation flux.
- Venus is a slowly rotating world; Mars is a fast daily rotator.
- Venus is more massive than Mars and therefore has a higher surface gravity.
- At its base the atmosphere of Venus is a high-pressure, high temperature environment.
- At its base the atmosphere of Mars is a low-pressure, low temperature environment.
- Venus has a high planetary Bond Albedo (A_V) and is therefore visibly bright and reflective.
- Mars has a low planetary Bond Albedo (A_M)and is therefore visibly dull and poorly reflective.
- The exit-to-space thermal radiation emission height of Venus is in the planet's stratosphere at an elevation of 71 Km.
- The exit-to-space thermal radiation emission height of Mars is in the planet's surface boundary layer at an elevation of 1.6 Km.

ii. *The Atmospheric Similarities*

Both Venus and Mars contain an abundance of carbon dioxide gas in their respective atmospheres (Venus 96.5%; Mars 95.1%).

Both Venus and Mars have an equivalent tropopause elevation (Venus 63.4 Km; Mars 62.0 Km) this is despite the massive differences in the pressure and temperature profiles of the two planet's tropospheres (Figure 3) and requires an explanation.

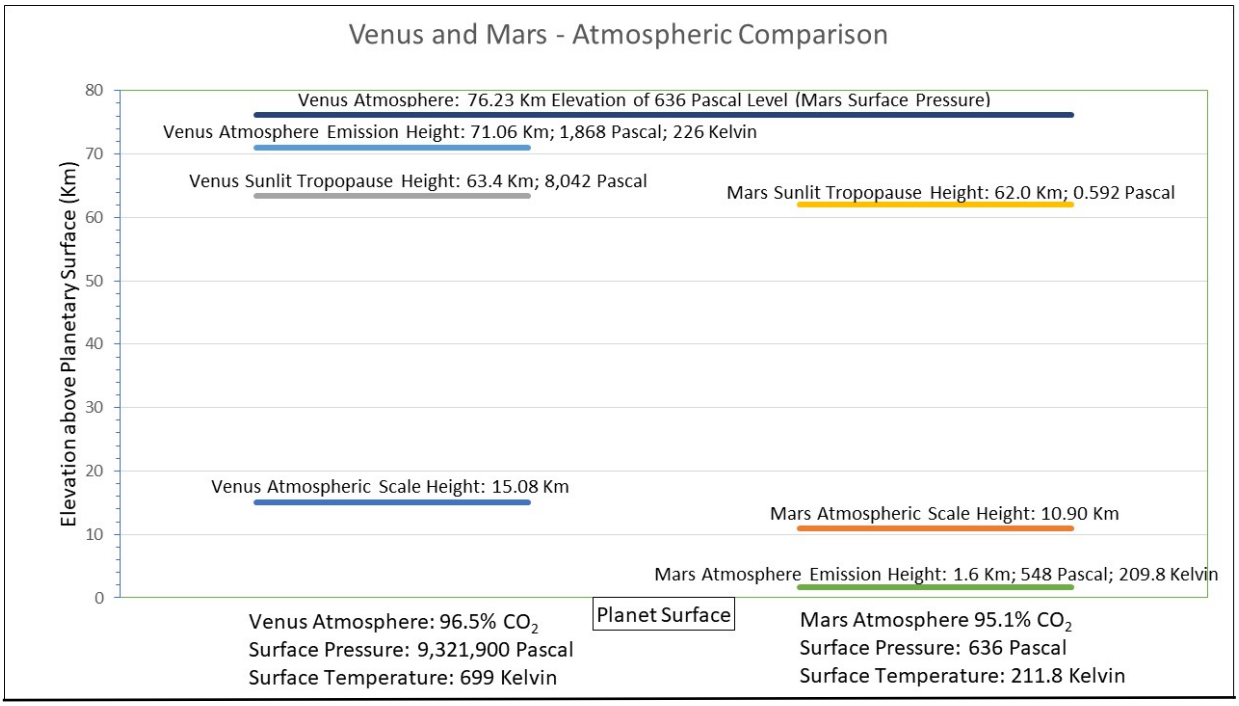

Figure 3: Venus and Mars - Atmospheric Comparison

III. The Dynamic-Atmosphere Energy-Transport (DAET) Inverse Modelling Study of MY29 Data

Climate Science is built on a conceptual model that removes from its fundamental analysis the dual complementary energy environments of a lit daytime hemisphere and a dark nighttime hemisphere. By preserving these two energy environments the Dynamic-Atmosphere Energy Transport (DAET) climate model more appropriately mimics the meteorological reality of a solar lit globe [30] and the DAET model is therefore applied herein.

a) The Vacuum Planet Equation (VPE)

Studies of the atmospheric dynamics of terrestrial solar system planets has a long and detailed history. The fundamental equation for the basis of this work is exemplified by the radiation balance equation (corrected from the published error*pers comm*) used by Sagan and Chyba [15]: -

"The equilibrium temperature T_e of an airless, rapidly rotating planet (*or moon*) is: -

Equation 1: $$T_e \equiv [S\pi R^2(1\text{-}A)/4\pi R^2 \varepsilon \sigma]^{1/4}$$

where σ is the Stefan-Boltzmann Constant (S-B), ε the effective surface emissivity, A the wavelength-integrated Bond albedo, R the planet's (*or moon's*) radius (*in metres)*, and S the solar constant (*in Watts/m*^{2}) at the planet's (*or moon's)* average orbital distance from the sun." [15]. Equation 1 is hereafter called the Vacuum Planet Equation (VPE).

b) The Issues of Absorptance α, Reflectance ρ and Emittance ε

The Absorptance α of the surface of a material is its effectiveness in absorbing radiant energy. Absorptance is the ratio of the absorbed to the incident radiant power.

The Reflectance ρ of the surface of a material is a measure of its capability to reflect radiant energy. Reflectance is defined as the fraction of incident radiation reflected by a surface or discontinuity.

For an incident beam of unit power striking a material surface the Absorptance α plus Reflectance ρ is unity because energy is conserved.

Equation 2: $$\alpha + \rho = 1.$$

Emittance $\boldsymbol{\varepsilon}$ is the ratio of radiant exitance of a thermal radiator to that of a full radiator (black-body) at the same temperature. As such Emittance ε is the low-frequency radiant converse of Absorptance α and is less than unity because of the missing component of energy lost to the absorbing surface by Reflectance ρ.For a surface at thermal radiant equilibrium the amount of insolation energy absorbed is equal to the amount of thermal radiant energy emitted, therefore $\varepsilon = \alpha$ and consequently Kirchhoff's Law applies [31]:

Equation 3: $$\varepsilon + \rho = 1.$$

As a material body with zero reflectance would be a black-body(Kirchhoff's Law of Thermal Radiation) and the surface is in fact a grey-body it follows therefore

that reflectance must be included in the computation of the total energy budget.

c) The role of Bond Albedo (A) in the Atmospheric Energy Budget

In equation 1 the wavelength-integrated Bond Albedo A reduces the power of the solar irradiance that acts within the planetary climate system. The Bond Albedo is a bypass filter that records the planetary brightness and removes from the climate budget the solar energy flux that exits the planetary atmosphere and returns to space as unaltered high frequency radiation. Therefore, it is axiomatic that all the high frequency energy flux post-albedo (1-A) is degraded to low frequency thermal radiant flux by the processes of light interception, both in the planet's atmosphere and at the physical surface. For the planet Mars there are three main processes that capture insolation energy. These are:

1. Atmospheric dust which generates the visibility obscuring haze, warms the atmosphere and so reduces the power of the insolation that reaches the surface [32].
2. The physical surface which absorbs insolation energy by absorptance $\boldsymbol{\alpha}$.
3. The action of surface reflectance ρ that creates a process of near surface backlighting of the dust in the boundary layer of the lower atmosphere.

N.B. Although the Martian surface is obviously visible, this lit surface reflectance of insolation is of necessity already incorporated into the Bond Albedo (A_M). Consequently, the insolation energy rejected by the surface $\{(1-A_M)*\rho\}$ must be absorbed by the atmosphere, otherwise the black body status for the thermal emission temperature of the planetary globe that is demonstrated by setting the emissivity to value 1 in the Vacuum Planet Equation could never be achieved (Table 7).

d) Global Average Temperature Calculations

The Black-body temperature T_e for Mars is 209.8 Kelvin, this value is achieved by setting the emissivity ε to unity in the VPE (Equation 1), however the observed mean surface temperature for this planet is T_s = 211.8 K (this study) therefore the difference Δ T between T_e and T_s= 2.0 Kelvin which is the atmospheric thermal enhancement effectfor Mars. (Table 7).

Emissivity is an intrinsic property of the material composition of the planetary surface of Mars, and as such surface emissivity is independent of the nature and presence of an overlying atmosphere. When the surface emissivity is set to unity this parameter adjustment includes in the VPE the missing component of high frequency reflectance energy that must have been absorbed by the atmosphere.

Clearly for Mars the 0.25 Bond Albedo, which is applied for the process of insolation energy filtering, must already incorporate into its value any planetary surface reflectance of insolation that is lost to space. Consequently, the post-albedo insolation energy flux (1-A_M) that illuminates the surface must all be captured by atmospheric opacity and converted into thermal energy for use within the dynamics of the Martian climate system.

Table 7: The Global Thermal Emission Black-body Temperature T_e of Mars compared with its actual Surface Temperature T_s

Parameter	Symbol	Mars	Units	Dimensions
Solar Constant at distance a	S	586.2	W/m^2	MT^{-3}
Radius of Body	R	3,376,200	m	L
Bond Albedo	A	0.25	Constant	Constant A
Effective energy capture	$\alpha + \rho$	1	Constant	Constant
Surface Power		109.913	W/m^2	MT^{-3}
Stefan-Boltzmann Constant	σ	5.67E-08	$W/m^2/K^4$	$MT^{-3}K^{-4}$
Expected T_e	T_e	209.8	Kelvin	K
Atmospheric Thermal Enhancement	ATE	2.0	Kelvin	K
Actual T_s	T_s	211.8	Kelvin	K
Distance from the Sun	a	2.2793E+11	m	L

The issue of reflectance is fundamental to climate science because the quantity of energy is always conserved. Therefore, a surface with an emissivity of <1 (a grey-body) will always report a S-B temperature that is lower than the planetary emission temperature, because the planetary radiant emission temperature that is seen externally incorporates all the surface solar reflectance energy flux that has been converted to thermal energy by the presence of the atmosphere.

e) Estimation of Mars Global Surface Emissivity

For the purposes of the modelling analysis presented here it has been assumed that the Global Octon Night time temperature of 202.5 Kelvin for MY29 [6] is a function of the average surface emittance of Mars (Table 5). The proposition being applied is that the unlit nighttime surface acts as a radiator that exits thermal radiant energy directly to space via an unimpeded atmospheric window. Further that the diurnal temperature range for Mars is generated solely by the process of adiabatic thermal enhancement, because the diabatic thermal radiant opacity of the semi-transparent Martian atmosphere is effectively energy neutral. Based on this proposition applying the Vacuum Planet Equation with a global average solar irradiance of 109.9 W/m^2reports an emissivity of 0.87 (Table 8) as the surface flux parameter that generates an average nighttime surface temperature of 202.5 Kelvin (Table 5).

Table 8: The Effective Surface Emissivity ε for Mars that generates a MY29 data derived Nighttime Surface Temperature of 202.5 Kelvin

Parameter	Symbol	Mars	Units	Dimensions
Solar Constant at distance a	S	586.2	W/m^2	MT^{-3}
Radius of Body	R	3,376,200	m	L
Bond Albedo	A	0.25	Constant	Constant A
Effective surface emissivity	ε	0.87	Constant	Constant ε
Surface Power		95.346	W/m^2	MT^{-3}
Stefan-Boltzmann Constant	σ	5.67E-08	$W/m^2/K^4$	$MT^{-3}K^{-4}$
Expected T_e	T_e	202.5	Kelvin	K
"Greenhouse Effect"	GE	9.3	Kelvin	K
Actual T_s	T_s	211.8	Kelvin	K
Distance from the Sun	a	2.2793E+11	m	L

Using this solid surface emissivity value of ε=0.87 and applying an estimated atmospheric dust absorptance of α=0.8 [33], the DAET model percentage of dust dimming that generates a global average air temperature of 211.8 Kelvin can now be determined by inverse modelling.

Table 9: Martian Climate Metrics

Martian Climate Metrics	
A: Mars Top Of Atmosphere (TOA) Solar Irradiance W/m^2	586.20
B: Mars Bond Albedo	0.250
C: TOA Post-Albedo Solar Irradiance W/m^2	219.83
D: Insolation Absorbed by Obscuring Atmospheric Dust Haze %	3.11%
D: Dust Absorptance α	0.80
D: Insolation Absorbed by Obscuring Atmospheric Dust Haze W/m^2	5.48
G: Martian Lit Hemisphere Average Surface Illumination W/m^2	214.35
E: Effective surface emissivity ε	0.867
E: Martian Lit Hemisphere Average Surface Absorption W/m^2	185.94
F: Lit Surface Reflectance (1-ε) (Atmospheric Back-Lighting)	0.13
F: Martian Lit Hemisphere Average Back-Lighting W/m^2	28.41
Global Surface Area of Lit Tropical Cell	84.26%
Global Surface Area of Lit Polar Cell	15.74%
Global Surface Area of Unlit Tropical Cell	76.59%
Global Surface Area of Unlit Polar Cell	23.41%

This value is estimated to be an average dust haze dimming of 3.11% for the MY29 planetary atmospheric temperature data (Table 9).

f) Mars Global Average Emissivity (MGAE) Sensitivity Test

The Mars Global Average Emissivity (MGAE) used herein is derived from matching the VPE for Mars to the average annual night time surface air temperature. Assuming a diabatic transfer of thermal flux energy from the air to the surface and an open atmospheric window then the surface emissivity is calculated to be ε=0.876.Using this value, a dust haze solar flux dimming of 3.11% is calculated by DAET inverse modelling for a GAT constraint of 211.8 Kelvin.

