

Formation of energetic Charged Particles in Lower Magnetosphere and Their Sporadic Showers through ECLIPTIC WINDOW, Explains All Total Solar Eclipse Related Phenomena.

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ABSTRACT

One of the biggest mysteries to solve in ‘Astro-particle physics’ has been to find out source of origin of ultrahigh-energy cosmic rays, very high-energy neutrinos and high-energy gamma rays.^[1] All energetic charged particles coming to earth and originating from any source are conventionally called ‘cosmic rays’.

Few ‘cosmic rays’ moving at the speed of light are reported to be coming from Sun and out side of the solar system, from supernovas in our galaxy, galactic centre or from far off galaxies while abundant lesser energy charged particles coming to our atmosphere have different sources which should be explored.

Some of the high energy charged particles reaching Earth are generated in the Sun and there number becomes significant during periods of *solar flare*.

“It has been observed that Jupiter is absorbing a lot of sulfur from its volcanic moon Io, and the gigantic magnetosphere of Jupiter generates billions of volts of electric field and energetic charged particles. In one study based on Galileo probe data, the presence of He ion as tracer for solar wind, sulfur ions coming from its natural satellite ‘Io’ and oxygen ions coming from Jovian atmosphere itself, were studied. The charged particle acceleration mechanisms in Jovian magnetosphere were reported as ‘Alfvén waves’, noadiabatic ion interaction with current sheet and by induced current fields”. [2]

Could these magnetospheres of all planets (except Venus and Mars which are devoid of magnetospheres) and few natural satellites of planets having magnetospheres can trap and generate energetic charged particles apart from low energy cosmic rays in our solar system apart from high energy charged particles are coming from our Sun?

Let us first study the possible mechanism of generation of energetic charged particles in our magnetosphere itself. Our aim will be to find out that from where the magnetosphere of Earth gets raw material for generation of charged particles? What is the mechanism of their production? How Magnetosphere can provide these particles, so much energy that they acquire the nature of cosmic rays?

This fundamental research studies the role of Moon in the formation of energetic charged particles in our magnetosphere and in regulation of its daily flux coming to Earth.

The sporadic showers on Earth of such energetic charged particles of magnetosphere, falling through proposed ECLIPTIC WINDOW (which forms in shadow area during all Total Solar Eclipses) were observed during 1995 TSE at India and it explains all observed

phenomena including permanent blindness of few unfortunate viewers.

This knowledge of creating artificial showers of charged particles from **lower magnetosphere (ionosphere)** can be used to search a possible source of ‘**renewable energy**’, as an inexhaustible source of Power generation. The technology can also be exploited to **change desert ecology** and to **increase ozone layers locally**.

TEXT

Cosmic rays were first deducted by observing increased rate of ionization ‘three times to sea level’, in a balloon at 5300 meter in 1912 by Victor Hess, and particles responsible were named as ‘cosmic rays’. ^[3]

Apart from several cosmic ray detectors on earth, and almost every space craft in their space missions done cosmic ray measurements. The pioneers labs in space are AMS -02 (alpha magnetic spectrometer experiment) operational since 2011 at 400 Km above Earth in international space station· CALET (Calorimetric Electron Telescope) from 2015, and CREAM is deducting charge on cosmic ray particles from 2017.

Radio transfer of data is being done from stratosphere ^[4] and PAMELA measures cosmic ray proton and helium ^[5]. But IBM computer simulations failed to justify observed ‘cosmic rays data’ ^[6]. Data from Fermi Space Telescope (2013) have shown that significant fraction of primary cosmic rays originate from super nova explosion of stars in our galaxy. ^[7]

Researchers know that some percentage of cosmic rays originates, from our sun,^[8] the multitude of stars^[9], super nova remnants

[10][11][12], Galactic center in the Milky Way^{[13][14]} and from other Galaxies. It has been observed that Very High energy gamma rays are coming from galactic centre ridge and cosmic rays are being accelerated at galactic centre^{[15][16]}

But the **difficulty in tracing of the particles to its specific source is persistent** and is because of the turbulence of inter-stellar gas, plasma and dust which cause them to scatter and re-scatter in different directions.

“Cosmic rays are particles, are mostly protons which are accelerated to relativistic speeds. When the accelerated proton encounters interstellar material, they produce neutral Pions, which in turn decay into gamma rays. This offers a compelling way to detect the acceleration sites of this proton. But the identification of Pion-decay gamma rays is difficult, because high-energy electrons also produce gamma rays via bremsstrahlung and inverse Compton scattering. In this study the characteristic pion-decay feature in the gamma-ray spectra of two SNRs, IC 443 and W44, were studied with the Fermi Large Area Telescope”. Despite wide agreement that supernova remnants (SNRs) are the sources of galactic cosmic rays; **unequivocal evidence for the acceleration of protons in these objects is still lacking.**^[17]

AMS -02 (alpha magnetic spectrometer experiment) operational since 2011 at 400 Km above Earth in international space station and collected 90 billion cosmic ray events in first 5 years. According to this data “In unpublished analysis, AMS scientists found that their measurement of the spectra and **ratio of different nuclei** – proton, lithium and helium - **did not fit with predictions.** Ratio of Boron (found only in secondary cosmic rays) and Carbon (primary cosmic rays) at different energies indicates possible evidence of turbulence in cosmic ray path to our planet. While positron excess, could not be explained at all. This could mean the Scientists **assumptions about cosmic rays need to be re-examined.**”^[18]

The ‘Ulysses international solar polar mission’ in 1992 (was operational up to 30 June 2009) **failed to deduct high energy cosmic rays** near 70° north of solar latitude near Sun. ^[19]

The Pierre Auger Collaboration **has observed large-scale anisotropy** in the arrival directions of cosmic rays above 8×10^{18} eV. ^[20]

Frequently observed showers of ‘**Gamma ray burst**’ coming to Earth which can last for few minutes, were suggested by author to be originating from remnants of disintegrating gravitational fields. (i.e. gravitational deformation of space matrix ^[21] of exploding star during its conversion to supernova ^[22 a] as hypothesized in his book, 2005, *INSIDE A WAVE*^[23]).

