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Satyavarapu Naga Parameswara Gupta (snp Gupta)

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We will see a simulation using a Subbarao path or Multiple bending of light rays, where a ray started at some star will go on bend and its frequency gets upshifted and gains energy at every star in its path. We also will present a table of types of stars that are existing in Milkyway which will be used in next subsequent papers.

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I. INTRODUCTION

There are multiple origins of Cosmic Rays. They originate outside solar system [1] or from distant galaxies [2]. In addition to the generally accepted sources of Cosmic rays like they originate from the supernova explosions of stars and Active galactic nuclei like blazar TXS 0506+056;(See for example, the data based on observations of neutrinos and gamma rays from Supernova explosions as observed by Fermi FGST in (2013) [3] & Active Galactic Nuclei produces Cosmic Rays observed from blazar TXS 0506+056 in 2018.[4][5]); Dynamic Universe Model proposes three additional sources like frequency upshifting of light rays, astronomical jets from Galaxy centres and occasional solar flares from sun or other stars in Milkyway.

How these cosmic rays acquire high energy and why they are intermittent, what are the stages of development of originated Cosmic rays will be discussed in subsequent next 12 papers or so. Every paper will have its mathematical back-ground and SITA calculation sheets and / or Subbarao path calculation sheets. We will discuss the origination of Cosmic Rays mostly outside Solar System and Milkyway also. We also know Cosmic rays are composed primarily of high-energy protons and atomic nuclei; they are of uncertain origin.

As we see above in the origins of Cosmic Rays there are three parts. Hence this original paper was divided into three papers as the simulations will be different for each paper. Hence those three additional sources for Cosmic Ray Origins are:

a. Frequency upshifting of light rays,
b. Astronomical jets from Galaxy centres
c. Occasional solar flares from sun or other stars in Milkyway

1.1. Composition

Cosmic Rays or Cosmic Radiation is different from electromagnetic radiation or photons. Photons are considered as massless for all practical purposes, (they have no rest mass) though there is a minute mass associated with these photons. These Cosmic Rays consisting of Protons, Helium and other higher elements with the electrons stripped off. This composition is confirmed by Fermi Space Telescope FGST Data [1]. They are not just positively charged ions of elements, but total electrons were missing from these nuclei. Composed primarily of high-energy protons and atomic nuclei, they are of uncertain origin. And Dynamic Universe Model proposes three different types of possible origins for these Cosmic rays.

Primary Cosmic rays originate outside of Earth's atmosphere.

Secondary Cosmic rays originate due to collisions with air and other particles in Earth's atmosphere and fall on Earth. Now on wards we will Refer Primary cosmic rays as Cosmic rays only.

Primary cosmic rays are about 99% (of which 89% are protons,9% are alpha rays, 1% are nuclei of other heavier elements, called HZE ions.[6]) are the nuclei of atoms without electrons and remaining 1% are electrons like beta particles. There is a minute fraction of positrons and antiprotons.

Electro magnetic radiation and frequency upshifting when the ray passes grazingly near a mass like Sun or planet. When the frequency is high enough like alpha, beta or gamma radiation will be formed. ("How these particles will particles will gain high energies and the mechanisms of such high energies acquisitions" will be covered in another paper.)

1.2. Energy

These Cosmic rays are at the higher end of the energy spectrum, it is generally believed in physics that relativistic kinetic energy is the main source of the mass-energy of cosmic rays. We will see how Dynamic Universe Model explains these higher energies.

The energies of the most energetic ultra-high-energy cosmic rays (UHECRs) have been observed to approach 3×10^{20} eV[7], about 40 million times the energy of particles accelerated by the Large Hadron Collider[8]. Most cosmic rays, however, do not have such extreme energies; the energy distribution of cosmic rays peaks on 0.3 gigaelectronvolts (4.8×10^{-11} J) [9]. The highest-energy detected fermionic cosmic rays are about 3×10^{6} times as energetic as the highest-energy detected cosmic photons. An Extreme-Energy Cosmic ray (EECR) is an UHECR with energy exceeding 5×10^{19}. The particles with estimated arrival energies above 5.7×10^{19} eV are extremely rare. It is about one such event every four weeks in the 3000 km^2 area surveyed by the observatory.[10].

1.3. Formation of Cosmic Rays

We discuss here what are the possible ways of formations of Cosmic rays according to Dynamic Universe Model:

The energy gained is "=1.00018503234357OOE+00" and frequency upshifting is with a ratio "1.00018503234357OOE+00". Surprisingly both are same. These formulae were derived by the author in his earlier papers as referenced below.[11], [12], [13] and [14].

1. d. The energy gain at each star is added to the existing energy possessed at present with the incoming electro-magnetic radiation. This radiation on the move will gain energy and continues its journey. After the radiation gains energy and its frequency get upshifted, this radiation may ....

1. d.1. Hit a planet or a star or any astronomical object

1. d.2. Travel into the vast empty space

1. d.3. Pass Grazingly at another star or planet and gains energy and its frequency gets upshifted and travel again. The cycle described in this point (d.3.) will gets repeated.

II. MATHEMATICAL BACKGROUND

The mathematics of Dynamic Universe Model is published and is available in many open access papers hence not repeated here. The following linear tensor equation (1) is the basis for all these calculations.

$$\Phi_{ext}(\alpha) = -\sum_{\substack{\beta=1 \\ \alpha\neq\beta}}^{N^{\gamma}} \frac{Gm_{\beta}^{\gamma}}{\left|x^{\gamma\beta} - x^{\gamma\alpha}\right|} - \sum_{\substack{\beta=1 \\ \alpha\neq\beta}}^{N^{\delta\gamma}} \frac{Gm_{\beta}^{\delta\gamma}}{\left|x^{\delta\gamma\beta} - x^{\delta\gamma\alpha}\right|}$$

This concept can be extended to still higher levels in a similar way. There are other variations of the mathematics used in some different applications like VLBI explanations. The above Equation is the main resourceful equation, which gives many results that are not possible otherwise today.

2.1 Case3. When the velocity of gravitational mass is not exactly opposite or exactly in the same direction to the incoming light ray:

In this case the gravitational field will act as some brake or enhance the energy of the incoming light ray depending on **(Cos ϕ)** of the velocity of gravitational mass relative to incoming radiation, where **(ϕ)** is the angle between the light ray and velocity of gravitational mass .