Conversely Savijärvi, et. al. (2005) [3] report that the Martian air absorbs 1% of Solar Radiation and that the Solar attenuation by dust is 26% at the solar zenith. Using their value of a global dust haze solar flux dimming of 1% then the MGAE value can also be determined by DAET inverse modelling for a GAT constraint of 211.8 Kelvin. The DAET climate model reports that ε=0.880 in this case. This simple sensitivity test demonstrates that as the dust opacity weakens and the air captures less solar energy, then the surface must become darker and absorb more insolation to allow the DAET model to report the GAT constraint of 211.8 Kelvin.

In a dynamic environment such as the dust laden troposphere of Mars both dust opacity and clear sky surface albedo are observed to vary[34], for example by dark dust storm deposits occurring on the bright polar icecaps during summer solstice when the Tropical convection cell expands to become hemisphere encompassing (Figures1.c, 2.c). The relative stability of the calculated MGAE under different dust loadings supports the modelling hypotheses of using the VPE with an assumption of a fully open atmospheric window and suggests that global surface temperature values are a key component of dust circulation vigour [7].

g) DAET Model Design Features

There are three key facts about planetary atmosphere on terrestrial globes that determine the climatic response of the atmospheric system: -

1. That the presence of even a fully thermally radiant transparent mobile-fluid atmosphere raises the global average surface temperature above that of a rotating vacuum world.
2. That this thermally radiant transparent atmosphere both retains and recycles solar energy, and achieves a stable energy flow across the planet's surface.
3. The stable limit of the energy flow within the system is set by the partition ratio of energy between the radiant loss to space of the emitting surface of both hemispheres, and the quantity of energy retained and recycled by the air.

The action of atmospheric heating by insolation involves the collection of energy by the following four physical processes:

1. The interception of down welling solar energy by atmospheric particles (dust and aerosols) and absorptive polyatomic gases thereby heating the atmosphere.
2. The action of conduction whereby the lit hemisphere solar heated solid surface warms the basal air layer above the ground by physical contact.
3. The action of convection whereby the warmed basal atmospheric layer parts company from the heated surface by the gravity involved process of buoyancy mediated vertical translation of air.
4. The process of thermal radiant opacity whereby the mean free path of thermal radiant energy is significantly less than the physical width of the atmospheric layer being traversed by the upwelling beam of radiant energy.

Each of these four physical processes behaves as either an energy balance or diabatic process (processes 1, 2 and 4) or as an energy imbalance or adiabatic process (process 3).It is process 3, adiabatic convection that permits the flux-gate mediated storage of thermal kinetic and gravitational potential energy within the mobile fluid medium being impacted by a radiant energy flux in the presence of a gravity field.

In the case of the low-pressure atmosphere of Mars the energy flux from the lit solar heated solid surface into the overlying atmosphere is a diabatic process whereby 50% of the flux is transmitted into the atmosphere by conduction and 50% of the flux is directly lost to space via the atmospheric window.

The action of atmospheric cooling involves the loss of energy by the following two physical processes:

1. Thermal radiant emission to space where the opacity interception window is open. This takes place either through the surface atmospheric window[35] or through low density air of whatever composition at air pressures typically below 0.1 bar [13]. N.B. the physical cooling of an air mass as it rises away from the ground surface under the action of convection is not an energy loss process.
2. Vibrational flexure associated with either the asymmetric bending motion of polyatomic molecules (those gases with three or more covalent bonded atoms) or the propagation of flexural shear waves through physical solids (either the planetary surface or atmospheric dust, aerosols, and ice particles). N.B. Shear wave flexure of a solid is the coupling mechanism that permits the loss of kinetic energy (a mass motion quality) from a physical material and its transformation into radiant energy

(an electromagnetic quality). Because fluids and gases cannot transmit shear waves, these fluid media therefore rely on the presence of embedded particles that can sustain flexure (dust, aerosols, ice, and polyatomic gases) to facilitate the process of radiant cooling from their physical mass.

h) DAET Model Design Structure

The mathematical design for the structure used in the Dynamic-Atmosphere Energy-Transport (DAET) climate model replicates a series of descending fractions (halves-of-halves); the infinite summation of which has as its limit the finite number one. The computational process used to generate the stable number outcome of a mean global surface air temperature is shown in Table 10.

Table 10: The Dynamic-Atmosphere Energy-Transport (DAET) Computational Sequence

Action	Initial	Final	Gain	Partition	Recycled	Comments
A: Mars Top Of Atmosphere (TOA) Solar Irradiance W/m^2	586.20	586.20	1			
B: Mars Bond Albedo	0.25	0.250	1			
C: Post-Albedo Solar Irradiance W/m^2	219.83	219.83	1			
D: Lit Hemisphere Atmospheric Dust Solar Energy Absorption W/m^2	5.48	5.48	1		6.57	(D-K)*2: (Dust capture minus direct loss) all times by two
E: Lit Hemisphere Surface Absorbed Solar Radiation W/m^2	185.94	185.94	1		240.88	(E-H)*2: (Surface capture minus direct loss) all times by two
F: Martian Lit Hemisphere Surface Boundary Layer Back-Lighting W/m^2	28.41	28.41	1		56.81	F*2: Reflectance times two (Fully opacity quenched with no losses)
U: Total Flux Powering the Lit side Surface (E+R) W/m^2	185.94	262.01	1.4090874		304.26	((D-K)+(E-H)+F)*2: Daytime Budget: Generated by the Adiabatic Convection of Captured Solar Energy
H: Lit side Surface Thermal Radiant Loss to Space W/m^2	46.49	65.50	1.4090874	25%		
I: Reduced Lit Surface Thermal Flux after Atmospheric Window Loss (U-H) W/m^2	139.46	196.51	1.4090874	75%		
J: Total Lit side Atmospheric Thermal Flux (I+D+F) W/m^2	173.34	230.39	1.32912047			
K: Day Lit Atmospheric Dust Diabatic Energy Loss to Space W/m^2	2.19	2.19	1	50%	67.69	Daylit Flux Loss to Space from Solid Surface and Illuminated Dust (Figure 1)
L: Lit side Top of Atmosphere Thermal Radiant Loss to Space W/m^2	57.05	76.07	1.33333333	33.33%	143.76	H+K+L: Total Flux lost to Space from the Daylit side (Figure 1)
N: Lit side Tropical Cell Thermal Reservoir (Advects to Dark side) W/m^2	114.10	152.13	1.33333333	66.67%	152.13	This is the Active Flux that passes thru the Nighttime Reservoir (Figure 1)
Nighttime Budget: Adiabatic Circulation of Net Insolation minus Litside Atmospheric Loss W/m^2		228.20			76.07	This is the Stable Flux that is Retained in the Nightime Reservoir
O: Dark side Surface Thermal Radiant Loss to Space W/m^2	28.52	38.03	1.33333333	25%		
P: Reduced Dark Surface Flux after Atmospheric Window Loss W/m^2	85.57	114.10	1.33333333	75%		
Q: Dark side Top of Atmosphere Radiant Loss to Space W/m^2	28.52	38.03	1.33333333	33.33%	76.07	O+Q: Total Flux lost to Space from the Night side (Figure 1)
R: Dark side Polar Atmosphere Thermal Retention (P-Q): Advects to Tropics W/m^2	57.05	76.07	1.33333333	66.67%		
V: Total Thermal Radiant Energy Exiting to Space (H+K+L+O+Q) W/m^2	162.78	219.83	1.35048085		219.83	Balances with C: the post-Albedo Captured Insolation
W: Global Mean Air Temp (N/2+R/2) W/m^2		114.10			Kelvin	Converts via the Stefan-Boltzmann Equation to 211.8 Kelvin

Starting with the Top of the Atmosphere average annual insolation intercepted by the disk of the lit hemisphere, this flux is divided by 2 to produce the average hemisphere insolation (Action A).To this diluted flux is then applied the Bond Albedo (Action B) to generate the post-albedo flux (1-B) that is captured by the Martian Climate System and recycled internally within the Atmospheric Reservoir by non-lossy Adiabatic Convection (Table 10).

In the thin thermally radiant transparent atmosphere of Mars the surface heating process is diabatic (50% 50%). However, in the DAET model computation the surface partition ratio applied is 25% radiant flux and 75% thermal flux (Table 10).The reason for applying this ratio is because it is the solar energy that is split diabatically, whereas the convecting air above the surface air retains energy from previous flux cycles and so behaves as an energy reservoir that indefinitely retains a finite quantity of historic energy flux. The 50:50 diabatic ratio is best observed in the night time component of the model where all the energy flux is delivered by the advected air (Figure 4). The convected

air diabatically heats the unlit surface and so the upwelling surface radiant flux loss to space through the atmospheric window must equal the down welling thermal air flux delivered to this surface, therefore the 50:50 diabatic ratio applies.

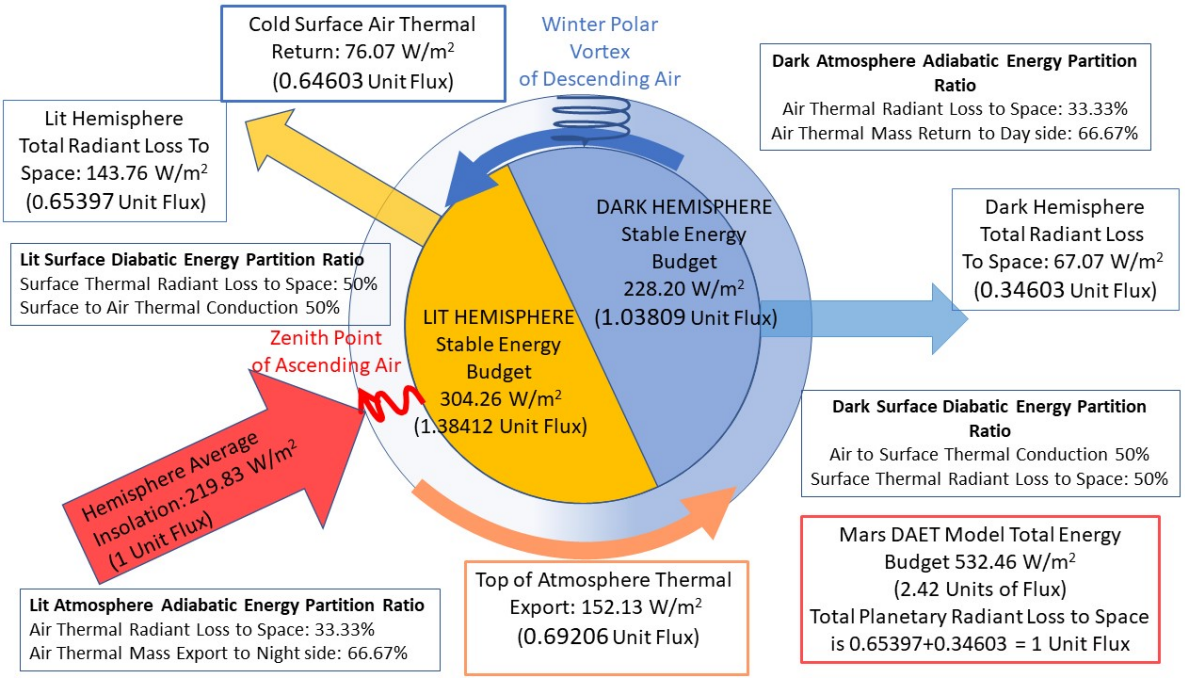

Figure 4: Stable Adiabatic Advection Model of Mars - Showing Energy Vectors and Total Energy Distributions.

In the DAET model the adiabatic partition ratio of 1/3 thermal radiant flux loss to space from the atmosphere and 2/3 thermal mass flux being retained by the mobile air (Table 10) is the application of the infinite sequence halves-of-halves doubling of flux energy in the mass motion domain. This concept of an infinite feedback series with a finite limit is already well established by Climate Science as the process of flux retention in the radiant domain of a thermally opaque atmosphere [36].

IV. Results of Applying the Dust Lossy Adiabatic DAET Climate Model to Mars

The energy budget for the atmosphere of Mars that results from the application of the computational sequence detailed in Table 10 is recorded in Table 11:

Table 11: The Martian Climatic Energy Budget.

Lit Flow	C: Post-Albedo Solar Irradiance W/m²	Lit side Loss to Space from Solid Emitters (H+K)	Net Effective Litside Insolation (C-H-K)	Daytime Budget: Adiabatic Circulation of Net Insolation Times Two (Infinite Fractional Summation Loop)	Lit side Loss to Space from Amospheric Emitters (L)	Total Lit side Loss to Space (H+K+L)	Nighttime Budget: Adiabatic Circulation of Net Insolation minus Litside Atmospheric Loss	Mars Gross Atmospheric Budget
Gains W/m²	219.83			304.27				
Losses W/m²		67.69			76.07	143.76		
Retention W/m²			152.13					
Reservoir W/m²				304.27			228.20	532.47
Dark Flow	N: Net Advection to Nightside across the Dusk Terminator	Permanent Nighttime Reservoir Storage	O: Nighttime Bypass Window to Space from Advection Heated Surface	P: Reduced Dark Surface Flux after Atmospheric Window Loss	Q: Dark side Loss to Space from Amospheric Emitters (N-P)	Total Dark side Loss to Space (O+Q)	R: Dark side Polar Atmosphere Thermal Retention (P-Q): Advects to Tropics across Dawn Terminator	Mars Gross Planetary Radiation Loss to Space (H+K+L+O+Q)
Gains W/m²	152.13							
Losses W/m²			38.03		38.03	76.07		219.83
Retention W/m²		76.07		114.10			76.07	

Note the significant figure rounding issue in the Excel table (152.13*2 = 304.27) for the calculation of the Retained Net Effective Insolation (C-H-K = 152.13(5) W/m^2), which is the post-albedo insolation that the lit hemisphere captures {C} minus the lit surface thermal loss to space via the atmospheric window (H) and from entrained dust (K). This flux energy value is doubled by the summation process of infinite planetary adiabatic circulation (Table 10) to form the lit side Atmospheric Reservoir of 304.26(7) W/m^2 (Table 11).