This hypothesis gets evidence by deduction of gamma rays coming from ‘Fermi bubble’ as observed by ‘Fermi-LAT’, and each of two lobes of this Fermi bubble were observed to be 25000 light years tall. ^[24]

Here it is suggested that this ‘Fermi bubble’ is nothing else but a three dimensional disintegrating gravitational field of a supernova, releasing ‘gamma ray burst’.

Can there be other sources of these charged particles which are showering continuously on Earth? This work put forward that some high energy charged particles can be generated in side magnetosphere of Earth (and in magnetospheres of other planets and natural satellites, well in side our solar system).

The hypothesis is strengthened by work of Sir Bruni, who in his book ‘Cosmic Rays’ ^[25] has written that our magnetosphere may generate cosmic rays.

CHARGED PARTICLES IN MAGNETOSPHERE OF EARTH COMING FROM MOON

(!) Continuous meteoric hits and tons of high speed material from space coming to moon surface daily will disperse a lot of moon dust into ‘Moon- Earth gravitational pit’, due to small escape velocity of moon. (Note that Earth itself gets 11000 Kg space material per day). [26]

(!!) Due to prolonged exposure to various sources like Cosmic ray, solar wind protons (especially during solar flares) energetic UV rays, X rays, gamma rays, alpha particles and ‘bare nuclei of atoms from Sun’, the fraction of moon dust at Moon (and this trapped dust in Moon-Earth space) will get ionized* and will then accumulate as charged particles. EGRET deducted gamma rays from moon [27]

*[Even Earth protected by magnetosphere and thick atmosphere can receive only attenuated charged particles, which still have sufficient energy to break the intra-nuclear bonds of nucleons of minerals **up to few meter depth from earth surface**. Thus, Currently 6 nuclides formed by these cosmic rays and charged particles interactions (^3He , ^{10}Be , ^{14}C , ^{21}Ne , ^{26}Al and ^{36}Cl) are routinely measured in “terrestrial cosmogenic nuclide (TCN) dating method”.] [28]

(!!!) The protons and bare nuclei in solar wind which are hitting atmosphere less moon at 400 Km /per second will also swipe these ionized atoms and dust particles from periphery of moon surface to ‘Moon – Earth space’. And then the atmosphere less moon, moving at a velocity of 31 Km/sec with respect to sun will behave some what like a big comet, shedding behind charged particles.

(!V) The magneto sphere extended up to ‘more than twenty two earth radii’ in night phase (and ‘ten earth radii’ in day phase) will **trap** these charged particles coming to earth with solar wind from different sources [in solar wind, from moon – earth gravitational pit, meteoric swarms (along comet paths), ‘Pick up ions from sun’ and lastly from Earth itself.

While competing with moon the Earth's share of this trapping of charged particles will be rhythmically influenced in 28 day cycle of moon due to its changing position with respect to Sun and is reflected in 28 days cycle of variations in cosmic ray flux, as observed on surface of Earth [29].

(V) Acceleration of ionized atoms and their further ionization which starts on Moon and in 'Moon -Earth gravitational Pit' will be further enhanced in upper magnetosphere.

This matter in its journey of 65000 Km from upper to lower magnetosphere will be further grinded and ionized by different plasma acceleration mechanisms e.g. *Alfven waves* [30] [31] and by direct hits of solar wind particles, cosmic rays and energetic solar ultra violet rays.

(V!) In this long journey towards lower magnetosphere the increasing distortion of electron orbits (which produces observed Zeeman and Stark effect) with ever increasing electrical and magnetic fields will *facilitate their further Ionization*, as intense solar UV radiation will then easily ionize these unprotected atoms. [32]

Several space probes have recorded that the *upper magnetosphere has lesser energy particles, while high energy particles are seen in lower magneto sphere* near Earth [33] It is also observed that most significant radiation is caused in this region, by the interaction of outer belt geomagnetic electrons with space crafts.

(V!!) Different plasma acceleration mechanisms especially “**Cyclotron mechanism**”, “Swan's and Fermie's collisions” and “Magnetic Pumping” and “Birth shocks” will accelerate these particles. [34],[35], [36], [37]

It is of interest to note, that the energy of fast particles gradually builds up and becomes larger than the turbulence energy in final

reckoning, e. g. As seen in energy build ups at centre of Hurricanes.

(V!!!) It is proposed, that these ionizing atoms will try to become even numbered nucleons a *stable diamagnetic configuration*.

These nucleons due to their diamagnetic property will move away from magnetic fields at neutral zones well above the magnetic equator and *will drift from west to east* (responsible for ‘cosmic ray flux’ mostly from west direction). They will also align in *iso-magnetic planes along magnetic equator* of earth

(!X)

(a) Accelerated diamagnetic even numbered nucleons with increase in magnetic field strength in day phase and during a solar flare, will *acquire higher ‘magnetic rigiditie’**. Along with acceleration due to Lorentz forces, the particles circling the earth from west to east, will move well above the magnetic equator, away from magneto nuclear grinder of lower magneto sphere, and is responsible for lower flux of cosmic rays in **day phase and during ‘Forbush decreases’**.^[38]

* Magnetic Rigidities (Gauss Cm) = Gyro radius of particles in Cm × Magnetic fields in gauss.