The gravitating mass is moving with a velocity μ making an angle **(ϕ)** as the angle between light ray velocity of gravitating mass and applies brake on the photon. This is something similar to the case where the gravitational mass is fixed in position and the photon of the rest mass E / c^2 is moving with velocity $\mu \, Cos \, \phi + c$

Hence the initial velocity of photon = $- \mu \, Cos \, \phi - c$. It's velocity is towards the gravitational mass. The photon is having a freefall. Its final velocity = $- \mu \, Cos \, \phi - c - g_o t$ [where t is the time of flight of photon].

Initial Energy = $m (\mu \, Cos \, \phi + c)^2 / 2 = E (\mu \, Cos \, \phi + c)^2 / 2 c^2 = E (\mu^2 \, Cos^2 \, \phi + c^2 + 2\mu \, Cos \, \phi \, c) / 2c^2$

3.2. From excel sheet Derivation of equations for the effect of movement of gravitational mass on the frequency of the incoming light ray with c:

Energy due to Gravitation of Sun (or star) on the photon = E_s = Initial Energy = $m (\mu \, Cos \, \phi + c)^2 / 2 = E (\mu \, Cos \, \phi + c)^2 / 2 c^2 = E (\mu^2 \, Cos^2 \, \phi + c^2 + 2\mu \, Cos \, \phi \, c) / 2c^2$

Frequency of photon = $\vartheta = E / h$ **or** $E = h \vartheta$

Energy due to Gravitation of Sun (or star) on the photon = $E_s = E \;\; g_o \, r / c^2$ = Initial Energy = $m (\mu \, Cos \, \phi + c)^2 / 2$ *vak 12102019 ?????*

Initial Frequency = = $E (\mu^2 \, Cos^2 \, \phi + c^2 + 2\mu \, Cos \, \phi c) / 2hc^2$

$= E (\mu \, Cos \, \phi + c)^2 / 2 \, hc^2$

Vak 18DEC 2019: ERRATA

The above equations which are in were wrong. This mistake happened while reducing the equation to derive "Initial Frequency = ϑi" *and* "Final Frequency = ϑo". *This was found while doing calculations numerically in excel. There was a result mismatch.*

Now the error was corrected.

Sorry for the error, and the Author regrets the error

=snp.gupta 18DEC 2019

Initial Frequency = $\vartheta i = E (\mu \, Cos \, \phi + c)^2 / 2 \, hc^2$

- ⇨ $\vartheta i = E (\mu \, Cos \, \phi + c)^2 / 2 \, hc^2$
- ⇨ $\vartheta i \, 2 \, hc^2 = E (\mu \, Cos \, \phi + c)^2$
- ⇨ $(\vartheta i \, 2 \, hc^2) / (\mu \, Cos \, \phi + c)^2 = E = h \, \vartheta s$
- ⇨ $(\vartheta i \, 2 \, c^2) / (\mu \, Cos \, \phi + c)^2 = \vartheta s$ =*Start Frequency*

Energy due to Gravitation of Sun (or star) on the photon after freefall = E_f = Final Energy = $½ (E / c^2)(- \mu \, Cos \, \phi - c - g_o t)^2 = ½ (E / c^2)(\mu^2 \, Cos^2 \, \phi + c^2 + g_o^2 t^2 + 2\mu \, Cos \, \phi \, g_o t + 2c g_o t + 2\mu \, Cos \, \phi c)$

Final Frequency = $\vartheta o = E (\mu^2 \, Cos^2 \, \phi + c^2 + g_o^2 t^2 + 2\mu \, Cos \, \phi \, g_o t + 2c g_o t + 2\mu \, Cos \, \phi c) / 2hc^2$

$= ½ (E / hc^2)(- \mu \, Cos \, \phi - c - g_o t)^2$

Final Energy $= ½ (E / c^2)(- \mu \, Cos \, \phi - c - g_o t)^2 = ½ (E / c^2)(\mu^2 \, Cos^2 \, \phi + c^2 + g_o^2 t^2 + 2\mu \, Cos \, \phi \, g_o t + 2c g_o t + 2\mu \, Cos \, \phi c)$

Final Frequency = $\vartheta o = 1 / [½ (E / c^2)(- \mu \, Cos \, \phi - c - g_o t)^2]$

$= 1 / [½ (E / c^2)(\mu^2 \, Cos^2 \, \phi + c^2 + g_o^2 t^2 + 2\mu \, Cos \, \phi \, g_o t + 2c g_o t + 2\mu \, Cos \, \phi c)]$

here $E = h \, \vartheta$ that means

$= \{ \; (2 \, c^2) / h \, (\mu^2 \, Cos^2 \, \phi + c^2 + g_o^2 t^2 + 2\mu \, Cos \, \phi \, g_o t + 2c g_o t + 2\mu \, Cos \, \phi c) \}$

III. WHAT ARE SUBBARAO PATHS OR MULTIPLE BENDING OF LIGHT RAYS?

Assume a light ray was emitted and coming from a distant Galaxy or star, that light ray passes grazingly with some other star or planet. Then four things will bound to happen...

a. It bends slightly in the gravitation field.
b. It gains energy while it bends.
c. Its frequency gets up-shifted when while it bends.
d. It travels further.

So, after bending the original light ray will be a different light ray with higher frequency. Then it may pass grazingly near another star. Near the Second star all the above 4 things will happen. Many of the light rays go diverted paths. But some paths will be constant for a while. When these bending's will happen multiple number of times, they will become "Subbarao's paths" or following "Multiple bending of light rays". When frequency gets up-shifted sufficient number of times they will become particles like muons or positrons or electrons.

This is how these cosmic rays originate. Because of the Dynamism built in the universe, none of the stars or planets will stay in positions for forming paths. Hence these "Subbarao's paths" or "Multiple bending of light ray paths" will never be constant. These paths will get disturbed always, and new paths will form.

That is the reason why a bunch of cosmic rays will appear and they will stop from that direction. The Cosmic rays will always be intermittent. The detailed discussion of this will form another paper with the proper simulations to prove the point.