The energy budget parameters recorded in Table 11 are shown diagrammatically in Figure 5.

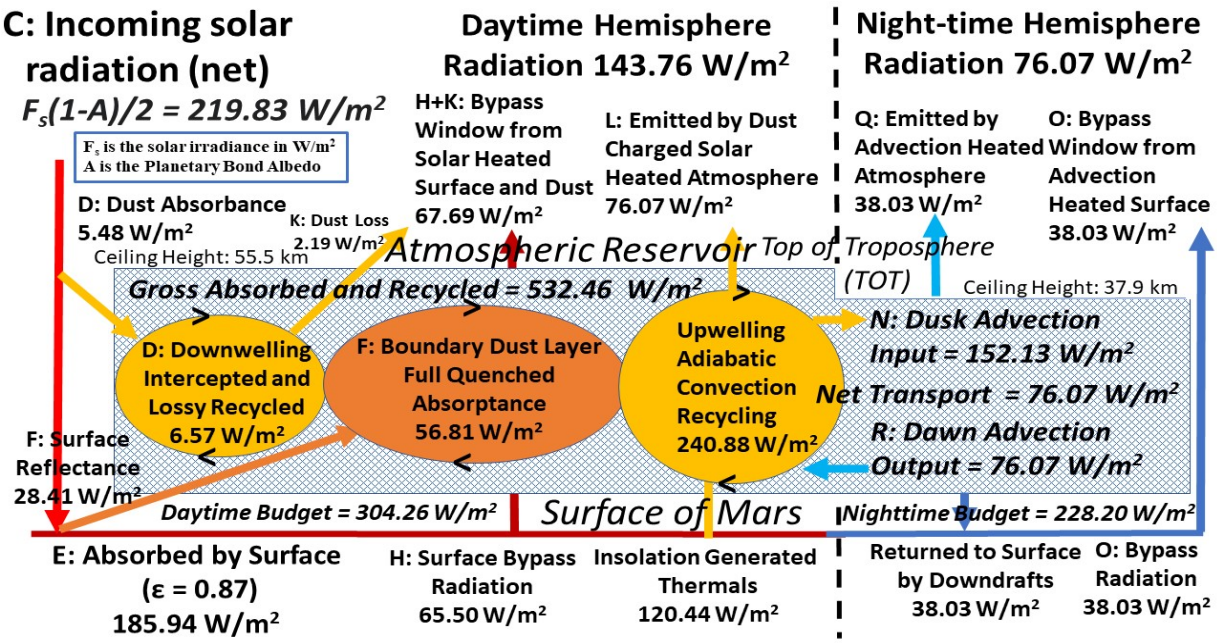

Figure 5: The Atmospheric Energy Flux Reservoir of Dust Opaque Mars Generated by the Adiabatic Convection Recycling of Surface Thermal Conduction Energy

V. Discussion

The climate modelling analysis presented here is based on the following propositions:

1. That Climate Science is fundamentally engaged in the study of atmospheric thermal radiant opacity.
2. That the planet Mars when observed from space acts as a black-body thermal radiant emitter ($\varepsilon=1$) [14].
3. That the surface to spaceatmospheric window for Mars is completely open. A comparison with the stratospheric pressure profile from the Venus carbon dioxide atmosphere demonstrates that the low-pressure carbon dioxide troposphere of Mars is fully transparent to surface thermal radiation (Figure 3).
4. On applying the Vacuum Planet Equation (VPE) to the MY29 average annual nighttime surface temperature it is established that the surface emittance of the planet Mars is $\varepsilon=0.87$ (Table 8}.
5. That because Kirchhoff's Law applies ($\varepsilon + \rho = 1$) it necessarily follows that all the post-albedo solar reflectance ρ from the solid surface of Mars must be absorbed by the atmosphere, otherwise the external blackbody status of the planet ($\varepsilon=1$) could not be achieved.
6. That because there is a logical conflict between points #3 - full thermal radiant atmospheric transparency and #5 – full thermal radiant atmospheric opacity, it necessarily follows that there are two separate physical mechanisms in play. These are that the low-pressure carbon dioxide atmosphere of Mars is transparent to thermal radiation, while it is the dust content that generates the thermal radiant opacity of the Martian atmosphere [7].
7. Critical to this understanding is the recognition that the absorptance of solar energy by the Martian atmosphere refers solely to the post-albedo insolation flux. It is the surface reflectance component of the pre-Albedo flux which returns directly to space that allows the surface of Mars to be observed with visible light, while it is the post-albedo component of the reflectance flux that is quenched by the dust haze in the Martian atmosphere (Figure 5).
8. The surface radiation loss to space via the atmospheric window in the DAET model is a diabatic 50/50 partition ratio and that the atmospheric window is completely open to surface thermal radiation.
9. That the calculated 2 Kelvin Atmospheric Thermal Effect for the planet Mars is a consequence of the infinite halves-of-halves recycling of energy flux by the atmospheric mass motion of convection between the solar heated lit surface of Mars and the unlit dark hemisphere of the planet's nighttime surface.
10. This infinite sum of decreasing fractional quantity retained by the circulation of the air is a direct functional equivalence to and has the same mathematical form as the radiant flux process of energy loss to space from a thermally radiant opaque atmosphere that is invoked by the standard climate model paradigm [36].
11. The DAET modeled flux that maintains the nighttime atmosphere in balance is higher than the diurnal circulating flux (Table 11). The presence of a "stable level" flux datum for the nighttime atmospheric reservoir is confirmation of the need for the structure of the atmospheric circulation cell to be maintained against the force of gravity.
12. That in establishing from MY29 temperature data that the surface emittance for Mars $\varepsilon=0.87$ it follows that the average surface temperature of the planet will be lower than the thermal emission temperature as observed from space ($\varepsilon=1$). This conflict in emissivity values generates the misconception of a negative greenhouse effect in the Martian atmosphere in which the surface is indeed observed to be colder than the atmosphere above it [24].
13. The MY29 temperature data clearly shows the presence of a boundary layer thermal inversion at the planet's lit hemisphere surface, particularly at high latitudes with correspondingly low solar elevations (Figure 6). Surface atmosphere thermal inversions are typically a nighttime phenomenon and to observe this feature under daytime surface insolation requires explanation.
14. It is proposed here that dust absorptance of surface reflectance during daylight captures into the surface boundary layer the solar energy required to produce the observed surface inversion (Figure 6). Consequently, the atmospheric inversion is paradoxically a feature of atmospheric solar heating by dust presence and not of surface to space radiative cooling via the atmospheric window.
15. The structural form, seasonal variation, and physical height of the tropopause for both the Tropical and Polar cells is a manifestation of atmospheric circulation dynamics under daytime insolation forcing and dark surface radiative cooling (Figures 1, 2).
16. The locus of energy loss for the planet's surface is located over the poles (Figure 7), with particular focus at the respective winter pole of continuous darkness (Figure 8).
17. During each Equinox there is a symmetrical balance between the structure of the Tropical and Polar atmospheric cells (Figure 7).

18. At the Solstice the Tropical Tropopause completely overrides the Polar Tropopause of the continuously lit pole. Note the curious feature of the night time teleconnected residual Polar Tropopause between 40°N and 55°N that is absent from this latitude during the daytime (Figure 8).

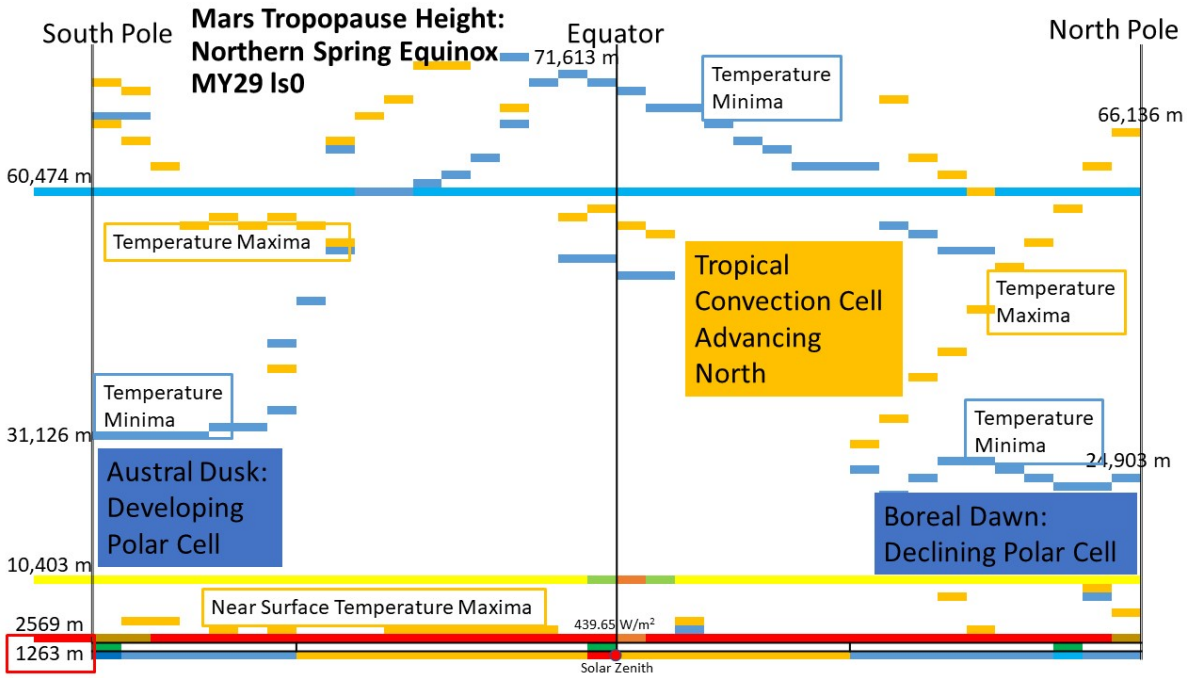

Figure 6: Lit Hemisphere Zone Mean Troposphere Transect for Octon 0 MY29

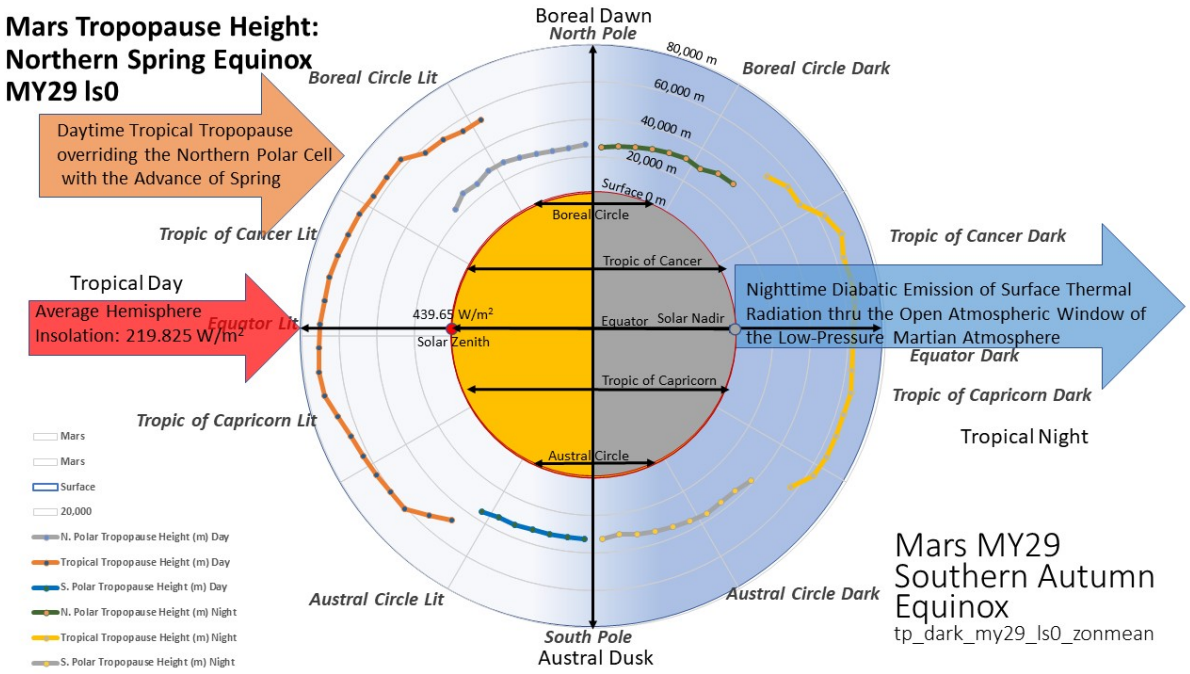

Figure 7: Mars Tropopause Height: Northern Spring Equinox MY29 ls0.