In contrast a reverse mechanism in night phase and at **Total Solar Eclipse** will decrease the ‘magnetic rigidities’ of even numbered nucleons, **they will de-accelerate and due to Lorentz forces will move towards earth** to be further crushed in magneto nuclear grinder in lower magnetosphere.^{[39] [40]}

(b) The nuclear fragmentation by splitting of ‘iron group of H nucleons’ of higher atomic numbered atoms will form ‘L nucleons of low atomic numbers’ in these electro magnetic (belts) grinders.

It has been observed that the ratio of L nucleons versus H nucleons doubles in lower magnetosphere. ^[41]

(X) The process of nuclear disintegration in lower magnetosphere is entirely different. In magneto nuclear grinders, while accelerating (and revolving west to east) in ‘time bound cyclotron mechanism’ and by electrostatic forces of repulsion due to repeated encounters of other positively charged subatomic particles, the ions are subjected to ever increasing ionization up to complete loss of electron cloud of atoms, which change them to **bare nuclei**. Subsequently, via splitting or by repeated loss of alpha particles the bigger bare nuclei of **H atoms will transform to bare nuclei of L atoms.** ^[42]

Primary cosmic ray on earth surface has abundance of bare nuclei of Lithium, Beryllium, Boron (all L nucleons) and He3 isotope of Helium while their cosmic abundance is very low. ^[43]

(X!) Still accelerating by ‘cyclotron mechanism’ and circling the Earth in ‘toroids’, *in the absence of an electron cloud* the impact of other particles and final splitting of nucleons become easy. The nuclear and electrostatic forces of repulsion of parent nucleus (which acts very forcibly at subatomic distances) will contribute to attain relativistic velocities i.e. **birth shocks.** ^[44]

The time bound accelerations along their circular paths around the earth due to ‘**cyclotron mechanism**’ will provide the relativistic velocities and energies to these charged particles. ^[45]

(X!!)

(a) As these subatomic particles are charged and they can pass through the ‘**electromagnetic sieve**’ on Earth, only after acquiring relativistic energies in ‘toroids’, i.e. 14 GeV at equator to 1 GeV near poles. ^[46]

(b) Or after their release from Earth magnetosphere (or from any magnetosphere of any cosmic body in solar system e.g. Gigantic Magnetosphere of Jupiter) they will soon **disperse all over solar system in their circular paths** (*eluding their source of origin*) as cosmic rays.

(X!!!) On Earth surface, the cosmic rays energy level normally varies in 1GeV, but some times it shoots to 10^{11} GeV and only occasionally the event energies are found many folds high. ^[47]

Incidences of ‘most energetic cosmic rays’ at up to 10^8 TeV reaching our atmosphere are reported approximately only once in one year, while most of energetic Charged particles (10000 per sq meter per sec) reaching Earth are at 1GeV charge. ^[48]

(X!V) The composition of primary cosmic ray particles (14% alpha particles, 6% bare nuclei and rest protons and neutrons) ^[49] indicates that **they are formed by disintegration of Atoms**. In terrestrial atmosphere the Neutrons disintegrates to proton in 880 seconds.

SOURCES OF CHARGED PARTICLES AND RAW MATERIAL FOR FORMATION OF EARTH’S MAGNETOSPHERE.

(a) – **Lunar Dust a raw material, for charged particles of Magnetosphere of earth:** Meteoritic hits of tens of tons per day* up to 72 Km/sec on atmosphere less surface of moon will disperse a lot of moon dust in outer space, due to very low (2.4 Km /second) escape velocity at Moon.

*(For comparison, the daily meteoritic input on Earth is 11000 Kg / per day) and the biggest hit in modern time on Earth was “TUNGUSKA HIT” which produced massive explosion 12 MT by a meteoroid of 50-60 meter at the speed of 27Km/Sec burst in atmosphere over Siberia in 1908 and flattened 1000 sq km forest. ^[50]

After reaching gravitational pit created in space matrix by Earth the moon dust can not escape from this ‘space matrix pit’, in which moon is also lodged.*

(* any nuclear explosion on moon is extremely dangerous, as the spilled out significant amount of moon dust will be trapped in gravitational pit of Earth and will partially block EM radiation of Sun coming to earth. Which will result in severe damage to delicate ecology of Earth?)

This dust is a raw material for synthesis of charged particles. In the period of hundreds of years this moon dust in gravitational pit of ‘moon-earth space’ will be crushed and ionized by UV rays of Sun*, solar wind particles and cosmic ray hits.

(* All atoms present in space of more than 400 sun radii can be ionized by UV radiation of sun)

(b) – Production and Accumulation of Charged particles in lunar dust:

(!) The obstruction of solar wind by body of moon causes *accumulation* of solar protons in moon dust.

(!!) The moon dust due to prolonged exposure to ultraviolet radiation, solar wind particles and other cosmic ray hits will *get ionized*.^[51]

These charged particle in moon dust will be continuously washed away from periphery of moon by solar wind, which is flowing at 400 Km per second (near moon).

Factors Affecting the Mobilization of Charged Particles from Moon:

From the peripheral area of the moon, according to the direction of the ‘radiation pressure’ and ‘repulsive forces of streams of solar wind particles’ will suck off the charged particles from moon dust.

Entire surface of moon will be swept of its charged particles rhythmically, in its 28 days cycle of rotation* and revolution around earth, which will subsequently reach Earth with solar wind.
(* by its slow rotation the moon always maintains its same face towards Earth)

The factors which will further facilitate the dislodging of charged particle from moon surface:-

(1) The atmosphere less moon with its low escape velocity of 2.4 Km/Sec and fast linear velocity of 31 km/sec, the moon will shed off charged particles from its surface.

(2) Inter particle electro static repulsive forces of positively charged ions will work.

(3) Increased kinetic energy of charged particles with changing temperatures (temperature on moon is 100 K in dark area and 400 K in lighted area) along with slow rotation of moon will help in their dislodging.