4.1.10.1. Bending of Light Equations and Diagram Fig.1:

Bending always happen in a 2D plane only. For a ray coming in 3 dimensions, it will bend in a 2D plane containing the center of gravity of star and line of the light ray. Let's assume a light ray is coming from a distant star or a Galaxy. Let the light ray is passing Grazingly near a star or Sun.

For calculation purposes lets an imaginary set of 2D coordinate axis as shown in figure. (Note: For information: an absolute set of coordinate axis is not necessary.) Let the light ray is passing through (0,0) of the set of axes as defined now. Let it make an angle α with x axis. See fig.1 for visualizing details.

The light ray bends an angle θ due to gravitation of that Star at the point A. After bending it continues its journey via point B. Lets drop a vertical line at point B via point C, which is the intersection of vertical and an horizontal passing through point A. Now in the right-angle triangle ABC the angle BAC is $\alpha - \theta$. Now we can see clearly, that 'AB' the distance 'ct' travelled by electro-magnetic radiation in time t with velocity c is the diagonal.

In triangle ABC the distance travelled in x coordinate direction = (x2-x1) = ct $\cos(\alpha - \theta)$ and the distance travelled in y coordinate direction = (y2-y1) = ct $\sin(\alpha - \theta)$.

Therefore the coordinates of B = (x2, y2) = [{x1 + ct $\cos(\alpha - \theta)$}, {y1 + ct $\sin(\alpha - \theta)$}] .

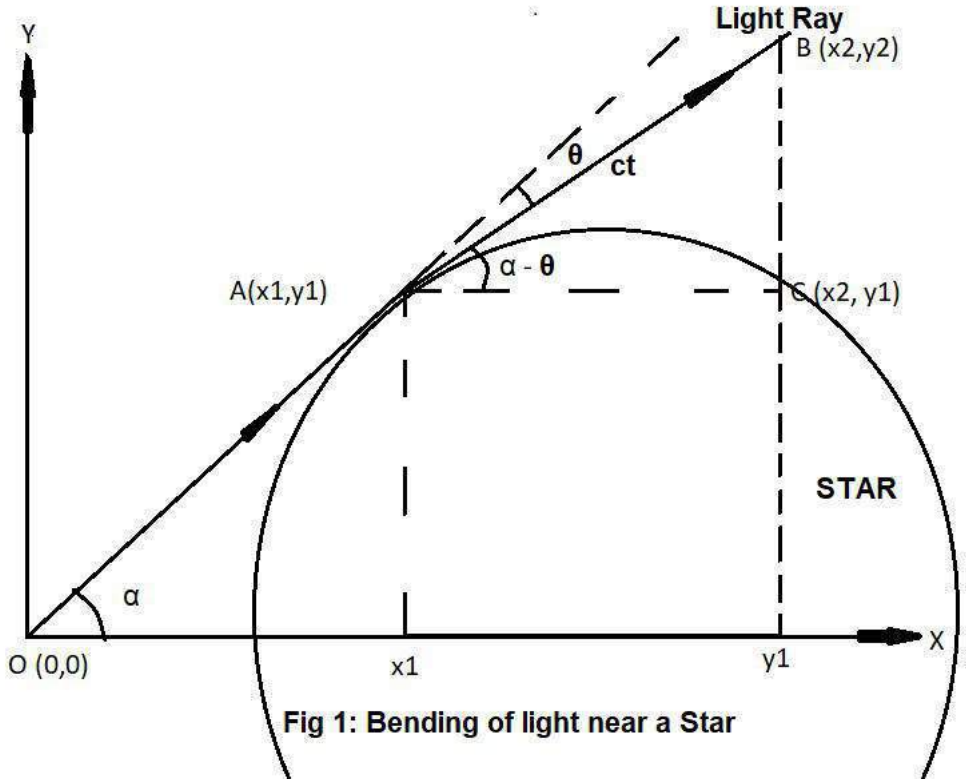

Fig 1: Bending of light near a Star

4.1.10.2. We will consider only those stars that are lying in a single plane, as the bending happens in a single plane. This electro magnetic radiation or the light travels further and 77further into the space. If this radiation encounters another star in the same plane, this radiation will bend again in its gravitation field or otherwise it will continue its voyage into space.

4.1.10.3. On every bending its energy will boost-up and frequency will increase.

4.1.10.4. We will calculate the energy and frequency of the electro-magnetic radiation depending on the type of star that populate in that region of the milky way.

4.1.10.5. There is more possibility that the radiation reaching the center of Milkyway (or any Galaxy).

IV. USING ARTIFICIAL INTELLIGENCE FOR SELECTION OF STARS

We can use Artificial Intelligence (AI) processes and equations fothis selection process for further accuracies. But we did not use AI at this stage.

Here the ray of light (Electro-magnetic radiation) forms a cone of light, which may cover a number of stars in its path. We will use AI equations to single out only one star. Or otherwise all the bending happens in one plane and a single ray of light (not cone). Simulate a Star's Mass, Diameter, Type according to the type of stars in that region of Milkyway Galaxy.

V. EQUATION OF BENDING INCOMING RAY OF LIGHT (θ)

The equation " $4\,(G\,M/c^2)/R_o$ " is the deflection angle for light found by using null geodesics in the Schwarzschild metric according to General Relativity.http://www.Theory.caltech.edu/people / patricia/obsertop.html

$$\theta = 4GM / c^2R$$

Where ***E*** is energy of photon and ***c*** is velocity of light photon.

The distance of the photon from center = ***r***. Energy due to Gravitation of Sun (or star) on the photon = $E_s = E\, g_o\, r / c^2$. Frequency of photon = $\vartheta = E / h$ or $E = h\, \vartheta$.

VI. COMPUTER SIMULATIONS / CALCULATIONS

We performed Simulations and calculations after implementing formulae as shown below.

Excel Table equations checking and Crosschecking the different calculations

Different formulae used in the Excel calculation sheet

Let $w = (2 c^2 / h)$

$x = (\mu \cos\phi + c + g_o t)^2$

$y = (\mu + c)(\mu + c)$

$z = (1 / (\mu \cos\phi + c + g_o t)^2) - (1 / (\mu+c)(\mu+c))$

$p = (2 c^2 / h) [(1 / (\mu \cos\phi + c + g_o t)^2) - (1 / (\mu+c)(\mu+c))]$

therefore...