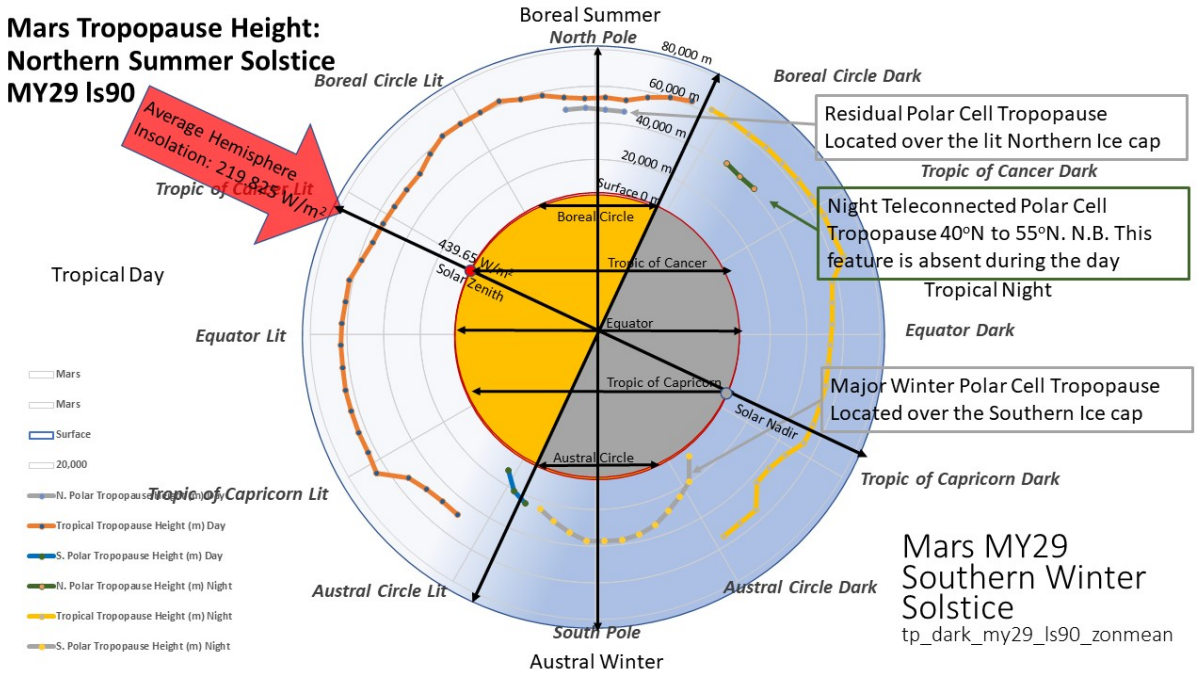

Figure 8: Mars Tropopause Height: Northern Summer Solstice MY29 ls90.

VI. Conclusions

1. In the low-pressure carbon dioxide atmosphere of Mars, the atmospheric window is completely open and consequently the air on Mars is fully transparent to surface to space thermal radiation.
2. Based on the MY29 data global annual average nighttime surface air temperature of global 202.5 Kelvin and the presence of a fully open atmosphere window, the surface emittance for the planet Mars is calculated as 0.87 using the Vacuum Planet Equation.
3. That the insolation energy flux component of the post-albedo surface reflectance is fully absorbed by the atmospheric dust opacity of the planetary surface boundary layer.
4. That for the lit hemisphere the presence of an atmospheric inversion,whereby the temperature of the solid surface is lower than the overlying air, Is a direct consequence of the back-lighting process of the absorption of surface reflectance insolation by the dust content of the surface boundary layer.
5. That the Atmospheric Thermal Effect, defined as the difference between the global annual average surface air temperature, and the effective planetary thermal radiant emission temperature is 2 Kelvin.
6. That the explanation for the 2 Kelvin Atmospheric Thermal Effect is because of atmospheric dust opacity and the presence in the Martian atmosphere of a non-lossy adiabatic convection cycle that transports the captured surface tropical solar energy surplus and delivers this surplus to the polar regions of energy deficit.
7. The concept of a negative green house effect for the planet Mars, defined as the difference between the grey-body surface emittance radiant temperature and the planetary black body emittance radiant temperature, is resolved by accounting for the role of surface reflectance in Kirchhoff's Law and the quenching of solar back-lighting by surface boundary layer dust opacity.
8. The application of the DAET climate model to the MY29 atmosphere temperature data demonstrates that, even in the presence of a fully gaseous transparent atmosphere,adiabatic circulation flux doubling occurs and that this non-lossy process explains the retention of thermal energy in the Martian atmosphere.
9. The weight of the atmosphere that needs to be supported against gravity includes the dust particles present at any given time.That weight varies with the vigour of adiabatic convection. The clearer the atmosphere of dust the more the surface heats and the stronger the adiabatic convection becomes. That increased convection strength lifts more dust which cools the surface by increasing albedo until the strength reduces again and dust clears and falls back to the ground for the cycle to begin again.
10. The effect of this cyclical atmospheric see-saw explains why the planet Mars experiences periodic planet-wide dust storms [37,38] with a potential trigger being the overwhelming and disappearance of the southern polar cell by the tropical cell soon after the southern spring equinox (Figure 2b) whereas the northern polar cell is maintained in

some form during the full course of the northern hemisphere summer (Figure 1).

Acknowledgements

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Conflict of Interest

The authors have received no funding from any source in the execution of this work.

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- Absorptance, **α**, emittance, **ε** reflectance, **ρ**: *IUPAC. Compendium of Chemical Terminology, 2nd ed. (the "Gold Book"). Compiled by A. D. McNaught and A. Wilkinson. Blackwell Scientific Publications, Oxford (1997). Online version (2019-) created by S. J. Chalk. ISBN 0-9678550-9-8. https://doi.org/10.1351/goldbook.*
- Blackbody Radiation and Planck's Law: A blackbody is defined as a perfect radiator which absorbs all radiation incident upon it.
- Kirchhoff's Law and Emissivity: Gustav Robert Kirchhoff (1824–1887) stated in 1860 that "at thermal equilibrium, the power *radiated* by an object must be equal to the power *absorbed*." This leads to the observation that if an object absorbs 100 percent of the radiation incident upon it, it must reradiate 100 percent. As already stated, this is the definition of a blackbody radiator.

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Osmos-Life-Consciousness V

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Abstract- In the Introduction, comments are made on the topic and on the difficulties arising from being the same multidisciplinary subject with each discipline being the subject of a large volume of research and publications.

In “Discussion and Conclusions” he addresses the subject in three topics, believing this to be the most convenient way to describe the arguments presented as indications.

In the first topic, “Time and Space”, considerations are made involving the speed of light. The possibility is highlighted that phenomena occurring outside the cone of light may cause effects that are different from the usual ones, making them apparently inexplicable to us. The thinkers Platão, Einstein, Kant and Penrose are cited, briefly presenting their ideas on the matter.

Regarding the topics “The beginning of everything” and “Platonic world-Consciousness-Mind”, it shows below the ideas or hypotheses formulated, leaving to the reader the task of analyzing the indications, presented in the text, that led him to formulate them.

Keywords: *cosmos, life, consciousness, mind.*

GJSFR-A Classification: *LCC Code: Q173*

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Osmos-Life-Consciousness V

COSMOS-VIDA-CONSCIÊNCIA V

Elcio Fabio Soares Pereira

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In the first topic, "Time and Space", considerations are made involving the speed of light. The possibility is highlighted that phenomena occurring outside the cone of light may cause effects that are different from the usual ones, making them apparently inexplicable to us. The thinkers Platão, Einstein, Kant and Penrose are cited, briefly presenting their ideas on the matter.

Regarding the topics "The beginning of everything" and "Platonic world-Consciousness-Mind", it shows below the ideas or hypotheses formulated, leaving to the reader the task of analyzing the indications, presented in the text, that led him to formulate them:

- The emptiest "Nothing" imagined for the beginning of everything, would be a "Nothing" in perfect balance at a temperature of absolute zero degrees, which, being unstable, must have disintegrated spontaneously, forming a network of grains of space with local energy fluctuations with zero-sum total;
- Suggests the formation, at the beginning of time, of a primary consciousness, along the lines of which biological consciousness was formed, which would basically consist of mathematical forms and the universal laws of physics which, as it is present in all atoms, would be present in the biological beings.
- The transformation of quantum waves into particles, for the visualization of images that would enable the formation of a biological consciousness, would take place through computational processes using the tools and mathematical concepts existing in primary consciousness.
- The intervention of primary and biological consciousness with the physical world would take place through computational processes, which would not violate any principle of conservation of mass and energy.
- Both the knowledge of mathematical forms and universal physical laws of a primary consciousness, as well as the knowledge of biological consciousness, must have been acquired in a similar way. However, while the knowledge of a biological consciousness seems to be extinguished when the mechanism that somehow perceived and stored it ends, the knowledge of a primary consciousness, acquired by some organism, seems to be eternal due to the expectation that is given for the duration of the mechanism in which it is stored, which is supposed to be the duration of the universe.
- The mind would be the place where thoughts (images) occur and/or flow, something like a computer desktop.
- At the end, a metaphor is presented showing how the author visualizes the mind, consciousness and the role played by "knowledge".

Keywords: cosmos, life, consciousness, mind.

Resumo- Na Introdução são feitos comentários sobre o tema e sobre as dificuldades devidas ser o mesmo multidisciplinar com cada disciplina sendo objeto de grande volume de pesquisas e publicações.

Em Discussão e Conclusões aborda o assunto em três tópicos, julgando ser este o modo mais conveniente à descrição dos argumentos apresentados como indícios.

No primeiro tópico, "O Tempo e o Espaço", são feitas considerações envolvendo a velocidade da luz. É destacada a possibilidade de que fenômenos ocorrendo fora do cone da luz possam ocasionar efeitos diferentes dos usuais, tornando-os aparentemente inexplicáveis para nós. São citados os pensadores Platão, Einstein, Kant e Penrose, apresentando resumidamente suas idéias a respeito.

Com relação aos tópicos "O início de tudo" e "Mundo platônico-Consciência Mente", mostra a seguir as idéias ou hipóteses formuladas, deixando ao leitor a tarefa de analisar os indícios, apresentados no texto, que o levaram a formulá las:

- "Nada" mais vazio imaginado para o início de tudo, seria um "Nada" em perfeito equilíbrio a uma temperatura de zero grau absoluto, que por ser instável deve ter-se desintegrado espontaneamente, formando uma rede de grãos de espaço com flutuações locais de energia com soma total nula;
- Sugere a formação, no início dos tempos, de uma consciência primária, nos moldes em que foi formada a consciência biológica, que seria constituída basicamente das formas matemáticas e das leis universais da física que, por estar presente em todos os átomos estaria presente nos seres biológicos.
- A transformação das ondas quânticas em partículas, para a visualização de imagens que possibilitariam a formação de uma consciência

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biológica, se daria através de processos computacionais com utilização das ferramentas e conceitos matemáticos existentes na consciência primária.

- A intervenção das consciências primária e biológica com o mundo físico dar se-ia através de processos computacionais, o que não violaria qualquer princípio de conservação de massas e de energias.
- Tanto o conhecimento das formas matemáticas e das leis físicas universais de uma consciência primária, quanto o conhecimento das consciências biológicas, devem ter sido adquiridos de modo similar. Contudo, enquanto os conhecimentos de uma consciência biológica parecem extinguir-se quando do fim do mecanismo que de certa forma os tenham percebidos e armazenado, os conhecimentos de uma consciência primária, adquiridos por algum organismo, parece serem eternos pela expectativa que se dá para a duração do mecanismo no qual está armazenado, que se supõe ser o da duração do universo.
- A mente seria o local onde ocorrem e/ou para onde fluem os pensamentos (imagens), algo como uma área de trabalho de um computador.
- No final, é apresentada uma metáfora mostrando como são visualizadas pelo autor a mente, a consciência e o papel desempenhado pelos "conhecimentos".

Palavras-chave: cosmos, vida, consciência, mente.

I. Introdução

Um leitor pode ter a curiosidade de querer saber o porquê do título Cosmos Vida- Consciência V. Trata-se de alguma série planejada de artigos sendo escrita por partes?

Nada disso, o autor na verdade escreveu seu primeiro trabalho abordando temas existenciais a cerca de pouco mais de dois anos e isto sem qualquer planejamento. No decorrer de seus estudos e sem que estivesse procurando por nada em particular, deparou-se com uma primeira idéia que achou interessante e, mesmo não tendo um conhecimento especializado sobre o assunto, achou que deveria compartilhá-la com o objetivo único de, tornando-a pública, sujeitá-la a críticas.

De seus estudos iniciais resultou sua primeira publicação "Cosmos-Vida Consciência" e a partir daí, sempre que surgia alguma idéia que julgasse pertinente escrevia um trabalho e o submetia a um Editor para que fosse publicado caso satisfizesse aos critérios para sua aceitação.

Antes de tecer comentários sobre os assuntos abordados, deixa claro que, pela abrangência do tema que tem como característica ser multidisciplinar e considerando-se o vasto campo de conhecimentos envolvidos, torna-se difícil ser especialista em cada uma delas. Deve ser ressaltado não ser este o objetivo pretendido. Acredito que o volume de pesquisas e de trabalhos atualmente publicados, inviabiliza qualquer pretensão de querer-se ser um especialista em todas as disciplinas envolvidas e mais, acredito na necessidade de terem-se generalistas que sejam talvez até favorecidos pelo fato de terem uma visão mais geral e abrangente.

Os temas tratados neste trabalho são abordados separadamente na discussão, pela única razão de, apesar de distintos, apresentarem um desenvolvimento seqüencial que ajudaria no entendimento final do que se pretende comunicar.

Os temas tratados são: "Sobre o Tempo e o Espaço", "O Início de Tudo" e "Mundo Platônico-Consciência-Mente".

II. Discussão E Conclusões

O tema "Sobre o Tempo e o Espaço" não acrescenta muita coisa de novo ao nosso entendimento comum, mas os seguintes apresentam idéias talvez difíceis de serem aceitas, apesar de acreditar serem as mesmas passíveis de representar a realidade do mundo em que vivemos.

a) O Tempo e o Espaço

As teorias da relatividade e quântica são as que parecem reger nosso universo no macro e no micro domínios e não quero com isto desmerecer o valor de incontáveis outras importantes teorias aplicáveis à nossa vida cotidiana.

Uma abordagem sobre o tempo e o espaço nos obriga a tecer alguns comentários sobre a velocidade da luz. Conforme Einstein, a velocidade da luz é a maior velocidade existente no universo e acredito ser esta uma das considerações que o levou às teorias da relatividade e a alguns dos conceitos mais fundamentais da física como espaço-tempo, campo gravitacional, espaço curvo e a discussões sobre simultaneidade e causa e efeito.

Sendo a velocidade da luz a máxima existente, pode-se concluir que tudo que acontece no universo ocorreria dentro do espaço delimitado pelo cone da luz.