(4) The gravitational forces of the Earth are continuously lifting the solid surface of moon facing earth by more then one meter*.

*(Due to gravitational pull of moon, apart from 'tidal waves' in water, the solid surface of earth also get lifted by 22cm, the reciprocal pull by earth will also work on moon)

(5) The gravitational pull of sun on the part of moon surface which faces sun (changing with slow rotation of moon) will experience a small tidal wave.

(5) The *uneven density and gravity of Moon** will also effect.

[* First author hypothesized in his book in 2015 that this **uneven gravity of moon** may be due to possible impaction of big pieces from broken biggest planet Megaskar, in body of proto- moon when moon was still consolidating about 4 billion years back.^{[21b] [22]}

It is to be noted that in moon soil the sodium and potassium is very low, while potassium is abundant in rocks of earth and lot of sodium is found in its oceans*. This indicates that after ionization sodium and potassium in moon soil got shifted to Earth. This could have played significant role in development of life on Earth.

[*Apart from chemical processes a definite ionization level of atmosphere is a must for origin and development of life. The finger prints of this deposition of sodium and potassium ions on early earth when life was still forming as coacervates” (a precursor of

the primordial cell) is seen in “sodium pump”, a basic biochemical process found in all living cells].^[52]

The maximum flux of energetic charged particles from moon will directly come towards earth at total solar eclipse during its totality period, when oblong body of moon will rotate to be perfectly aligned *with Sun Earth axis* * and **gets momentarily squeezed**, due to simultaneous gravitational pull of Sun and Earth.

This squeezing (gravitational deformation of moon’s body at TSE) will help in dislodging of charged particles from its peripheral area and they will be swept with solar wind (which is moving at 400 km/sec and normally strikes Earth at 55 degree angle) which will shift these particles from moon to earth within 1.6 minutes.

(*Normally moon remains about 6° up or down from Sun- Earth axis but during any eclipse the moon comes to lie on this axis. Thus the moon globe will be momentarily squeezed along its diameter by several meters (when directly facing Earth at TSE) due to combined gravitational effects of both Sun and Earth.^[53])

3- Pick up ions from Sun: Apart from a continuous supply of charged particles with *solar wind*, some **interstellar micro matter in clusters at high speed also interact with sun every day and are responsible for ‘pick up ions of all elements’.**^[54]

Eventually out of large number of fast particles from sun itself, ‘pick up ions’ are thus generated and released from Sun. Those reaching earth will be trapped by magnetosphere of Earth.

4- Ionized Atoms from comet paths (meteoric swarms): Ionized atoms from many meteoric swarms encountered by Earth during its journey around Sun will also be trapped by magnetosphere. Incidentally when the findings of increased showers of charged particles were recorded on earth during TSE of 24 October 1995 in North India, the earth moon system was passing through one of these ‘meteoric swarm named as Orinoids’.^[55]

5- Charged Particles from nuclear explosions on Earth:

After high altitude nuclear explosion in 1958 ‘Argus belts’ over south Atlantic I, ii, iii, made up of electrons was formed at two earth radii distance in magnetosphere. ^[56] The concentration of ¹⁴C and ³H radionuclide gets significantly increased in the geo-sphere due to nuclear explosion. ^[57]

Hydrogen bomb “star fish” explosion in 1962 increased the electron flux at three earth radii to 10^9 electrons / cm³/ sec for months. ^[58]

Sometimes even the Earth releases electrons in atmosphere. Terrestrial gamma rays from radioactive materials in earth crust also contribute for radiations in earth atmosphere.

CHARGED PARTICLES IN UPPER MAGNETOSPHERE

(1) Trapping of charged particle:

Drifting with solar wind and coming from different sources these charged particles and ionized atoms will be trapped by layers of upper magnetosphere. The share of charged particles and ionized atoms received by magnetosphere of Earth will be cyclically influenced due to the continuous change in position of competing moon in its 28 days cycle (*which can explain 28 days cycle of Cosmic ray flux variations*).

(a) The quantity of charged particles washed away, from moon’s periphery by solar wind* and accompanied with it, towards magnetosphere of earth will have daily variations according to the changing directions of solar wind hitting moon, and with respective changing positions of moon and earth.

*('Galileo space probe' in 1995 and 'Ulysses international solar polar mission' in 1992 first discovered radiation belts around Jupiter which have billion ampere electrical field and a very strong magnetic field.

Volcanic Jupiter moon LO eruptions, supplies atoms of sulfur and sodium into orbits around Jupiter where they lose electrons and are absorbed by radiation belts of Jupiter). [59]

(b)The charged particles and raw matter beyond moon will be concentrated and focused by moon's gravity towards Earth (Especially at TSE), but regularly moon itself will compete with Earth in this gravitational trappings.

(2) Acceleration of trapped charged particles:

In the region at fourteen earth radii magneto-hydro-dynamic collision less *shock wave* ^[60] of solar wind and *EM radiations* of Sun will be primary accelerating factors of these charged particles in upper magnetosphere.

In their journey towards lower magnetosphere with continuously increasing magnetic and electrical fields, charged particles (stripped nuclei and semi ionized atoms) will gain momentum and will shift from parabolic to circular orbits of its rotations around Earth.

Inter particle Swan and Fermis collisions and 'plasma cheek pinches' (i.e. sudden magnetic field reversals) will provide further gains in its revolution speed.

Other plasma acceleration mechanisms as 'acoustic collision wave', 'Alfven waves', 'Langmuir waves' will form and 'Fermies magnetic pumping' will occur. It is of interest that the energy of fast particles in final reckoning becomes larger than the turbulence energy as it gradually builds up. ^[61]

(3) Further Stripping of electrons:

The *shock wave of solar wind* accumulates solar wind particles and helps in there ionization. Hits of these solar wind particles, other

charged particles and cosmic rays along with prolonged solar UV radiation, will cause progressive ionization and stripping of atoms in their 65000 km long journey from upper magnetosphere towards lower magnetosphere in very long time.