$P = w / x - w / y = w (1/x - 1/y)$

Change in Energy = $\frac{1}{2} (E / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)$, here $E = h\, \vartheta$ that means

Change in Energy = $\frac{1}{2} (h\, \vartheta / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)$

// ////////////////////////// Following equations are added to cross check accuracy of implementation in excel , there can be mistakes while we apply equations and perform calculations // //

$P = w / x - w / y = w (1/x - 1/y)$

We checked this above equality for making sure calculations are going in right direction.

Hight of Photon from the surface of Sun = (R-r) Where r is radius of Sun and R is the distance of photon from the centre of Sun

Initial Energy due to sun at R = $m\, g_o (R-r) = m (\mu \cos\phi + c)^2 / 2 = E (\mu \cos\phi + c)^2 / 2 c^2 = E (\mu^2 \cos^2\phi + c^2 + 2\mu c) / 2c^2$

Final Energy due to sun = $m\, g_o (R - r - c\, t - g_o t^2) = \frac{1}{2} (E / c^2)(-\mu \cos\phi - c - g_o t)^2 = \frac{1}{2} (E / c^2)(\mu^2 \cos^2\phi + c^2 + g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t + 2\mu \cos\phi\, c)$

Change in Energy due to Sun = $m\, g_o (R - r - c\, t - g_o t^2) - m\, g_o (R-r)$

$= m\, g_o (R - r - c\, t - g_o t^2 - R + r) = m\, g_o (-c\, t - g_o t^2)$ = LHS

Change in Energy RHS = $\frac{1}{2} (E / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)$, here $E = h\, \vartheta$ that means

Change in Energy RHS = $\frac{1}{2} (h\, \vartheta / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)$

LHS = RHS gives......... Check this identity......

$m\, g_o (-c\, t - g_o t^2) = \frac{1}{2} (h\, \vartheta / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)$

/////////////////////////////////////

For cross checking only // //

Hence change in Frequency = $\delta\vartheta = 1 / \{2 (h / c^2) (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)\}$

$= \{2c^2 / (h (g_o^2 t^2 + 2\mu \cos\phi\, g_o t + 2 c g_o t)\}$

Here it can be observed that above equation is the main equation and the "change in Frequency equations" in the above case1 and case 2 of this section are special cases of above equation. It will become equation in case1 when φ is '0 degrees' and equation in case 2 when φ is 180 degrees.

While making the excel sheet we find two types initial frequencies and two types of initial energies. These are confusing, so one will be renamed as START frequency, and another as

START energy. The other two calculated initial frequency and calculated initial energy will exist as it is.

Attached File name

vak CRP1 Origins.xls

1. We need to formulate an excel interation sheet such that we input frequency and it will calculate all the other values like initial energy, final energy, final frequency etc., depending on Sun's gravity, radius and type. By changing input frequency and taking another star also exactly similar to Sun.

In later simulations we will change star data also and get more relevant and meaningful simulations.

File name

C:\E\Vak Cosmic Rays\Vak CR papers\P1 Origins\P1.1. Feq Upshift\vak1 CRP1 Origins.xls

C:\E\Vak Cosmic Rays\Vak CR papers\P1 Origins\P1.1. Feq Upshift\vak CRP1 Origins.xls

2. Here we started with start frequency and that frequency become the final frequency after freefall. Later the light ray of same frequency was went to another star and became initial frequency.

Initial Frequency = $\vartheta i = \zeta = E\,(\mu^2\, Cos^2\, \phi + c^2 + 2\mu\, Cos\, \phi c\,)/2hc^2$

$= E\,(\mu\, Cos\, \phi + c)^2\, /2\, hc^2 = \zeta$

⇨ $2\zeta hc^2/E = (\mu\, Cos\, \phi + c)^2$

⇨ $2\zeta hc^2/E = (\mu\, Cos\, \phi + c)^2$

⇨ $(2\zeta h/E)^{1/2} = (\mu\, Cos\, \phi + c)$

⇨ $((2\zeta h/E)^{1/2} - c) = \mu\, Cos\, \phi$

Final Frequency = $\vartheta o = E\,(\mu^2\, Cos^2\, \phi + c^2 + g_o^2 t^2 + 2\mu\, Cos\, \phi\, g_o t + 2cg_o t + 2\mu\, Cos\, \phi c\,)/2hc^2$

$= ½\,(E\,/\,hc^2\,)(-\,\mu\, Cos\, \phi - c - g_o t)^2$

$\vartheta o = ½\,(E\,/\,hc^2\,)(-\,\mu\, Cos\, \phi - c - g_o t)^2$

⇨ $\vartheta o = ½\,(E\,/\,hc^2\,)(-\,\mu\, Cos\, \phi - c - g_o t)^2$

⇨ $(c\,(2\,\vartheta o\,h/E)^{1/2} - c - g_o t) = \mu\, Cos\, \phi = (c\,(2\zeta h/E)^{1/2} - c)$

⇨ $(c\,(2\,\vartheta o\,h/E)^{1/2} - c - g_o t) = (c\,(2\zeta h/E)^{1/2} - c)$

⇨ $(c\,(2\,\vartheta o\,h/E)^{1/2} - g_o t) = (c\,(2\zeta h/E)^{1/2}\,)$

⇨ $(2\,\vartheta o\,h/E)^{1/2} - g_o t/c = (2\zeta h/E)^{1/2}$

Initial energy = $h\,\vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2$

Initial frequency = Initial energy / h

$= h\,\vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2\, /\, h$

$= \vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2$

Photon Start frequency = E (μ Cos ϕ +c)² /2 hc²

Initial energy = $h\,\vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2$

Initial frequency = Initial energy / h

$= h\,\vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2\, /\, h$

$= \boldsymbol{\vartheta\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2}$

Photon Start frequency = E (μ Cos ϕ +c)² /2 hc²

Ratio (Final energy / Initial Energy) =

$=[½\,(E\,/\,c^2\,)(-\,\mu\, Cos\, \phi - c - g_o t)^2]\,/\,[E\,(\mu\, Cos\, \phi + c)^2\, /2\, c^2\,]$

$= [\,½\,(E\,/\,c^2\,)(\mu^2\, Cos^2\, \phi + c^2 + g_o^2 t^2 + 2\mu\, Cos\, \phi\, g_o t + 2cg_o t + 2\mu\, Cos\, \phi c\,)\,]\,/\,[\,E\,(\mu^2\, Cos^2\, \phi + c^2 + 2\mu\, Cos\, \phi c\,)/2c^2\,]$