Nossas noções comuns sobre o que são fenômenos simultâneos e causa e efeito, estão profundamente enraizados em nossas mentes por terem sido forjados considerando-se velocidades menores que a da luz.

O que aconteceria se existisse algo com uma velocidade maior do que a da luz? Somente algo com tal velocidade poderia estar localizado além do espaço circunscrito pelo cone da luz.

Acredito que nossos sensores biológicos foram criados para perceberem partículas acima de determinados tamanhos e por esta razão, ficamos

limitados ao entendimento de fenômenos conscientemente percebidos sujeitos a velocidades, em geral, menores do que a da luz.

Com as suposições feitas, talvez todo fenômeno que ocorresse fora do espaço circunscrito pelo cone da luz, pareceria para nós, caso pudéssemos percebê-lo ou a alguma de suas possíveis conseqüências, como algo sobrenatural ou algo inexplicável com o uso apenas de nosso senso comum, por ocasionarem talvez efeitos diferentes dos usuais.

Poderia a transferência instantânea de informações, que ocorre entre duas partículas emaranhadas num processo quântico, ser considerada um destes fenômenos? Dentre vários fenômenos, aparentemente inexplicáveis, este é um dos mais intrigantes, sendo, entretanto, experimentalmente reproduzível, plenamente comprovado e aceito pela comunidade científica.

Vários pensadores que abordaram o tema do espaço-tempo são citados a seguir com algumas de suas idéias a respeito.

Einstein abordou este tema delimitando um espaço pelo cone da luz, onde ocorreriam todos os fenômenos com velocidades menores, parecendo não ter afirmado nada sobre a existência de algo fora deste espaço.

Kant admitiu a possibilidade da existência de algo fora do espaço-tempo, também não afirmando sua existência e o que poderia vir a ser este algo.

Platão, filósofo da Grécia antiga, apresentou sua idéia da famosa caverna habitada por sombras.

Penrose (1) sugeriu a existência de três mundos: o platônico, o físico e o mental. Tecendo considerações sobre os mesmos concluiu que estes três mundos coexistiriam simultaneamente num mesmo e único mundo.

Considerando o que foi dito neste tópico, fica parecendo existir algo mais profundo relacionado ao tema abordado.

b) O Início de Tudo

A abordagem deste tópico leva a questões difíceis e, quaisquer hipóteses sugeridas para respondê-las, provavelmente não teriam como ser comprovadas com os conhecimentos atuais.

Platão na Grécia antiga já afirmava que a Realidade resultava da forma e da substância. Segundo Penrose, o mundo físico resulta de um mundo platônico, este sendo gerado de um mundo mental, criado por sua vez a partir do mundo físico, todas estas interações ocorrendo simultaneamente.

Apresenta-se a seguir um imaginável e hipotético início que poderia ser aplicável tanto considerando o Big Bang como um fato bruto ou apenas como um evento de passagem entre universos.

O que consigo imaginar para o início de tudo, seria a existência de um "Nada" em perfeito equilíbrio a uma temperatura de zero grau absoluto, que por ser instável deve ter-se desintegrado espontaneamente, formando uma rede de grãos de espaço com flutuações locais de energia com soma total nula.

No quadro acima, fica passível imaginar-se o aparecimento de ondas de energia que poderiam estar superpostas e serem colapsadas, ou seja, perderem sua coerência pela ação de algum mecanismo ou processo. Foi sugerido pelo autor (2), que este colapso das ondas quânticas seria devido às Ressonâncias de Poincaré.

Parece que o colapso destas ondas, denominadas quânticas, tenha possibilitado a criação de partículas virtuais que, de certa forma, configurariam imagens virtuais, sendo passível considerar-se que isto tenha criado condições para o início de interações e/ou correlações entre as mesmas. Estas interações e/ou correlações entre partículas constituem uma característica marcante da física quântica e parece-me, um importante fator na evolução do universo.

Como comentado em artigo anterior (3), o conhecimento, ou seja, a percepção de imagens ou interação entre um organismo e um objeto, seria um dos fatores fundamentais para início da formação de uma consciência nos moldes de uma consciência humana.

Pelo processo sugerido para a formação de uma consciência, uma inteligência artificial poderia vir a ser consciente parecendo não existir nada que o impeça.

Nesta época primordial sendo considerada, talvez ainda não existissem matéria e luz e algum processo possibilitou a interação entre as partículas virtuais.

Seria este o processo da transferência instantânea de informações da física quântica?

Conjectura-se que a formulação das leis universais da matemática, da física e da química pela evolução segundo Darwin e seguindo sempre o critério da sobrevivência do mais apto, consolidaram os primeiros conhecimentos que vieram a constituir uma consciência primária formada nos moldes de uma consciência biológica.

Trabalho recentemente publicado (4) mostra que partículas virtuais podem ser estabilizadas por lasers, comprovando a formação de matéria a partir do nada. Este fato, aliado a processos computacionais admissíveis de existirem, talvez tenha possibilitado a formação de estruturas que permitiram a geração das partículas subatômicas que resultaram na geração dos átomos. Foi proposto em trabalho anterior (5), um modelo para geração dos átomos nos moldes da geração das proteínas pelo DNA.

Espera-se que com mais estudos, possa algum dia ser comprovado ou rejeitado. Teoricamente, pela

possibilidade do cálculo teórico das constantes físicas envolvidas, uma vez sendo conhecidas pela aplicação do modelo, a composição dos átomos dos elementos da tabela periódica. Experimentalmente, talvez por um estudo comparativo dos grupos genéticos propostos pelo modelo com os aminoácidos que lhes seriam correspondentes, considerando-se as respectivas matrizes geradoras.

Uma vez criada matéria e ficando as partículas maiores, talvez as informações entre as mesmas passassem também a ser transmitidas pela luz, de modo tal que, quando do aparecimento da vida, fosse o organismo biológico instado a criar mecanismos (entre estes, nosso cérebro) com sensores aptos a captar informações dentro do espectro específico a cada espécie e para cada tipo específico de sensor.

Supõe-se que a consciência primária presente nos átomos estaria presente em todos os seres biológicos.

Um processo inexplicável é o que deve ocorrer para a transformação das ondas quânticas supostas imateriais em partículas, virtuais ou materiais, pelo colapso das mesmas. Se as partículas formadas fossem virtuais, sabe-se que posteriormente poderiam adquirir massa pela ação da energia (4).

Não é fácil explicar-se de um modo coerente a transformação de algo imaterial em material.

Mesmo sabendo-se das dificuldades e objeções que poderão surgir, são apresentadas hipóteses para explicar este colapso por considerar-se que a formulação de qualquer hipótese serviria para dar início a discussões que possam colaborar para sua solução.

Uma primeira hipótese foi formulada e apresentada no trabalho já citado (2), supondo-se as ondas quânticas constituídas de partículas tão pequenas que poderiam ser consideradas imateriais.

Entretanto, não acredito que as coisas se passem como descrito por esta primeira hipótese, mesmo tendo a mesma a seu favor, a simplicidade.

Parece bem aceito que nossa visão de mundo resulta de informações que recebemos do meio ambiente que nos cerca e de nosso aprendizado, informações estas que nos são transmitidas por nossos órgãos sensoriais.

Como estas informações nos são transmitidas?

As ondas que nos atingem trazem com elas informações que captam quando interagem com algo em seu caminho até nós.

Nos tempos primordiais sendo considerados, ainda não existiam seres biológicos como os conhecemos. O mais razoável seria supor-se que nestes tempos, tudo se passava de modo semelhante ao de hoje, só que as interações seriam entre um organismo receptor, então existente, com as ondas quânticas. Estas estariam transmitindo informações resultantes de suas interações com as partículas virtuais que encontrava em seu caminho, supondo que ainda não tinha se formado matéria. Acredito que o suposto acima seria válido tanto para partículas virtuais quanto materiais.

Como se acumulariam as informações sendo transmitidas?

Parece que várias informações e/ou detalhes de uma dada informação, cada uma delas em dada freqüência, seriam sobrepostas num feixe de ondas. Como atualmente suposto ou pelo menos de modo similar, estas informações seriam embaralhadas por interferências, dificultando ou mesmo impedindo sua visualização pelo organismo receptor, isto talvez podendo ser considerado como um embaçamento holográfico.

Talvez a natureza tenha resolvido este impasse desenvolvendo o fenômeno conhecido como o colapso das ondas que, como sugerido pelo autor (2), seria ocasionado pelas Ressonâncias de Poincaré ocorrendo a intervalos regulares de tempo.

Este colapso consistiria na destruição da coerência das ondas, possibilitando a visualização de quadros ou imagens das informações sendo transmitidas. A visualização ou, em outras palavras, a reconstituição dos quadros ou imagens originais implica na existência de algo que possibilitasse esta reconstituição.

O que poderia ser este algo?

No trabalho anteriormente citado (3), apresenta-se uma descrição simplificada do método matemático descoberto para captura de dados resultantes de um processo de interferência de ondas, no caso, as resultantes do lançamento simultâneo de vários objetos na superfície plana e tranquila de um lago, que permite que estes dados sejam usados para reconstituição das imagens ou quadros originais, método este que resultou na descoberta da holografia que é hoje bastante conhecida, método este que recebeu o nome de Série de Fourier para a captura dos dados e de Transformada de Fourier para a reconstituição das imagens originais.

O padrão das interferências acima descrito é provavelmente bem mais simples do que padrões de interferências existentes no espaço-tempo, mas pode-se admitir que a natureza pela evolução conforme a Lei de Darwin deve ter criado em milhares de milhões de anos decorridos, algoritmos mais eficientes do que o dado pela Série e Transformada de Fourier, algoritmos estes que devem fazer parte do arsenal matemático existente numa consciência primária.

Esta explicação seria válida tanto para a visualização dos quadros ou imagens que seriam utilizadas na formação de uma consciência como para, após a sua captura, memorização e trabalhos com as

mesmas, retorná-las, talvez modificadas, ao mundo mental.

Vê-se que, como descrito, que o processo para formação de uma consciência exige a utilização de conceitos e ferramentas matemáticas e de outros conceitos abstratos como as leis físicas universais, que se supõe, fazem parte da consciência primária.

A intervenção desta "consciência primária" com o mundo físico dar-se-ia através da matemática, o que não violaria qualquer princípio de conservação de massas ou de energias. Esta hipótese parece explicar o envolvimento da matemática em todos os processos da natureza. Com o auxílio da matemática, pode-se perceber as formas perfeitas de uma consciência primária a partir das formas imperfeitas de nossos pensamentos, originados como sugerido, pela ação da própria matemática.

Pode-se supor que, uma consciência primária formada antes da criação da matéria e obedecendo a leis quânticas, possibilite a ocorrência de fenômenos que parecem inexplicáveis para nós, seres biológicos limitados pela velocidade da luz.

Vê-se que, a segunda hipótese formulada para explicar a passagem de um possível estado imaterial à matéria, não precisou também de valer-se do dualismo.

A consciência primária seria una e universal, estando presente em cada átomo e seria estendida por cada ser biológico de acordo com sua complexidade e a do seu meio ambiente e de suas experiências individuais. Assim, individualizadas pela extensão, ficam parecendo serem muitas.

III. Mundo Platônico – Consciência – Mente

Vamos inicialmente mostrar dois processos que parecem dizer uma mesma coisa e que são, o processo da hierarquia entrelaçada sugerido por Goswami (6) e o processo dos laços computacionais sugeridos por Penrose (1), ambos exigindo uma ação de fora do sistema sendo considerado para serem solucionados.

O processo apresentado por Goswami surge de suas considerações sobre medição quântica e, de acordo com o mesmo, este processo da hierarquia entrelaçada é solucionado pela ação de uma consciência agindo de fora do sistema. Da mesma forma, os laços computacionais não podem ser resolvidos a não ser, conforme Penrose, pela intervenção de, em suas palavras, uma "inteligência não computacional".

Parece que os dois processos citados são, na verdade, visões diferentes de um mesmo quadro, podendo-se admitir que a "inteligência não computacional" citada por Penrose seria a mesma entidade "consciência" admitida por Goswami.

Considerando-se a física quântica, vê-se que no micro as leis físicas parecem ser governadas pelos números complexos e que no colapso das ondas quânticas, na junção entre o mundo micro com o mundo familiar de nossas percepções, o comando parece passar para as leis da teoria das probabilidades, tudo no reino mágico das formas e leis matemáticas e físicas. O que acontece realmente é um mistério, talvez explicado, como sugerido, pela ação de algum algoritmo matemático existente numa consciência primária universal.

De Strogatz (7), são citados alguns fatos que são indícios de que a matemática está de alguma forma incorporada ao sistema operacional do universo.

Fenômenos de refração são um bom exemplo para o que se pretende mostrar.

A lei senoidal estipula que a razão sen a/sen b é constante para um determinado par de meios físicos, onde a representa o ângulo do raio de entrada e b o do raio de saída, ambos em relação à perpendicular à interface entre os meios. Este era um fato não explicado.

Conforme ainda Strogatz, Fermat achava que a luz otimizava sua trajetória seguindo o caminho de menor resistência entre dois pontos, ou seja, o mais rápido possível. Esse princípio do menor tempo explicaria a razão da luz se mover em linha reta em um meio uniforme e de, sendo refletida em um espelho, ter seu ângulo de incidência igual ao seu ângulo de reflexão.

Poderia este princípio de menor tempo prever corretamente como a luz se curvava ao passar de um meio a outro? Explicaria a refração?

A luz poderia ir de um ponto de origem em um meio para um ponto de destino em outro meio por um número infinito de caminhos retilíneos, cada qual dobrado na interface como um cotovelo.

Fermat estudou este problema aplicando sua versão do cálculo diferencial e assim fazendo, demonstrou que a luz viaja sempre da forma mais eficiente, não a mais direta, mas a mais rápida. De todos os caminhos possíveis, a luz de algum modo sabe, ou se comporta como soubesse, como chegar de um ponto a outro o mais rápido possível.