In this journey to lower magnetosphere the distortion of electron orbits* due to ever increasing electrical and magnetic fields will facilitate their further ionization.

[* Due to the deformation of electron orbits of atoms by electrical and magnetic fields (which exhibits Stark and Zeeman effects respectively) in upper magnetosphere, these atoms will be easily ionized.] ^[62]

‘Anuradha experiment’, has deduced that due to further stripping of ionized atoms, **the ratio of ‘stripped bare nuclei’ to ‘semi ionized atoms’ increase by a factor of two in their journey up to lower magnetosphere.**

‘Space lab 3 probe’ deduced 25% of semi-ionized atoms (T^{+6} , Cr^{+8} , Fe^{+20}) among 16 fully stripped nuclei in this area. ^[63]

(C) IN LOWER MAGNETOSPHERE

(1) Charged particles orientation and magnetic shell:

While ionizing, the atoms will *try to become even numbered nucleons, a stable diamagnetic configuration*, as these balanced and least deformed ions (with compact electron orbits) will be less vulnerable to further ionization.

These diamagnetic even numbered nucleons due to their diamagnetic properties will be driven to weakest magnetic fields at neutral zones, well above the magnetic equator. The observed structure and particle density of Van Allen layers supports this view.

These positive particles approaching the magnetic fields of earth with sufficient velocity and deflected by *Lorentz's forces* will circulate around earth from **west to east**.

The path of rotation of these even numbered diamagnetic nucleons will be comet like orbits. Being accelerated in day phase to circular orbits and de-accelerated in night phase into elliptical orbits. This explains the comet like deformation of earth magnetosphere at night and also illustrates that the particles are oriented according to their magnetic rigidities in these layers.

While circling earth these dia- magnetic particles will be perfectly aligned in *iso-magnetic planes* along magnetic latitudes according to their magnetic rigidities (*it explains Isocos distribution of cosmic rays*).

Suppression of one of electron spin (Lamar precession) of few of these even numbered nucleons will push them to higher latitudes depending on their resultant electron spin. On reaching earth pole, these least energy protons will even fall and will contribute in formation of '**Protonic aurora**'*.

*The solar wind is striking on magnetosphere of Earth at 55° stream angle from ecliptic plane, to which the earth is inclined by 23.27° . After 46 degrees latitude the angular flow of solar wind governs the drift of charged particles toward poles and their participation in 'aurora formation'.

Due to the shift of magnetic centre of earth by 356 kilometers towards east the radiation belt dips up to 400 km (-300 km) over south Atlantic, while they rise to 1000 km (+ 300 km) over central pacific. It is being suggested that, unprotected from high magnetic shields the near zero Ozone levels in our atmosphere has been observed in this region of west pacific. ^[64] ^[65].

This dip of belts in west and the revolution of positively charged particles from west to east results with and explains the *favoring of west direction by cosmic rays*.

Diamagnetic even numbered nucleons while being accelerated or with increase in magnetic fields, will acquire ***higher magnetic rigidity**** in day phase or at a solar flare (*Forbush decreases*), as they move to bigger orbits well above the magnetic equator (away from magneto-nuclear grinder in lower magnetosphere) result in **lower flux of cosmic rays in day phase and during ‘Forbush decreases’**.

In contrast a reverse mechanism observed in night phase and at TSE, will ***decrease the magnetic rigidities*** of even numbered nucleons and thus they will de-accelerate towards ‘magneto-nuclear grinder in lower magnetosphere’ and towards Earth. The decrease or increase of raw material to grinder in day or at night phase respectively, will decrease or increase the churned out matter of low primary cosmic ray particles (*day and night variation of cosmic ray flux*).^[66]

(2) Magneto Nuclear Grinder:

Coming to lower magnetosphere the charged particles and stripped atoms will do docking with magnetic fields of earth according to their magnetic rigidities.

The ‘odd numbered nucleons’ will form $-1/2$ or $+1/2$ magnetrons, according to their unbalanced spins. The ‘*spin spin interaction*’ of these magnetrons with legend fields of Earth magnetism by driving in resonance, will form *extensive superfine structures* on either side of magnetic equator all around earth.

The magnetic rigidities of charged particles forming this shell are the sole factor which decides their staying power and position in this magnetic shell.

Unidirectional mini loop currents generated by spin of electrons in nucleons will sum up and will form ‘surface currents’ on thus formed super fine structures, as in ‘toroids’.

Toroids like super fine structure extending from one pole to another pole all around earth having $\frac{1}{2}$ or $-\frac{1}{2}$ magnetrons in respective hemisphere will form a “MAGNETIC SHELL”. This multi-layered magnetic shell acts as an “ELECTRO MAGNETIC SIEVE” for energetic charged particles.

Even numbered nucleons with opposite spins are grinded in toroid like super fine structures in this ‘magnetic shell’ thus it will also acts as “MAGNETO NUCLEAR GRINDER”.

(D) RELATIVISTIC VELOCITIES:

All these factors mentioned below will combine together to help charged particles to acquire relativistic velocities.

(1) Cyclotron mechanism :

The electro-magnetic fields extending up to thousands of kilometers around earth will act as cyclotron for charged particles to provide ‘*time bound energy gains*’.