$= [\,(-\,\mu\, Cos\, \phi - c - g_o t)^2]\,/\,[\,(\mu\, Cos\, \phi + c)^2\,]$

$= [\,(\mu^2\, Cos^2\, \phi + c^2 + g_o^2 t^2 + 2\mu\, Cos\, \phi\, g_o t + 2cg_o t + 2\mu\, Cos\, \phi c\,)\,]\,/\,[\,(\mu^2\, Cos^2\, \phi + c^2 + 2\mu\, Cos\, \phi c\,)\,]$

=1.0001850323435700E+00

Ratio (Final frequency / Initial frequency)=

= ϑi / ϑf

Stars In Galaxy

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VII. MILKYWAY GENERAL STRUCTURE

Our Milkyway appears to be a galaxy with a 12-18,000 ly long “bar” in the central bulge, which is two to three times longer than it is wide. Its central bulge consists of old stars whose brightest stars are red giants of relatively low mass and big bluish stars recently born from gas held tightly around the galactic center (towards an object called Sagittarius A* , a Densemass massing about 2.5 million suns), Its central bulge extends to two to four bluish spiral arms on opposite sides that wrap around the bulge and each other outwards through the dimmer and redder galactic disk, possibly including broken arm segments, yellowish "ghost" arms where most short-lived OB stars have already perished.

Surrounding the Milky Way's spiral disk and bulge is the slightly flattened galactic halo of old stars, averaging somewhat lower in mass than our sun, including a relatively small number of individual stars and 200 or so globular clusters -- roughly half above and half below the disk.

VIII. SPECTRAL TYPE

Electromagnetic radiation from the star is analyzed by splitting it with a prism or diffraction grating into a spectrum exhibiting the rainbow of colors interspersed with spectral lines. Each line indicates a particular chemical element or molecule, with the line strength indicating the abundance of that element. The strengths of the different spectral lines vary mainly due to the temperature of the photosphere, although in some cases there are true abundance differences.

This is a system of classification which indicates the star's predominant colour showing its surface temperature. (See Table1. Spectral types) The sequence of the seven basic spectral types is denoted in capital letters, as derived from surface temperature, particularly at the extremes of the spectrum, in the bluish and reddish tints of the hottest and coolest stars, respectively.

Table 1: Spectral types: Shows a system of classification which indicates the star's predominant colour showing its surface temperature, with examples

Class	Effective temperature[1][2]	Vega-relative chromaticity[3][4][a]	Chromaticity (D65)[5][6][3][b]	Main-sequence mass[1][7] (solar masses)	Main-sequence radius[1][7] (solar radii)	Main-sequence luminosity[1][7] (bolometric)	Hydrogen lines	Fraction of all main-sequence stars[8]	Example
O	≥ 30,000 K	blue	blue	≥ 16 $M_\odot$	≥ 6.6 $R_\odot$	≥ 30,000 $L_\odot$	Weak	~0.00003%	Iota & Zeta (Alnitak) Orionis Aa
B	10,000–30,000 K	blue white	deep blue white	2.1–16 $M_\odot$	1.8–6.6 $R_\odot$	25–30,000 $L_\odot$	Medium	0.13%	Algol A, Regulus Aa
A	7,500–10,000 K	white	blue white	1.4–2.1 $M_\odot$	1.4–1.8 $R_\odot$	5–25 $L_\odot$	Strong	0.6%	Sirius A, Vega
F	6,000–7,500 K	yellow white	white	1.04–1.4 $M_\odot$	1.15–1.4 $R_\odot$	1.5–5 $L_\odot$	Medium	3%	Procyon A, Eta Cassiopeia A (F9-G0)
G	5,200–6,000 K	yellow	yellowish white	0.8–1.04 $M_\odot$	0.96–1.15 $R_\odot$	0.6–1.5 $L_\odot$	Weak	7.6%	Sun, Alpha Centauri A

K	3,700–5,200 K	light orange	pale yellow orange	0.45–0.8 $M_\odot$	0.7–0.96 $R_\odot$	0.08–0.6 $L_\odot$	Very weak	12.1%	Alpha Centauri B, Epsilon Eridani
M	2,400–3,700 K	orange red	light orange red	0.08–0.45 $M_\odot$	≤ 0.7 $R_\odot$	≤ 0.08 $L_\odot$	Very weak	76.45%	Proxima Centauri, Barnard's Star

Each spectral type is further subdivided into 10 divisions from 0 through 9, hottest to coolest. Most stars are of type M, with diminishing numbers up to type O -- quite rare in our galaxy. About 90 percent of all stars are main sequence dwarfs of spectral type F through M (excluding 9 percent white dwarfs, 0.5 percent red giants, and 0.5 percent everything else). On the other hand, the average mass of main sequence dwarf stars rises dramatically from M to O.

The current version of CHVIEW consolidates stars of unknown spectral type as well as those of all other spectral types into "X". The non-OBAFGKM spectral types include reddish giants and supergiants that have become relatively rich in carbon, such as C (formerly R and N) and S types, as they have run out of hydrogen as the primary fuel for nuclear fusion -- none are currently believed to be located within 250 ly from Earth. WC (carbon-rich) and WN (nitrogen-rich) Wolf-Rayet stars such as Suhail (WC8, Gamma2 Velorum Aa) are massive stars (averaging 20 solar masses in binaries with O stars) that may have already expelled 40 percent or more of their original mass, including their entire hydrogen envelope. The extreme luminosity of Wolf-Rayets is obscured by the dust and gas shed by them.