Este princípio do menor tempo foi posteriormente generalizado para o princípio da mínima ação, sendo estendido a diversas áreas da física.

Segundo Einstein, os planetas giram em torno do sol não atraídos por uma força, mas apenas seguindo os caminhos de menor resistência no tecido curvo do espaço-tempo.

Cito a seguir mais um fato também tirado de Strogatz e encaminho os leitores interessados para esta sua publicação (7).

Este consiste na previsão da existência da antimatéria, feita por Dirac, conciliando a teoria da

relatividade espacial de Einstein com os princípios da mecânica quântica aplicados a um elétron que se aproxima da velocidade da luz. Dirac considerou em seu estudo três restrições: a compatibilidade com as teorias da relatividade e da mecânica quântica e com a elegância matemática. Com isto e com seu gênio, previu a existência do pósitron que foi posteriormente comprovado.

Passei grande parte de minha vida dedicado a problemas de engenharia tendo contato com matemática, física e química em diversas disciplinas cursadas e lecionadas, mas confesso que, apenas quando passei a me dedicar ao estudo de questões existenciais, é que me convenci da importância da matemática na evolução do cosmos e da vida.

Parece que as leis matemáticas, suas formas geométricas, seus teoremas e todas as demais leis universais da física e da química sempre existiram, mas, contudo, não consigo deixar de considerá-las como "conhecimentos", que a partir do momento em que são percebidos pelo nosso "eu" de um modo consciente, passam a fazer parte de nossa consciência e acredito que necessitam ser guardados de certa forma em uma memória, seja esta contida no cérebro de seres biológicos ou de algum outro modo em um organismo não biológico, para que possam ser usados quando necessário.

Pode-se, com as considerações apresentadas, supor-se a consciência como pertencente a um hipotético mundo platônico, um mundo das formas matemáticas consideradas eternas?

E quanto aos próprios princípios matemáticos e todas as leis físicas universais, teriam existência eterna ou deveriam também ser considerados como conhecimentos adquiridos, com o auxílio da Lei de Darwin, na evolução do universo nos milhares de milhões de anos de sua existência?

Parece-me que tanto o conhecimento dos conceitos e formas matemáticas quanto o conhecimento adquirido pelos seres biológicos seriam uma mesma coisa, a diferença residindo no fato de que, enquanto o conhecimento humano (consciência humana) parece extinguir-se quando do fim do mecanismo que de certa forma o tenha percebido e armazenado, o conhecimento das formas matemáticas (consciência primária), que também suponho tenha sido adquirido por algum organismo do qual não tenho ciência, parece ser eterno pela expectativa que se dá para a duração deste mecanismo no qual está armazenado, que se pode supor ser o da duração do universo.

Pensando em tudo que foi discutido nos parágrafos anteriores, o hipotético mundo platônico seria uma "consciência primária" do universo, formada nos moldes de uma consciência humana e mais, parece ter ficado claro que, ter consciência significa o mesmo que ter conhecimento.

Uma nova questão que merece ser considerada é a relativa à mente O que é a mente?

Intuitivamente, diria que a mente é o local onde ocorrem e/ou para onde fluem os pensamentos (imagens), algo como uma área de trabalho de um computador.

Apresento a seguir uma metáfora que acredito servirá para mostrar de modo mais claro, como visualizo a mente.

Suponha inicialmente que a consciência humana seja como uma casa com diversos inquilinos que seriam os diversos conhecimentos obtidos e apreendidos pela mesma e pela consciência primária. Suponha também que a mente seria um local aberto a qualquer público que desejasse freqüentá-lo. Imagine agora o que poderia ocorrer ou que poderia estar ocorrendo a qualquer instante, ou seja, num dado instante este local público (a mente) poderia estar recebendo a visita de um ou mais inquilinos tanto da consciência humana quanto da primária, que aproveitariam a ocasião para trocar idéias e fazer projetos e conjecturas diversas, ocasionando talvez até o surgimento de novos inquilinos. Certos inquilinos poderiam ser mais assíduos e outros poderiam parar de freqüentar este espaço público por estarem enfraquecidos ou terem falecido (sido deletados das memórias?).

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Quark-Colorization of Cabibbo-Kobayashi-Maskawa Matrix CKM

By ShaoXu Ren
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Abstraction- This paper proposes an interesting representation $V^{CKM}(q_{RGB}, \Phi, \xi)$ of Cabibbo-Kobayashi-Maskawa Matrix CKM, which based on scalar products of quark color quantum numbers q_R, q_G, q_B, or q_{RGB} (00.1). This representation is called colorization of CKM in weak interaction. The colors of down-type quarks q_w, $(w=d, s, b)$ in the quarkcolor scalar products of CKM are "*Color-Broken*, $\xi \neq 0$, which results in isospin $I_3(q_w)$ to be violated in weak interaction, further charges $Q^{CKM}_{dsb}(\xi_{rw})$, to be a slight deviated from $\frac{-1}{3}e$ of SM theoretical value. A short discussion of possible existence of higher-charges of quark *q* is given in Epilogue.

Keywords: cabibbo-kobayashi-maskawa matrix CKM, quark-colorization, quarkcolor scalar product, isospin I_3 be conserved and be broken, weak interaction pairing $\vec{\Phi}$, color-broken.

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0. Introduction

The three-colors R, G, B of quarks is really a curious and excellent concept in monder particle physics. In Standard Model SM, R, G, B are used to treat strong interaction quark classfication and weak interaction flavor-transitions among particles in different generations.

In previous papers [1] when discussing SM, Colous Spectrum Diagram of Flavour CSDF is introduced by Spin Topological Space STS math frame [2], in which the concretization of color values $q_{\mathrm{R}}, q_{\mathrm{G}}, q_{\mathrm{B}}$ of each quark can be selected from the third components $\pi_3(q)$ of one-sixth spin $\vec{\pi}(q)$ below

$$\pi_3(q) = \ldots, \underline{\frac{-29}{6}, \frac{-23}{6}, \frac{-17}{6}, \frac{-11}{6}, \frac{-5}{6}}, \underline{\frac{+1}{6}, \frac{+7}{6}, \frac{+13}{6}, \frac{+19}{6}, \frac{+25}{6}}, \ldots \subseteq q_{\mathrm{RGB}} \equiv q_{\mathrm{R}}, q_{\mathrm{G}}, q_{\mathrm{B}} \tag{00.1}$$

$$\vec{\pi}(q) \times \vec{\pi}(q) = i\vec{\pi}(q) \tag{00.2}$$

To discuss hadronic constiteunts in strong interaction [3], *colored quark*, $q(\chi, \alpha) = q(\chi) + q_\alpha$ is introduced (where quark spin $q(\chi)$, $\chi = \uparrow, \downarrow$ and quark color $q_\alpha = q_{\mathrm{RGB}}$ (00.1), $\alpha =$ R, G, B). We will again make use of quark color q_α, turn to disscuss weak interaction in this paper.

• **1)** One of the most distinguishing between weak interaction and strong interaction is the behavior of isospin of particle: The third isospin component I_3 and total isospin I are conserved in strong interaction. but both I_3 and I are not invariant in weak interaction, that means flavor are not " pure ", there are flavor-transitions among particles in different generations. Now I_3 be violated, be broken. How to devise a beautiful math platform to demonstrate such kind process of physical values of I_3 ?

Because these colors q_α or $q_{\mathrm{R}}, q_{\mathrm{G}}, q_{\mathrm{B}}$ can offer an unified isospin $I_3(q)$ representation [1] for all six quarks below. so we decide to use $I_3(q)$ (0.0) to research weak interaction following

$$I_3(q) = \frac{1}{3}(q_{\mathrm{R}} + q_{\mathrm{G}} + q_{\mathrm{B}}) \equiv I_3(q_{\mathrm{RGB}}) \tag{0.0}$$

Or

$$\vec{u} = (u_R, u_G, u_B) = (\tfrac{-5}{6}, \tfrac{+1}{6}, \tfrac{+13}{6}), \qquad I_3(u) = \tfrac{1}{3}(\tfrac{-5}{6} + \tfrac{+1}{6} + \tfrac{+13}{6}) = \tfrac{+1}{2} \tag{0.1}$$

$$\vec{d} = (d_R, d_G, d_B) = (\tfrac{-11}{6}, \tfrac{-5}{6}, \tfrac{+7}{6}), \qquad I_3(d) = \tfrac{1}{3}(\tfrac{-11}{6} + \tfrac{-5}{6} + \tfrac{+7}{6}) = \tfrac{-1}{2} \tag{0.2}$$

$$\vec{c} = (c_R, c_G, c_B) = (\tfrac{+1}{6}, \tfrac{+7}{6}, \tfrac{+19}{6}), \qquad I_3(c) = \tfrac{1}{3}(\tfrac{+1}{6} + \tfrac{+7}{6} + \tfrac{+19}{6}) = \tfrac{+3}{2} \tag{0.3}$$

$$\vec{s} = (s_R, s_G, s_B) = (\tfrac{-17}{6}, \tfrac{-11}{6}, \tfrac{+1}{6}), \qquad I_3(s) = \tfrac{1}{3}(\tfrac{-17}{6} + \tfrac{-11}{6} + \tfrac{+1}{6}) = \tfrac{-3}{2} \tag{0.4}$$

$$\vec{t} = (t_R, t_G, t_B) = (\tfrac{+7}{6}, \tfrac{+13}{6}, \tfrac{+25}{6}), \qquad I_3(t) = \tfrac{1}{3}(\tfrac{+7}{6} + \tfrac{+13}{6} + \tfrac{+25}{6}) = \tfrac{+5}{2} \tag{0.5}$$

$$\vec{b} = (b_R, b_G, b_B) = (\tfrac{-23}{6}, \tfrac{-17}{6}, \tfrac{-5}{6}), \qquad I_3(b) = \tfrac{1}{3}(\tfrac{-23}{6} + \tfrac{-17}{6} + \tfrac{-5}{6}) = \tfrac{-5}{2} \tag{0.6}$$

• **2)** Many weak interaction phenomena can be explained by V_{CKM}, CKM matrix (0) [4] that based on experimental observation.

$$V_{CKM} = \begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix} = \begin{pmatrix} 0.975 & 0.224 & 0.004 \\ 0.224 & 0.974 & 0.042 \\ 0.009 & 0.041 & 0.999 \end{pmatrix} \tag{0}$$

After that, CKM matrix *is parameterized* [5] to be written as a product of three rotation matrices, that called a smart Wolfenstein parametrization, one of its advantage is CP violation can be involved. (Ref [6],[7],...[12])

In this paper, CKM matrix *is colorized* by means of quark color q_R, q_G, q_B. And scalar products of colors q_R, q_G, q_B and isospin broken $I_3(\xi_{rw})_{CKM}$ are concerned about into Cabibbo-Kobayashi-Maskawa Matrix CKM.

Outline Flowchart for Isospin Violated In CKM Matrix

I. Quarkcolor Scalar Products in CKM Matrix

$$V_{CKM} = V^{CKM}(q_{RGB}) \Rightarrow V(\vec{r} \cdot \vec{w}) \quad (1)\bigstar \Rightarrow V(\vec{r'} \cdot \vec{w'_r}) \quad (2)\bigstar \Rightarrow V(\vec{r'} \cdot \vec{w}_r) \quad (3)\bigstar$$

Here

【1】
$$\vec{r} \cdot \vec{w} = r_R w_R + r_G w_G + r_B w_B \tag{1.0}$$

【2】
$$\vec{r'} \cdot \vec{w'_r} = r'_R w'_{rR} + r'_G w'_{rG} + r'_B w'_{rB} \tag{2.0}$$

【3】
$$\vec{r'} \cdot \vec{w}_r = r'_R w_{rR} + r'_G w_{rG} + r'_B w_{rB} \tag{3.0}$$

Symbols (1)★, (2)★, (3)★ respectively stand for the quarkcolor scalar products (1.0),(2.0),(3.0) of CKM Matrix in different interaction regions shown below

【1】Strong interaction color represention of flavor, when $I_3(q)$ is conserved

$$\vec{r} = \vec{r}(q) = (r_R, r_G, r_B) \tag{1.1}$$

$$\vec{w} = \vec{w}(q) = (w_R, w_G, w_B) \tag{1.2}$$

【2】Weak interaction color represention of flavor, when isospin $I_3(q)$ is conserved $(\xi = 0)$.

$$\vec{r'} = \vec{r}(q) + \tfrac{1}{6}\vec{\Phi}_r \tag{2.1}$$

$$\vec{w'_r} = \vec{w}(q) + \tfrac{1}{6}\vec{\Phi}_{rw} = (w_R, w_G, w_B) + \tfrac{1}{6}((\Phi_{rw})_R, (\Phi_{rw})_G, (\Phi_{rw})_B) \tag{2.2}$$

【3】Weak interaction color represention of flavor, when isospin $I_3(q)$ is broken $(\xi \neq 0)$

$$\vec{r'} = \vec{r}(q) + \tfrac{1}{6}\vec{\Phi}_r \tag{3.1}$$

$$\vec{w}_r \equiv \vec{w'_r}(\xi) = \vec{w}(q) + \tfrac{1}{6}\vec{\Phi}_{rw}(\xi) \tag{3.2}$$

Where $r = u, c, t$ are *up-type quarks*, quark charge $Q_r = \frac{+2}{3}e$ and $w = d, s, b$ are *down-type quarks*, quark charge $Q_w = \frac{-1}{3}e$. It will be shown that in case【3】, the charge Q_w of *down-type quark* will be a slight deviated from $\frac{-1}{3}$ due to isospin broken $I_3(q)$. Superscript " $'$ ", that written on the top right of r and w, stands for quark being in weak interaction region.