(2) Birth Shocks

Newly formed positively charged daughter nuclei, at the time of fragmentation of parent bare nuclei will be subjected to significant *repulsive forces* at sub atomic distances. These repulsive forces

along with released *internal energy* from nucleus; will add to their velocities as ‘birth shocks’. In this disintegration of bare nuclei, the *retarding forces* of electronegative electron cloud around nucleus will be absent. [67]

(3) **Propulsion and acceleration by medium:**

Further increasing ionizations of positively charged ions, will act like ‘booster fires of rockets’ and they will be accelerated at each such event of further stripping of electrons, by increasing electrostatic forces of repulsion. (Proton, Alfa-particles and bare nuclei, all primary cosmic rays components, are positively charged particles)

All above factors at each level will impart relativistic energies to charged particles in these layers.

Above described picture of energetic charged particles also explains all observed following phenomenon related with cosmic rays. [68]

- Favoring of west direction by cosmic rays.
- Day and night variation of cosmic ray flux.
- Latitude variation of cosmic ray intensity.
- Iso cos distribution of cosmic rays
- Forbush decreases
- 28 days cycle of cosmic ray intensity curve

Supporting evidences.

- The composition of primary cosmic ray components i.e. 80% proton and neutrons, 14% alfa particles and 6% bare nuclei, *indicates their birth from atomic disintegration.* ^[69]
- Sub-iron to iron nuclei ratio doubles in lower magnetosphere *indicating splitting of H nucleons to L nucleons* in these layers.
- The bare nuclei concentration of lithium, beryllium and of boron is *high in cosmic rays in comparison of their “cosmic abundance”*. He³ isotope is also abundant with primary cosmic ray.
- The *high energy particles are in lower magneto sphere than upper magnetosphere* and their concentration is also high in lower magneto sphere. ¹⁴C and ³H radionuclide are found in upper atmosphere.
- *Ionospheric plasma has a composition that reflects the composition of the planet’s atmosphere* (e.g., abundant O⁺ for the Earth and H⁺ for the outer planets).
- The 1500⁰ K temperatures in these lower magneto sphere, is a circumstantial proof which points towards a *slow nuclear activity* in this region.
- Apart from Sun, the Jupiter’s gigantic magnetic belts with billions of volts of electrical fields and strong magnetic fields are *another potential source of energetic charged particles generated in solar system.*

- As soon as these energetic charged particles will acquire relativistic velocities in their circular orbits they will escape from these magnetospheres and *will disperse all over solar system eluding their source of origin.*

EFFECTS OF TOTAL SOLAR ECLIPSE ON MAGNETOSPHERE

(A) **MAGNETIC STORMS** : The charged particles in magnetosphere are responsible for 7% of earth magnetism. It is to be noted that X component of geomagnetic field decreases while Y component increases around TSE.

(a) Due to obstruction of normal solar wind flow on magnetosphere of Earth.

The solar wind is striking on magnetosphere at 55° stream angle from ecliptic plane, where as earth is inclined by 23.27° . After 46° latitude, the angular flow of solar wind will govern the drift of charged particles towards poles and their participation in ‘aurora formation’.

The ‘*solar constant*’ has fluctuations as if “sun is breathing” it can be observed every couple of minutes. The ‘regular pulsation of magnetic flux of earth magnetism’ can be directly related with these fluctuations of solar constant.

Due to 5.9° inclined axis of moon, it does not cast its shadow on Earth except at TSE. The blockage of solar wind flow towards magnetosphere, by slowly approaching moon towards sun-earth

line for TSE, will cause observed disturbances of geo magnetic flux two or three days before and after solar eclipse. [70]

B) Due to blockage of EM radiation on magnetosphere.

Blockage of electro magnetic radiation of sun by moving shadow of moon on magneto sphere at TSE will also disturb the irregular fields of earth magnetism.

The obstruction of solar EM radiations on magnetosphere will result in drop of temperatures of ions and charged particles in shadow area. This *anisotropy in ionic temperatures* will lead to excitation of *Alfven waves in these layers*. This turbulence in magnetosphere will also contribute to magnetic storms at TSE. [71]

(2) GRAVITY WAVE ON IONOSPHERE :

A moving magnetopause on ‘Van Allen layers’ due to moon blocking the solar wind and abrupt cut of solar EM radiations in shadow area at TSE will affect the ionosphere. The anisotropy in electrons temperature in shadow area will lead to excitation of ‘*Whistlers*’ in these layers. [72]

These changes will lead to de-acceleration of electrons, decrease in ionosphere electron density and moving transient ionosphere disturbances: and all of these together, **in shadow area are observed as gravity wave on ionosphere.** [73]

(3) SHADOW BANDS :

The **new scattered light radiations are seen in a wave form on earth just before totality** in fading lights of TSE is named as “Shadow bands.” The possible mechanism of generation of these

light photons responsible for visualization of shadow band may be [74]

- (i) The ionosphere turbulence in shadow area and de-acceleration of nucleons to nearby zone, may lead to ‘electron *ion collisions*’ and generation of electro magnetic radiation’s including light by ‘*Thermal Bremsstrahlung*’ mechanism.
- (ii) The light radiation may also come from turbulent excited electrons by “*synchrotron mechanism*”
- (iii) Even ‘*Thomson scattering*’ with change in direction and amplification of electro magnetic radiation of sun could take place in this plasma of turbulent electrons in magnetosphere.

(4) **ECLIPTIC WINDOW** :

Ordinarily in day phase the charged particle can pass *electro magnetic sieve* only by acquiring the 14 Gev at equator and 1 Gev near poles.

This is upper range of magnetic rigidity of these layers and staying power of these particles in magnetic belts. The magnetic rigidities of these layers lowers down at night, but at total eclipse an ECLIPTIC WINDOW will form in shadow area of moon through which it will produce sporadic ‘*showers of pouring out cones*’ of charged particle on Earth.

This ecliptic window in lower magnetosphere will form due to two reasons:

1_ **Change of magnetic rigidities of charged particles** in magnetosphere alters the *latitudinal thresh hold rigidity* of these layers for energetic charged particles.