Analysis of the spectral lines found in star light yields additional information, which is noted in lower case letters following the capital letter denoting spectral type. Examples include:

Table 2: Types of Spectral lines: Analysis of the spectral lines found in star light yields additional information

Spectral peculiarities for stars	
Element symbol: Code	Abnormally strong spectral lines of the specified element(s)[30]
:	uncertain spectral value[17]
...	Undescribed spectral peculiarities exist
!	Special peculiarity
comp	Composite spectrum[30]
e	Emission lines present[30]
[e]	"Forbidden" emission lines present
er	"Reversed" center of emission lines weaker than edges
eq	Emission lines with P Cygni profile
f	N III and He II emission[17]
f*	N IV λ4058Å is stronger than the N III λ4634Å, λ4640Å, & λ4642Å lines[31]
f+	Si IV λ4089Å & λ4116Å are emitted, in addition to the N III line[31]
(f)	N III emission, absence or weak absorption of He II
(f+)	[32]
((f))	Displays strong He II absorption accompanied by weak N III emissions[33]
((f*))	[32]
h	WR stars with hydrogen emission lines.[34]

ha	WR stars with hydrogen seen in both absorption and emission.[34]
He wk	Weak Helium lines
k	Spectra with interstellar absorption features
m	Enhanced metal features[30]
n	Broad ("nebulous") absorption due to spinning[30]
nn	Very broad absorption features[17]
neb	A nebula's spectrum mixed in[30]
p	Unspecified peculiarity, peculiar star.[d][30]
pq	Peculiar spectrum, similar to the spectra of novae
q	P Cygni profiles
s	Narrow ("sharp") absorption lines[30]
ss	Very narrow lines
sh	Shell star features[30]
var	Variable spectral feature[30] (sometimes abbreviated to "v")
wl	Weak lines[30] (also "w" & "wk")

Some stars have stellar companions so close that they appear to be single stars. Analysis of the spectra from such stars may indicate Doppler shifts from the movements of the stellar pair, suggesting the presence of a companion star. Called spectroscopic doubles (spec.dou.) or binaries (SB), spectral lines found in their star light may be periodically doubled ("double-line" binary). If one star's spectrum is too faint to be seen, however, the spectral lines of the primary star may oscillate about a mean position ("single-line" binary). In astrometic binaries, the presence of an invisible companion is inferred from slight "wobblings" in the motion of the primary.

MASS & EVOLUTION. A star is probably born as a nebular cloud of gas and dust of interstellar size collapses, spinning inward via an accretion disk towards an increasingly dense core. While still obscured from view by dust, nuclear fusion may ignite at the center of these pre-stellar objects, as hydrogen is fused into helium. Proto-stars (pre-"main sequence," T-Tauri stars and Herbig-Haro objects, possibly R Coronae Australis/CD-37 13027 which may only be 27 ly from Sol) are born as the energy of hydrogen fusion pushes outward to balance the inward pull of gravity. Eventually, any surrounding -- possibly stellar amounts of -- gas and dust that remain around the star will be blown away by the star's radiation in T-Tauri winds, including much that may be infalling through its stellar disk and blown out in jets (that may be driven by an intense magnetic field) at the star's poles. Once fusion begins, planets may have only a few hundred thousand years or so to form from proto-planetary objects before the dusty circumstellar disk becomes too tenuous, and the star enters the main sequence. Young stars in the solar neighborhood include many OBA type stars such as Beta Pictoris (A3-5), which is young enough to have an easily detectable dust disk, Epsilon Eridani (a K2V with a dust ring as wide as 60 times the Earth to sun distance that is estimated to be between one half and one billion years old), the double-binary system of HD 98800 which has four main-sequence K and M stars that may be only 10 million years old.

Astrophysicists have concluded that, in order to sustain the nuclear reactions necessary to become a star, a gaseous body must have about 0.074-0.080 the mass of our sun. Currently, some astronomers have been defining smaller objects with between 0.013 and 0.080 solar masses (about 13 to 80 Jupiter masses) as "brown" dwarfs, especially those in particularly eccentric orbits around a star since such objects probably formed at about the same time as the star from the same nebular cloud. (According to at least one theory, a "super planet" that is detected in a close-in orbit could be either a brown dwarf or a gas giant that formed after the birth of the star from a dust disk but migrated inward as the result of friction with dust or some other mechanism.) While at least one theory predicts a huge number of brown dwarfs, their dimness make them difficult to detect and few discoveries were actually confirmed until recently. In 1995, however, a brown dwarf companion to Gliese 229 (only about 19 ly distant) was not only confirmed by the international astronomical community but also photographed by the Hubble Space Telescope; by late 1996, at least 12 were found within 250 ly of Earth -- even more if farther objects are counted.

Most stars begin their life as "dwarfs" and spend the bulk of their lifetime in the main sequence with the same spectral type. As a star ages within the main sequence, however, it can become more as well as less luminous. Once a star moves off the main sequence, it will eventually swell so large that it's surface temperature will drop enough to shift its spectra dramatically downwards. Some large stars will shift spectral class down and back up more than once, as they shed mass through stellar winds and outbursts like nebulae and novae and shift from core hydrogen fusion (e.g., to helium, carbon, then oxygen) as their primary source of radiant energy.

Roughly 90 percent of all dwarf stars have a mass between 0.085 (M8) and 0.8 (G8) in theory -- such as Tau Ceti (G8p) -- of that of our sun, Sol. About 10 percent of the stars, including Sol (G2), lie within the intermediate main sequence. While the lower limit of this range is 0.9 solar masses, the upper mass limit is uncertain, somewhere between six (B5) and 10 (B2) solar masses in theory.

Most of the stars discussed thus far will swell up and become giant stars for a period of about 20 percent of their main-sequence lifetime, as they use up their core hydrogen and begin fusing helium then heavier elements at higher temperatures. Our own sun will leave the main sequence by expanding from its current diameter of about 0.01 of an astronomical unit (AU) -- 1/100 of the distance from the Earth and to the sun -- to as much as one AU. Eventually, these giant stars will literally puff off their cooler outer layer of mostly unfused hydrogen into interstellar space as planetary nebulae, leaving behind the dense cores called "white" dwarfs that are as small as, or smaller, than the Earth in diameter but with 0.5 to 1.4 solar masses.

Less than one percent of all stars lie in the upper main sequence, between about eight (B3) and 120 (O3) solar masses in theory. These stars quickly consume their core hydrogen, swell up into larger "supergiants," but may blow up in supernovae. The end result of such explosions may be a neutron star (1.4 to six solar masses) or a more massive a black hole.