Detail Processes for Isospin Violated In CKM Matrix

II. Isospin I_3 be Conserved in CKM Matrix

For clear logical route to quark-colorization of Cabibbo-Kobayashi-Maskawa Matrix CKM, in following an example (labelled by mark " ♦ ") of color scalar procuct $\vec{u'} \cdot \vec{d}_u$ is given, which (includes **2.1.** $\vec{u} \cdot \vec{d}$♦ and **2.2.** $\vec{u'} \cdot \vec{d'_u}$♦) arranged in the top left element V_{11} of CKM matrix.

2.1. In【1】Strong interaction color represention of flavor, (4) is color scalar product of *u quark* and *d quark*

$$\vec{u} \cdot \vec{d}\blacklozenge = u_R d_R + u_G d_G + u_B d_B = \left(\tfrac{-5}{6}\right)\left(\tfrac{-11}{6}\right) + \left(\tfrac{+1}{6}\right)\left(\tfrac{-5}{6}\right) + \left(\tfrac{+13}{6}\right)\left(\tfrac{+7}{6}\right) = \tfrac{1}{36}\{+55 - 5 + 91\} = \tfrac{+141}{36}\blacklozenge \quad (4)$$

obtain isospin $I_3(q_{RGB})$

$$I_3(u) = \tfrac{1}{3}\left(\tfrac{-5}{6} + \tfrac{+1}{6} + \tfrac{+13}{6}\right) = \tfrac{+1}{2} \quad (0.1)$$

$$I_3(d) = \tfrac{1}{3}\left(\tfrac{-11}{6} + \tfrac{-5}{6} + \tfrac{+7}{6}\right) = \tfrac{-1}{2} \quad (0.2)$$

In this way, for CKM Matrix we get following

Matrix (1)★

$$V^{CKM}(q_{RGB}) = \begin{pmatrix} \vec{u} \cdot \vec{d}\blacklozenge & \vec{u} \cdot \vec{s} & \vec{u} \cdot \vec{b} \\ \vec{c} \cdot \vec{d} & \vec{c} \cdot \vec{s} & \vec{c} \cdot \vec{b} \\ \vec{t} \cdot \vec{d} & \vec{t} \cdot \vec{s} & \vec{t} \cdot \vec{b} \end{pmatrix} = \tfrac{1}{36}\begin{pmatrix} +141\blacklozenge & +87 & +33 \\ +87 & -75 & -237 \\ +33 & -237 & -507 \end{pmatrix} \quad (5)$$

Matrix (5) always appears in strong interaction.

2.2. In【2】Weak interaction color represention of flavor, (10) is color scalar product of u' *quark* and d'_u *quark*

To research for the properties of quark color scalar product and quark isospin in Weak Interaction, so-called " *weak interaction pairing* $\vec{\Phi}$ " of CSDF is introduced and $\vec{\Phi}$ be attached to each of the six flavors $\vec{t}, \vec{c}, \vec{u}, \vec{d}, \vec{s}, \vec{b}$ of strong interaction.

(6),(7) are the concrete expressions of *weak interaction pairing*, for *up-type quark u* and *down-type quark d*, by which, $\vec{u'}$ and $\vec{d'_u}$ of express (2.1) and (2.2) are obtained.

$$\vec{\Phi}_u = \left(\frac{+1}{2}, \frac{+16}{2}, \frac{-17}{2}\right) \tag{6}$$

$$\vec{\Phi}_{ud} = \left(\frac{+5}{2}, \frac{+10}{2}, \frac{-15}{2}\right) \tag{7}$$

$$\vec{u'} = \vec{u} + \frac{1}{6}\vec{\Phi}_u = \left(\frac{-5}{6}, \frac{+1}{6}, \frac{+13}{6}\right) + \frac{1}{6}\left(\frac{+1}{2}, \frac{+16}{2}, \frac{-17}{2}\right) = \left(\frac{-9}{12}, \frac{+18}{12}, \frac{+9}{12}\right) \tag{8}$$

$$\vec{d'_u} = \vec{d} + \frac{1}{6}\vec{\Phi}_{ud} = \left(\frac{-11}{6}, \frac{-5}{6}, \frac{+7}{6}\right) + \frac{1}{6}\left(\frac{+5}{2}, \frac{+10}{2}, \frac{-15}{2}\right) = \left(\frac{-17}{12}, \frac{0}{12}, \frac{-1}{12}\right) \tag{9}$$

$$\vec{u'} \cdot \vec{d'_u}\blacklozenge = \left(\vec{u} + \frac{1}{6}\vec{\Phi}_u\right) \cdot \left(\vec{d} + \frac{1}{6}\vec{\Phi}_{ud}\right) = \left(\frac{-9}{12}, \frac{+18}{12}, \frac{+9}{12}\right) \cdot \left(\frac{-17}{12}, \frac{0}{12}, \frac{-1}{12}\right) = 1.000\blacklozenge \tag{10}$$

Formulas (11) (12) show in case【2】, isospin I_3 is conserved too, as that I_3 (0.1) and (0.2) in strong interaction. (11) (12) are I_3 *crucial piont states* of weak interaction.

$$I_3(u') = \frac{1}{3}\left(\frac{-9}{12}+\frac{+18}{12}+\frac{+9}{12}\right) = \frac{+1}{2} \tag{11}$$

$$I_3(d'_{\mathrm{u}}) = \frac{1}{3}\left(\frac{-17}{12}+\frac{0}{12}+\frac{-1}{12}\right) = \frac{-1}{2} \tag{12}$$

There are nine *weak interaction pairings* $\vec{\Phi}$. in Matrix (2)★ below. Similar to *pairing* $\vec{\Phi}$ (6)-(7), after deliberate calculations, at last the eight other weak interaction pairings $\vec{\Phi}$ are found out, and using them, further previous Matrix (1)★ and (5) of CKM Matrix of strong interaction could be reconstructed into Matrix (2)★ and (13) of weak interaction. we get following

$$\text{Matrix (2)★}\quad V^{\mathrm{CKM}}(q_{\mathrm{RGB}},\Phi) = \begin{pmatrix} \vec{u'}\cdot\vec{d'_{\mathrm{u}}}\blacklozenge & \vec{u'}\cdot\vec{s'_{\mathrm{u}}} & \vec{u'}\cdot\vec{b'_{\mathrm{u}}} \\ \vec{c'}\cdot\vec{d'_{\mathrm{c}}} & \vec{c'}\cdot\vec{s'_{\mathrm{c}}} & \vec{c'}\cdot\vec{b'_{\mathrm{c}}} \\ \vec{t'}\cdot\vec{d'_{\mathrm{t}}} & \vec{t'}\cdot\vec{s'_{\mathrm{t}}} & \vec{t'}\cdot\vec{b'_{\mathrm{t}}} \end{pmatrix} = \begin{pmatrix} 1.000\blacklozenge & 0.000 & 0.000 \\ 0.000 & 1.000 & 0.000 \\ 0.000 & 0.000 & 1.000 \end{pmatrix} \tag{13}$$

(13) is the representation of crucial piont state of CKM in weak interaction and (13) is unitary obviously.

III. Isospin I_3 be Broken in CKM Matrix

Taking broken parameter $\xi_{ud}= \xi = 0.2$ into (7) of *pairing*-$\vec{\Phi}$ (6)-(7) obtain (14) and (15)

$$\vec{\Phi}_{ud}(\xi) = (\tfrac{+5}{2}, \tfrac{+10-\xi}{2}, \tfrac{-15}{2}) = (\tfrac{+5}{2}, \tfrac{+10-0.2}{2}, \tfrac{-15}{2}) = (\tfrac{+5}{2}, \tfrac{+9.8}{2}, \tfrac{-15}{2}) \quad (14)$$

Abbreviation

$$\vec{d}_u \equiv \vec{d'_u}(\xi) = \vec{d} + \tfrac{1}{6}\vec{\Phi}_{ud}(\xi) = (\tfrac{-11}{6}, \tfrac{-5}{6}, \tfrac{+7}{6}) + \tfrac{1}{6}(\tfrac{+5}{2}, \tfrac{+9.8}{2}, \tfrac{-15}{2}) = (\tfrac{-17}{12}, \tfrac{-0.2}{12}\blacklozenge, \tfrac{-1}{12}) \quad (15)$$

When broken parameter ξ appears in $\vec{\Phi}$, we call $\vec{\Phi}$ be "*Color-Broken*" and call the colors of down-type quark $\vec{d}$ (15), or quarkcolor scalar products (16) of CKM be "*Color-Broken*".

From $\vec{d}_u$, simultaneously & respectively obtain two physical quantities $\vec{u'} \cdot \vec{d}_u$ (16) and $I_3(\vec{d}_u)$ (18) below:

$$\vec{u'} \cdot \vec{d}_u\blacklozenge = (\tfrac{-9}{12}, \tfrac{+18}{12}, \tfrac{+9}{12})(\tfrac{-17}{12}, \tfrac{-0.2}{12}\blacklozenge, \tfrac{-1}{12}) = \tfrac{1}{144}\{+144 - 3.6\} = \tfrac{1}{144}\{+140.4\} = 0.975\blacklozenge \quad (16)$$

$$I_3(u') = \tfrac{1}{3}(\tfrac{-9}{12} + \tfrac{+18}{12} + \tfrac{+9}{12}) = \tfrac{+1}{2} \quad (17)$$

$$I_3(\vec{d}_u)\blacklozenge = \tfrac{1}{3}(\tfrac{-18}{12} + \tfrac{-0.2}{12}) = \tfrac{-1}{3}(\tfrac{3}{2} + \tfrac{0.1}{6}) = \tfrac{-1}{2}(1 + \tfrac{0.1}{9}) = \tfrac{-1}{2}(1 + \tfrac{1}{90}) = \tfrac{-1}{2}(1.011)\blacklozenge \quad (18)$$

• Formula (18) shows in case【3】$\xi \neq 0$, isospin I_3 is not conserved in weak interaction, there is a deviation 0.011 from $I_3(d)= \tfrac{-1}{2}$ (0.2)

There are nine independent real parameters ξ_{rw} (19) in CKM matrix, in which the third components I_3 are broken (20)

$$\xi_{rw} = \begin{pmatrix} \xi_{ud} & \xi_{us} & \xi_{ub} \\ \xi_{cd} & \xi_{cs} & \xi_{cb} \\ \xi_{td} & \xi_{ts} & \xi_{tb} \end{pmatrix} = \begin{pmatrix} +0.200\blacklozenge & -1.792 & -0.032 \\ -1.0753 & +0.1248 & -0.2016 \\ -0.03086 & -0.140571 & +0.003429 \end{pmatrix} \tag{19}$$

$$I_3(\xi_{rw})_{\text{CKM}} = \begin{pmatrix} I_3(\vec{d}_u)\blacklozenge & I_3(\vec{s}_u) & I_3(\vec{b}_u) \\ I_3(\vec{d}_c) & I_3(\vec{s}_c) & I_3(\vec{b}_c) \\ I_3(\vec{d}_t) & I_3(\vec{s}_t) & I_3(\vec{b}_t) \end{pmatrix} = \begin{pmatrix} \frac{-1}{2}\cdot(\text{d}) & \frac{-3}{2}\cdot(\text{s}) & \frac{-5}{2}\cdot(\text{b}) \\ \frac{-1}{2}\cdot(1.011)\blacklozenge & \frac{-3}{2}\cdot(0.9668) & \frac{-5}{2}\cdot(0.9996) \\ \frac{-1}{2}\cdot(0.9403) & \frac{-3}{2}\cdot(1.0023) & \frac{-5}{2}\cdot(0.9978) \\ \frac{-1}{2}\cdot(0.9983) & \frac{-3}{2}\cdot(0.9974) & \frac{-5}{2}\cdot(1.00038) \end{pmatrix} \tag{20}$$

(20) is an elegant expression of isospin I_3 broken in CKM Matrix math frame. Respectively compaire the first, the second and the third column of $I_3(\xi_{rw})_{\text{CKM}}$ (20) with $I_3(d)(0.2)$, $I_3(s)(0.4)$ and $I_3(b)(0.6)$ of $I_3(q_{\text{RGB}})$ (0.0).