The lowering of magnetic rigidities of these layers in shadow area will allow even the lesser energy particles to pass through “Ecliptic Window”.

The positively charged particles of lower magnetosphere drifts from west to east in Earth's magnetic fields due to the Lorentz Forces. The magnetic flux of Earth varies from 0.32 Gauss at geomagnetic equator to 0.63 Gauss at poles.

Thus the charged particles of same charge, at a given height, normally acquire a definite slot at fixed latitude according to its momentum. In quite conditions these layers of lower magnetosphere, hundreds of Km thick and with large particle densities, will be systematically aligned. Thus a multi layered "Electro Magnetic sieve" (filter) for charge particles is formed. Only the charged particles of fixed threshold energy and above can pass at fixed latitude through this sieve.

First we will describe the mechanism of, acceleration or de-acceleration of charged particles, in these layers.

The activity of Sun can directly alter the magnetic rigidities of charged particles in "Van Allen Layers", by changing the particle velocity and surrounding flux of geomagnetic field.

The working of "electro magnetic sieve" gets influenced by activity of Sun. The change of threshold rigidity of these layers of lower magnetosphere for high energy charged particle will alter the particle flux towards earth.

Increased magnetic rigidities of charged particles of these layers due to increased solar activity will cause '*Forbush decreases*' and "*Day phase decreases*" of charged particles flux coming towards Earth.

Just reverse will occur due to the cessation of solar activity on these layers with de-acceleration of charged particles with decreased magnetic rigidities. This will result in observed

increased cosmic ray flux towards Earth during “*Night Phase*” and in ‘*shadow area of moon*’ through the ‘*Ecliptic Window*’ at TSE.

Thus the threshold rigidity for charged particles (*i.e.* ‘*Stromer cone*’) at particular latitude does not depend on magnetic fields of Earth alone but depends on magnetic rigidities of charged particles in lower magnetosphere as well. Accordingly to the alterations in ‘*Day and Night flux of cosmic rays*’ “*Latitudinal variations of cosmic ray intensity*” and “*Isocos distribution of cosmic ray intensity*” and “*Isocos distribution of cosmic rays*” (*i.e.* the cosmic rays of same intensity are found at a particular latitude), all regulated by this “*Electro Magnetic sieve*”.

2 - Changed angle of gyration and decreased magnetic rigidities of charged particles of lower magnetosphere in shadow area will form whirl pool like “Pouring Out Cones” of charged particles.

Magnetic rigidities of charged particles are directly proportional to the momentum of particles and this is the *main staying force of charged particles in magnetosphere*. The increased magnetic rigidities due to acceleration of particles will force them to acquire bigger orbits and will move them towards magnetic equator. The de-accelerating particles with lower magnetic rigidities will be pushed towards the poles and will participate in ‘*Aurora Formation*’ at poles.

At TSE, the temperature anisotropy will be marked in shadow area for bigger protons and other positively charged ions then for electrons. The changed angle of gyration and decreased magnetic rigidities of these charged particles of lower magnetosphere in shadow area of moon will result in sporadic fall of these charged particles through ‘*Ecliptic Window*’ as ‘*whirl pool like pouring out cones*’.

(E) EFFECTS OF “TSE” ON LIVING BEINGS

(a) **DIRECT EFFECTS**: *The normal density of energetic charged particles is of ‘one particle per cubic centimeter per minute at sea level’.*^[75] The abrupt and increased appearance of energetic charged particles can directly cause –

(i) Blindness of viewers and fetal anomalies

The sudden and sporadic blindness of few TSE viewers can be explained by passage of a shower of charged particles through the eyes of an unfortunate viewer.

Traditionally the blindness of TSE viewers, with unprotected eyes is attributed due to the effect of increased ultra violet radiation on eyes.

It was noted that the flux of UV rays does not drop with the same rate as the flux of light rays at TSE. This leaves a high level of UV radiation level in atmosphere which affects the eyes and causes blindness in prolonged exposures.

But the *discrepancy in the drop of flux of UV radiation and light intensity is of the order of 13% only and thus primarily it is not likely to cause blindness and secondarily it cannot explain why only few viewers loose their eye sight.*

During early months of pregnancy the passage of such shower through the womb of a pregnant woman can cause fetal anomalies.

(ii) Effect on Mental patients, excited state of animals and birds, increased incidence of epileptic fits in epileptic patients, feeling of fatigue etc.

The above mentioned are effected due to **increase in internal electrical conductivity of body** due to increased passage of charged particles through the body and brain at TSE.

(a) The full moon has long been related with increased manic fits in mental patients. “*Lunatic*” word used for mental patients comes from *lunar* cycle of moon. The observed increased mental excitation at full moon **can be attributed to peak of charged particles flux, in 28 day cosmic ray cycle, at full moon.**

(b) On full moon the emergency department of New York hospitals is always kept on high alert, as irritable state of mind of drivers invites more road side accidents on full moon.

(F) INDIRECT EFFECTS OF INCREASED LEVEL OF CHARGED PARTICLES IN ATMOSPHERE

(i) *Fog Formation*: Apart from other parameters for fog formation, the high radiation level of atmosphere is a must for sporadic fog formation.

(ii) It is also responsible for sporadic *increased electrical conductivity of atmosphere* and vice versa during TSE. Rai. J.

(iii) *Increased percentage of high energy electro magnetic radiation of sun in atmosphere.* Jaffery S.N.A. et al

(iv) The birds have magneto sensitive cells in their ‘pineal bodies’ which gives them the sense of direction. The magnetic disturbances at TSE can be the cause of *confused state of birds.*

POSSIBLE USES OF ARTIFICIALLY FORMED ECLIPTIC WINDOWS IN LOWER MAGNETOSPHERE:

(Artificial showers of charged particles from Lower magnetosphere can be obtained, by creating artificial ‘ecliptic window’ or by using ‘electro magnetic deflectors’ on satellites)

(!) TO CHANGE THE DESERT ECOLOGY –

The desert’s ecology can also be altered by prolonged showers of charged particles, ^{[76] [77] [78] [79]} through artificial Ecliptic window.