Small, cool, and faint M stars -- such as nearby Barnard's Star (M3.8) which may already be around 10 billion years old -- may last for 50 billion years or more before cooling into black dwarfs. However, the more massive a star is, the faster it consumes and sheds its mass, and the shorter it "lives" as a star. [The lifespan of a star is a function of their mass (or energy supply) and luminosity (rate of energy consumption) -- roughly proportional to 1/Mass raised to the power of 2.5.] The hottest and most massive stars may use up their hydrogen at such a pace that they last less than a million years, short compared with our sun's expected lifetime of about 10 billion years -- still about five billion to go. Vega, type A0, may live only one billion years; a type B star may live for 30-some million years; and the massive O types may last only as long as three to four million years. Hence, the OBA stars observed in our skies are relatively young stars compared with redder spectral types, and any planets found around these stars are unlikely to have had the time to have evolved multi-cellular lifeforms similar to those found on our 4.5 billion-year-old Earth. Since the estimated age of our galaxy is about 13 billion years or less, none of the lower mass stars (M to G8) have had time to fade from view, but most of the previously born, higher mass stars (B to O) have already perished.

Stars also are assigned luminosity classes:

Table 3: Yerkes luminosity classes: A number of different luminosity classes are distinguished and listed above.

Yerkes luminosity classes		
Luminosity class	Description	Examples
0 *or* Ia+	hypergiants or extremely luminous supergiants	Cygnus OB2#12 – B3-4Ia+ [18] V810 or Omicron1 Centauri (?)
Ia	luminous supergiants	Eta Canis Majoris – B5Ia [19] Antares Aa, Canopus
Iab	intermediate-size luminous supergiants	Gamma Cygni – F8Iab [20]
Ib	less luminous supergiants	Zeta Persei – B1Ib [21]
II	bright giants	Beta Leporis – G0II [22] Dubhe A, Tarazed
III	normal giants	Arcturus – K0III [23] Aldebaran Aa, Arcturus
IV	subgiants	Gamma Cassiopeiae – B0.5IVpe [24] Procyon A, Beta Hydri
V	main-sequence stars (dwarfs)	Achernar – B6Vep [21] Sol, Sirius A
sd (*prefix*) *or* VI	subdwarfs	HD 149382 – sdB5 *or* B5VI [25] Kapteyn's Star
D (*prefix*) *or* VII	white dwarfs [c]	van Maanen 2 – DZ8 [26] Procyon B, Sirius B

This classification system is perhaps a better indicator of a star's relative age and stage of evolution within its class as well as of its mass. Subdwarfs, such as nearby Kapteyn's Star (M0VI or M0sd), are more bluish than younger main-sequence dwarf stars and have a lower "metals" content of elements heavier than helium -- perhaps due to their birth in an earlier age (or region) of the galaxy when relatively few supernovae had as yet spewed their metals into surrounding dust clouds. Most of the stars in the central bulge and in the globular clusters of the galactic halo are old, low metals stars.

LOCAL STARS & STELLAR POPULATIONS. Stars in the solar neighborhood include representatives of the two major stellar populations of the galaxy, disk and halo stars.

Including the stars of the distant globular clusters, halo stars are among the galaxy's oldest, thought to be mostly 10 billion years and older. While halo stars are only very weakly concentrated towards the galactic plane, they exhibit a strong concentration towards and including the galactic nucleus but with highly eccentric orbits. These stars contain a very low metals abundance relative to the sun (with a mean around 0.02 of Sol's). Not surprisingly, there are very few halo stars are in the solar neighborhood (perhaps as low as 0.1 percent), but they include local subdwarfs, Kapteyn's Star (M0VI or M0sd) and Groombridge 1830 (a G8VIp with "superflares" that is now believe to be a single star -- no M-type flare star companion). Also called Population II stars because of their later discovery, this group also includes RR Lyrae variables with periods greater than 12 hours, subdwarfs and other extremely metal-poor stars, and some red giants.

Often called Population I stars, the relatively younger stars of the galactic disk can be further subdivided into four distinctive groups: very young spiral arm; young thin disk;

intermediate-age disk; and older thick disk and nucleus. As mentioned previously, the spiral arms include most of the galaxy's interstellar gas and dust, young stars, and stellar associations, including: O and B stars; supergiants; Cepheid variables; pre-main sequence, T-Tauri stars and Herbig-Haro objects (e.g., R Coronae Australis/ CD-37 13027); and some A stars. Less than a hundred million years old, these stars are rich in metals (as rich as, but ranging up to twice, Sol's abundance) and have highly circular galactic orbits within 1,000 ly of the galactic plane. While often extremely bright when not obscured by dust, these stars probably total substantially less than one percent of all Milky Way or nearby stars.

Young thin disk stars lie within 1,500 ly of the galactic plane and have galactic orbits of low eccentricity. Around one billion years or more in age, they include many A and F stars, AFGK giants, some GKM main-sequence dwarfs, and white dwarfs. While they have a mean metals abundance near Sol's (1.0), some may be twice as rich. Totalling as much as nine percent of all stars in the solar neighborhood, they include Sirius2 (A0-1Vm and A2-5VII -- also DA2-5) and Vega (A0Va).

Intermediate-age disk stars include our Sun (G2V), most G and some K and M dwarfs, some subgiants and red giants, and planetary nebulae. Many are around five billion years old and have a metals content ranging from 0.5 to 1.0 of Sol's (with a mean around 0.8). These stars lie within 3,000 ly of the galactic plane, with moderately eccentric galactic orbits. For example, Sol is traveling at seven kilometers per second north ward out of the plane and may eventually rise 200-250 ly above it after 15 million years, while the Alpha Centauri3 (G2V, K1V, and M5.5Ve flare star) system may eventually travel about 800 ly out with an upward velocity that is three times faster. As much as 84 percent of the stars in the solar neighborhood are included in this group.

Most thick disk and many nucleus stars are old. While many are more than eight billion years old, they are probably less than 10 billion years old. They include many K and M dwarfs, white dwarfs, some subgiants and red giants, moderately metals-poor stars, long-period variables, and RR Lyrae variables with periods less than 12 hours. Most thick disk stars lie within 5,000 ly of the galactic plane (thick disk mean of 3,500 ly) and have considerably eccentric orbits. Their metals abundance ranges from 0.2 to 0.5 of Sol's (with a thick disk mean of 0.3). Thick disk stars may comprise as much as four percent of nearby stars, including Lalande 2115 (M2.1V) which is moving perpendicular to the galactic plane at a fast velocity of 47 km/sec.