• Mindful of the deviated values of the third isospin components above: for diagonal terms $I_3(\vec{d}_u), I_3(\vec{s}_c), I_3(\vec{b}_t) > 1$ and for off-diagonal terms $I_3(\xi_{rw}) < 1$

• Formula (16) be filled in (21). After the fullness of the eight other elements in CKM Matrix, ultimately we complete the processes of CKM Matrix colorization below

$$\text{Matrix (3)}\bigstar \quad V^{\text{CKM}}(q_{\text{RGB}}, \Phi, \xi) = \begin{pmatrix} \Downarrow & \Downarrow & \Downarrow \\ \vec{u'}\cdot\vec{d}_u\blacklozenge & \vec{u'}\cdot\vec{s}_u & \vec{u'}\cdot\vec{b}_u \\ \vec{c'}\cdot\vec{d}_c & \vec{c'}\cdot\vec{s}_c & \vec{c'}\cdot\vec{b}_c \\ \vec{t'}\cdot\vec{d}_t & \vec{t'}\cdot\vec{s}_t & \vec{t'}\cdot\vec{b}_t \end{pmatrix} = \begin{pmatrix} \Downarrow & \Downarrow & \Downarrow \\ 0.975\blacklozenge & 0.224 & 0.004 \\ 0.224 & 0.974 & 0.042 \\ 0.009 & 0.041 & 0.999 \end{pmatrix} \tag{21}$$

IV. Conclusions

In interaction【3】region, isospin $I_3 = I_3(\xi_{rw})_{CKM}$, is not conseved, which lead to *charge-deviated of quarks* $Q^{CKM}_{dsb}(\xi_{rw})$ (Ref. (E))

$$Q_{d_U} = I_3(d_u) + \frac{+1}{6} = \frac{-1}{2}(1.011) + \frac{+1}{6} = \frac{-1}{3}(1.011)e$$

$$Q_{d_C} = I_3(d_c) + \frac{+1}{6} = \frac{-1}{2}(0.9403) + \frac{+1}{6} = \frac{-1}{3}(0.91045)e$$

$$Q_{d_t} = I_3(d_t) + \frac{+1}{6} = \frac{-1}{2}(0.9983) + \frac{+1}{6} = \frac{-1}{3}(0.99745)e$$

$$Q_{s_U} = I_3(s_u) + \frac{+7}{6} = \frac{-3}{2}(0.9668) + \frac{+7}{6} = \frac{-1}{3}(0.8506)e$$

$$Q_{s_C} = I_3(s_c) + \frac{+7}{6} = \frac{-3}{2}(1.0023) + \frac{+7}{6} = \frac{-1}{3}(1.01035)e$$

$$Q_{s_t} = I_3(s_t) + \frac{+7}{6} = \frac{-3}{2}(0.9974) + \frac{+7}{6} = \frac{-1}{3}(0.9883)e$$

$$Q_{b_u} = I_3(b_u) + \frac{+13}{6} = \frac{-5}{2}(0.9996) + \frac{+13}{6} = \frac{-1}{3}(0.997)e$$

$$Q_{b_c} = I_3(b_c) + \frac{+13}{6} = \frac{-5}{2}(0.9978) + \frac{+13}{6} = \frac{-1}{3}(0.9835)e$$

$$Q_{b_t} = I_3(b_t) + \frac{+13}{6} = \frac{-5}{2}(1.00038) + \frac{+13}{6} = \frac{-1}{3}(1.00285)e$$

OR

$$Q_{\mathbf{dsb}}^{\mathrm{CKM}}(\xi_{rw}) = \begin{pmatrix} Q_{\mathrm{d_U}} & Q_{\mathrm{s_U}} & Q_{\mathrm{b_u}} \\ Q_{\mathrm{d_C}} & Q_{\mathrm{s_C}} & Q_{\mathrm{b_c}} \\ Q_{\mathrm{d_t}} & Q_{\mathrm{s_t}} & Q_{\mathrm{b_t}} \end{pmatrix} = \begin{pmatrix} \frac{-1}{3}\cdot(1.011)e & \frac{-1}{3}\cdot(0.8506)e & \frac{-1}{3}\cdot(0.997)e \\ \frac{-1}{3}\cdot(0.91045)e & \frac{-1}{3}\cdot(1.01035)e & \frac{-1}{3}\cdot(0.9835)e \\ \frac{-1}{3}\cdot(0.99745)e & \frac{-1}{3}\cdot(0.9883)e & \frac{-1}{3}\cdot(1.00285)e \end{pmatrix} \quad (22)$$

• Mindful of the deviated values in (22): diagonal terms $Q_{\mathrm{d_U}}, Q_{\mathrm{s_C}}, Q_{\mathrm{b_t}}$ >1; off-diagonal terms $Q_{\mathrm{d_C}}, Q_{\mathrm{d_t}}$、 $Q_{\mathrm{s_U}}, Q_{\mathrm{s_t}}$、 $Q_{\mathrm{b_u}}, Q_{\mathrm{b_c}}$ <1 (22). In weak interaction, charges $Q_{\mathbf{dsb}}^{\mathrm{CKM}}(\xi_{rw})$ of *down-type quark* will be a slight deviated from $\frac{-1}{3}e$ (SM theoretical value), due to isospin broken $I_3(\xi_{rw})_{\mathrm{CKM}}$ of CKM Matrix ***colorized***.

Epilogue

• The charge Q_q of all known six quarks can be expressed by the sum (E) of isospin I_3 (0.0) and quark color q_{RGB} (00.1) below

$$Q_q = I_3(q) + q_{\text{RGB}} \tag{E}$$

$$q_{\text{RGB}} = (\tfrac{1}{6} + n), \qquad n = 0, \pm 1, \pm 2\ldots \tag{E1}$$

For *up-type quark*, $n = 0, -1, -2\ldots$ (E2)

$$Q_{\text{t}} = I_3(t) + \tfrac{-11}{6} = \tfrac{+5}{2} + \tfrac{-11}{6} = \tfrac{+15}{6} + \tfrac{-11}{6} = \tfrac{+4}{6} = \tfrac{+2}{3}e \tag{E.5}$$

$$Q_{\text{c}} = I_3(c) + \tfrac{-5}{6} = \tfrac{+3}{2} + \tfrac{-5}{6} = \tfrac{+9}{6} + \tfrac{-5}{6} = \tfrac{+4}{6} = \tfrac{+2}{3}e \tag{E.3}$$

$$Q_{\text{u}} = I_3(u) + \tfrac{+1}{6} = \tfrac{+1}{2} + \tfrac{+1}{6} = \tfrac{+3}{6} + \tfrac{+1}{6} = \tfrac{+4}{6} = \tfrac{+2}{3}e \tag{E.1}$$

For *down-type quark*, $n = 0, +1, +2\ldots$ (E3)

$$Q_{\text{d}} = I_3(d) + \tfrac{+1}{6} = \tfrac{-1}{2} + \tfrac{+1}{6} = \tfrac{-3}{6} + \tfrac{+1}{6} = \tfrac{-2}{6} = \tfrac{-1}{3}e \tag{E.2}$$

$$Q_{\text{s}} = I_3(s) + \tfrac{+7}{6} = \tfrac{-3}{2} + \tfrac{+7}{6} = \tfrac{-9}{6} + \tfrac{+7}{6} = \tfrac{-2}{6} = \tfrac{-1}{3}e \tag{E.4}$$

$$Q_{\text{b}} = I_3(b) + \tfrac{+13}{6} = \tfrac{-5}{2} + \tfrac{+13}{6} = \tfrac{-15}{6} + \tfrac{+13}{6} = \tfrac{-2}{6} = \tfrac{-1}{3}e \tag{E.6}$$

Compairing (E) with Gell-Mann-Nishijiama relation (E4) [13],[14], then obtain (E5) below

$$Q = I_3 + Y/2 \tag{E4}$$

$$Y = 2q_{\text{RGB}} \tag{E5}$$

Where, hypercharge $Y = B + S$. B baryon number and S strange number of quark q. We see Gell-Mann-Nishijiama relation (E4) is a special situation of (E), The latter (E), *math-mysterious*, is the extension of the former (E4), *empirical*.

• The algebra symmetry of q_{RGB} of color representation of flavor *Table* 1 [3] could permute many possible arrangements. Further a series of magic figures, those are multiples of $1/3$, are constructed, that may illuminate the hypothesis about possible existence of higher-charges of quark q.

Two examples of quark charge formula (E) with $q_{\text{RGB}} = \frac{+1}{6}$, and with the fourth general quark are given below

For $I_3 = \frac{+1}{2}, \frac{-1}{2}$

$$I_3 + \frac{+1}{6} = \frac{+1}{2} + \frac{+1}{6} = \frac{+3}{6} + \frac{+1}{6} = \frac{+4}{6} = \frac{+2}{3}e$$

$$I_3 + \frac{+1}{6} = \frac{-1}{2} + \frac{+1}{6} = \frac{-3}{6} + \frac{+1}{6} = \frac{-2}{6} = \frac{-1}{3}e$$

For $I_3 = \frac{+3}{2}, \frac{-3}{2}$

$$I_3 + \frac{+1}{6} = \frac{+3}{2} + \frac{+1}{6} = \frac{+9}{6} + \frac{+1}{6} = \frac{+10}{6} = \frac{+5}{3}e$$

$$I_3 + \frac{+1}{6} = \frac{-3}{2} + \frac{+1}{6} = \frac{-9}{6} + \frac{+1}{6} = \frac{-8}{6} = \frac{-4}{3}e$$

For $I_3 = \frac{+5}{2}, \frac{-5}{2}$

$$I_3 + \frac{+1}{6} = \frac{+5}{2} + \frac{+1}{6} = \frac{+15}{6} + \frac{+1}{6} = \frac{+16}{6} = \frac{+8}{3} e$$

$$I_3 + \frac{+1}{6} = \frac{-5}{2} + \frac{+1}{6} = \frac{-15}{6} + \frac{+1}{6} = \frac{-14}{6} = \frac{-7}{3} e$$

For $I_3 = \frac{+7}{2}, \frac{-7}{2}$

$$I_3 + \frac{+1}{6} = \frac{+7}{2} + \frac{+1}{6} = \frac{+21}{6} + \frac{+1}{6} = \frac{+22}{6} = \frac{+11}{3} e$$

$$I_3 + \frac{+1}{6} = \frac{-7}{2} + \frac{+1}{6} = \frac{-21}{6} + \frac{+1}{6} = \frac{-20}{6} = \frac{-10}{3} e$$

Charges of the fourth general quark $I_3 = \frac{+7}{2}, \frac{-7}{2}$

I_3	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$	$\frac{+7}{2}$	$\frac{-7}{2}$
q_{RGB}	$\frac{+19}{6}$	$\frac{+19}{6}$	$\frac{+13}{6}$	$\frac{+13}{6}$	$\frac{+7}{6}$	$\frac{+7}{6}$	$\frac{+1}{6}$	$\frac{+1}{6}$	$\frac{-5}{6}$	$\frac{-5}{6}$	$\frac{-11}{6}$	$\frac{-11}{6}$	$\frac{-17}{6}$	$\frac{-17}{6}$		
Q	$\frac{+20}{3} e$	$\frac{-1}{3} e$	$\frac{+17}{3} e$	$\frac{-4}{3} e$	$\frac{+14}{3} e$	$\frac{-7}{3} e$	$\frac{+11}{3} e$	$\frac{-10}{3} e$	$\frac{+8}{3} e$	$\frac{-13}{3} e$	$\frac{+5}{3} e$	$\frac{-16}{3} e$	$\frac{+2}{3} e$	$\frac{-19}{3} e$		

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New Properties of Photons and Photoelectric Effect

By Md. Kamal Uddin

Abstract- The photons has an important property. It is electrically neutral but couples with electric charges.

That is why photons do not interact with each other ? Since photons are mass less, Photons do not interact with each other, Because it seems that The interaction between charge particles exist only when they are possesses mass, Otherwise there will be no any interaction between them.

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New Properties of Photons and Photoelectric Effect

Md. Kamal Uddin

Why Photons Do Not Interact With Each Other?

Abstract- The photons has an important property. It is electrically neutral but couples with electric charges.
That is why photons do not interact with each other ?Since photons are mass less, Photons do not interact with each other, Because it seems that The interaction between charge particles exist only when they are possesses mass, Otherwise there will be no any interaction between them.

I. Introduction

a) Physical Properties

A photon is mass less has no electric charge and is a stable particle. Photons are emitted is many natural processes. In empty space, the moves at C (velocity of light) and its energy momentum are related by E=PC, Where P is the magnitude of the momentum vector P.

The photons from the sun are necessary for life on the earth. However the energy is produced from fusion at the center of the sun the other two interactions in the standard model also play important roles. The photons has an important property. It is electrically neutral but couples with electric charges.

That is why photons do not interact with each other ?Since photons are mass less, Photons do not interact with each other, Because it seems that The interaction between charge particles exist only when they are possesses mass, Otherwise there will be no any interaction between them.
Now Let us consider Planck's theory we have

$$E = \frac{hc}{\lambda} = Pc \qquad \text{or} \qquad P = = \frac{h}{\lambda}$$

Here all factors of P are strictly not change. So we can observed that there is no the rate In momentum, this imply that there is no any interaction exist in bundle of photons.

New about photoelectric effect

We can observed conclusion from Einstein equation for photoelectric effect

$$E = \Phi + E_{electron}$$

$$\Rightarrow h\nu = h\nu_0 + \tfrac{1}{2}m_e v^2$$

$$\Rightarrow \tfrac{1}{2}m_e v^2 = h\nu - h\nu_0$$

$$\Rightarrow \tfrac{1}{2}m_e v^2 = h(\nu - \nu_0) \ldots\ldots\ldots\ldots\ldots (1)$$

Where, Φ tends to infinity or $h\nu_0$ tends to infinity, Since Φ go the infinity, we can assume that electrostatic potential at infinity is equal to zero. After photoelectric effect process, when electrons are ejected the total energy

$$E = \tfrac{1}{2}m_e v^2 \Rightarrow h\nu = \tfrac{1}{2}m_e v^2 \ldots\ldots\ldots\ldots (2)$$

So total rest mass energy of electron = $h\nu$
In this equation we can observed that the mass converted into

Energy without its own (mass) existence. So we can imagine the energy concept without existence of mass. From above equation we can also think the energy cam be converted into mass. Under the right circumstances light should be used to push electrons from the surface of solid from them. This energy is equal to $h\nu$. This process is called the photoelectric effect. which give all its energy to the electron and eject it.

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Career | Credibility | Reputation

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Fellows receive discounts on future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

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john [AT] globaljournals [DOT] org.

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Career | Credibility | Financial

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Fellow members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

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Become a member of the Editorial Board

Fellows may join as a member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. Additionally, Fellows get a chance to nominate other members for Editorial Board.

Career | Credibility | Exclusive | Reputation

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All members get access to 5 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 10 GB free secure cloud access for storing research files.

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.

To the institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

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Career | Credibility | Exclusive | Reputation

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Associates can use the honored title of membership. The “ASFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., ASFRC or William Walldroff, M.S., ASFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

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Career | Credibility | Reputation

Future Work

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Earn 30-40% of sales proceeds

Associates can publish articles (limited) without any fees. Also, they can earn up to 30-40% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.

Exclusive | Financial

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Get a remuneration of 15% of author fees

Associate members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

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Associate	Fellow	Research Group	Basic
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Certificate, LoR and Momento **2** discounted publishing/year **Gradation** of Research **10** research contacts/day **1 GB** Cloud Storage **GJ** Community Access	**Certificate,** LoR and Momento **Unlimited** discounted publishing/year **Gradation** of Research **Unlimited** research contacts/day **5 GB** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**Certificates,** LoRs and Momentos **Unlimited** free publishing/year **Gradation** of Research **Unlimited** research contacts/day **Unlimited** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**GJ** Community Access

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

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Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

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Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

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- Writings
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- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

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1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

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:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- 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.

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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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