All growing parts in nature including leaves on growing ends of plants have negative potentials. ^[80] Apart from other findings it was deduced that *the forests attracts charged clouds due to these negative potentials, and thus act to slow their drift.*

In CLOUD experiments done at CERN in Switzerland found that the *‘cloud formation is influenced by cosmic rays’* The *biogenic vapors emitted by trees and oxidized in atmosphere* have a significant role in cloud seeding. ^[81]

It was observed that increase in ionization level by 25% in Earth’s atmosphere and production of ionizing molecules by energetic charged particles will seed clouds. *Artificial atmospheric ionization might be used intentionally to improve degraded weather.* ^{[82] [83] [84][85][86]}

(ii) AS ENERGY SOURCE FOR POWER GENERATION

It is suggested that, by changing the angle of gyration of these particles with artificial electro magnetic reflectors (in group on artificial satellites) will redirect them ^[87] 15 page 43, **to create artificial shower of “pouring out cones” of energetic charged**

particles, which can be exploited as an in-exhausting source of energy.

Superconducting wire loops of many kilometers across, can work as ‘achromatic magnetic lenses’, or even ‘solenoid magnetic lenses’ can be used to concentrate unidirectional flowing same energy charged particles in a particular belt (height) and it can be focused as useful optimum energy density to generate power by generators on Earth.

The possibility of wireless transportation of power (in steps) generated from charge particles in space craft orbiting at 50 Km above Earth inside ionosphere, can be explored. The ‘*long distance wire less transmission of electric supply*’ is based on very old principle of ‘Nikola Telsa’ (1899) ‘*that two objects having similar resonant frequency and in magnetic resonance tends to exchange energy*’ and being successfully used commercially at Emrod as power transmission technique in Newzeland.

(!!!) TO LOCALLY INCREASE THE OZONE LAYER –

It is observed that in our atmosphere there are holes in ozone layer over poles where radiation belts are absent. It is also noted that there is ‘near zero concentration of ozone’ over central pacific*^[AO] where the magnetosphere rises up to a height of 1000km (+300 Km).

(*The magnetic centre of earth is shifted by 352Km towards east from centre of earth. Thus the magnetic belts dip to 400 Km (-300) over south Atlantic, while they rise to 1000Km (+300) over central pacific.)

‘Silent electric sparks’ initiates the conversion of oxygen into ozone, when oxygen molecules interact with charge particles in lower magnetosphere. The increased height of these layers over central pacific will lower the flux of charged particles and their ‘cascade showers’ in upper atmosphere, which in turn will result in

deficient production of ozone layer due to reduced incidences of charge particle generated 'silent sparks' in this region.

Prolong 'artificial showers of charged particles' through artificial ecliptic window will increase 'ozone formation' in selected local area of atmosphere.

POINTS TO PONDER :

(!) Ionizing radiation is natural part of our living. The origin of life, aging and life span are all dependent upon atmospheric radiation level. To prove this, we have a circumstantial evidence that by *increase of temperature (Thermal radiation), the egg hatched changes its gender in crocodiles* (Ferguson and Joanen 1982), while rate of *all bio chemical processes enhances and bacteria grow fast.*

(!!) The Indian Ocean, protected by thick and lower magnetosphere overhead and have '*lower Flux of cosmic rays near equator*', is full of flora and fauna.^[88]

(!!!) The production of 'free radicals' (molecules with 1 or more unpaired electrons in outer shell), in our bodies is also linked with radiation. It can *directly be related to constant passage of charged particles through our body* which causes ionization of atoms to start a chain reaction to produce free radicals; *this is one of the causes of aging.* ^{[89] [90]}

(!V) The turtle with strong protective cover from charged particles on its back lives for 200 to 300 years. (Encyclopedia Britannica)

(!V) In the resonant state the pyramid can concentrate EM energy in pyramids internal chambers as well as under its base.^[91] Perhaps the bodies of Pharaohs were kept in these structures to protect them from further decay by radiation. We can also increase

our life span on Earth by sleeping in *radiation protected houses*.
[92] Incidentally during a recent ‘Muons ray imaging’ a third unfinished and previously undetected big chamber was found located under great pyramid.

(V) Radiation check can be achieved during our space journeys. In future our space crafts moving at ‘Super-luminous velocities’ on Interstellar journeys [22c], will strongly need this protection from space radiation, which will be done by production of *self created ‘magnetic bubble’ around space craft by on board ‘electric powered deflectors’*. [93] [94]

COMMENTS

Part of this research work was first presented at international seminar on Total Solar Eclipse, organized at Chung-Li Taiwan, MAY5-6, 1996 and later on it was published by its first author in his book INSIDE A WAVE, 2005. [18] The relevance of this work is still continued and even supported by data collected so far, so this part is re-produced here, after incorporating results of new data collected and research work done so far on this topic.

CONCLUSION

This fundamental research work observes that the Moon contributes significantly in providing raw material which subsequently changes to energetic charged particles in our magnetosphere itself.

These charged particles in lower magnetosphere can sporadically shower down on Earth as its daily flux, but during TSE its sporadic showers can pass through ECLIPTIC WINDOW, formed in shadow area and are responsible to produces all TSE related phenomena. This shower of low energy charged particles or sporadic cosmic ray burst is responsible for sudden permanent

blindness of few unfortunate viewers watching TSE with unprotected eyes.

It is suggested here, that there is strong possibility of trapping energetic charged particles from ionosphere and lower magnetosphere as inexhaustible possible source of power generation and it should be explored.

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