NOTABLE NEARBY STARS. More information on specific nearby stars (with links to research papers abstracted and electronically scanned by NASA and other organizations or by individual astronomers) is available at SolStation.com's web pages on Notable Nearby Stars.

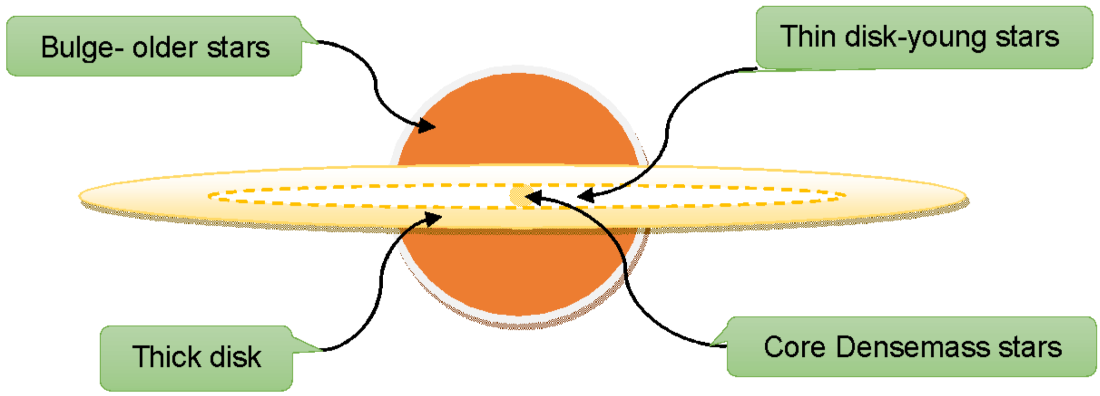

Fig 2. Milkyway or any Spiral Galaxy

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Larger and jumbo image.

Spiral galaxies like the Milky Way and its largest neighbor, Andromeda, have large central bulges of mostly older stars, as well as a relatively young thin spiral disk (surrounded by older, thick disk stars that may have come from mergers with satellite galaxies) and a luminous halo that includes numerous globular clusters (more).

Now we will form a Table of types of Stars in the Milkyway (See above fig):

Table 4: Types of Stars in various parts of Milkyway

Part of Milky-way	Types of stars in it	age
Local stars & stellar populations	disk stars	
-do-	disk and halo stars See Note1	10 billion years and older
-do-	distant globular cluster stars	10 billion years and older
Solar neighbour hood	subdwarfs, Kapteyn's Star (MoVI or Mosd) and Groombridge 1830 Note 2	
-do- Population II stars	RR Lyrae variables, subdwarfs and other extremely metal-poor stars, and some red giants. See Note3	
Galactic Disk	Population I 1. very young spiral arm; 2. young thin disk; 3. intermediate-age disk; 4. older thick disk and nucleus. See note 4	
Galactic disk and Spiral arms	young stars, and stellar associations, including: O and B stars; supergiants; Cepheid variables;	

	pre-main sequence, T-Tauri stars and Herbig-Haro objects (e.g., R Coronae Australis/CD-37 13027); and some A stars See note 4	
Young thin disk stars lie within 1,500 ly of the galactic plane	A and F stars, AFGK giants, some GKM main-sequence dwarfs, and white dwarfs See Note 5	one billion years or more
Intermediate-age disk stars lie within 3000 ly	our Sun (G2V), most G and some K and M dwarfs, some subgiants and red giants, and planetary nebulae see Note 6	
thick disk and many nucleus stars lie within 5,000 ly (thick disk mean of 3,500 ly)	K and M dwarfs, white dwarfs, some subgiants and red giants, moderately metals-poor stars, long-period variables, and RR Lyrae variables with periods less than 12 hours See Note 7	More than8 Billion years old

Note1: Halo stars show increasing concentration towards galactic center. They have low metal abundance compared to Sun.

Note 2: subdwarfs, Kapteyn's Star (M0VI or M0sd) and Groombridge 1830 (a G8VIp)

Note 3: These are Population II stars includes RR Lyrae variables, subdwarfs and other extremely metal-poor stars, and some red giants.

Note 4: Population I stars: includes galaxy's interstellar gas and dust, young stars, and stellar associations, including: O and B stars; supergiants; Cepheid variables; pre-main sequence, T-Tauri stars and Herbig-Haro objects (e.g., R Coronae Australis/CD-37 13027); and some A stars.

Note 5 : they include many A and F stars, AFGK giants, some GKM main-sequence Totalling as much as nine percent of all stars in the solar neighbourhood, they include Sirius2 (A0-1Vm and A2-5VII -- also DA2-5) and Vega (A0Va).

Note 6: Intermediate-age disk stars include our Sun (G2V), most G and some K and M dwarfs, some subgiants and red giants, and planetary nebulae. the Alpha Centauri3 (G2V, K1V, and M5.5Ve flare star) As much as 84 percent of the stars in the solar neighborhood are included in this group.

Note 7: Thick disk and many nucleus stars: They include many K and M dwarfs, white dwarfs, some subgiants and red giants, moderately metals-poor stars, long-period variables, and RR Lyrae variables with periods less than 12 hours. Thick disk stars may comprise as much as four percent of nearby stars.

IX. DISCUSSIONS AND CONCLUSION

Here in this paper we saw that

1. That High energy Cosmic rays can be originated from star light from our Milkyway or Any other Galaxy with a low energy. The light rays will gain frequencies and energies will become particles and gain energies to become High energy.
2. We did a simulation of Subbarao's path (Multiple Bending) with all the stars in a plane. A ray started will go on bend and its frequency gets upshifted and gains energy at every star in its path. Real star positions will be taken in a subsequent paper.
3. We have shown a table of star distributions in our Milkyway. This table will be used in the next paper where we will take the stars types possible at various locations in our Milkyway, and near real star simulation will be done.
4. Dynamic Universe Model proposed like the three additional sources 1. frequency up-

shifting of electro-magnetic radiation rays, 2.astronomical jets from Galaxy centres and 3. occasional solar flares from sun or other stars in Milkyway. We simulated and proved that first one ”frequency upshifting of electro-magnetic radiation rays” is a feasible solution to this problem of “Origins of Cosmic rays”.

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