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Study of General Theory of Relativityand Cosmological Model of Copernicus

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ABSTRACT

In this present paper, we studied about mechanics of general theory of relativity and cosmological model. Copernicus forwarded the process of gravitation and he explained that the velocity of a falling body is depending upon its mass.

Keywords: Relativity, Gravitational Radiation, Cosmological Model, Universe.

I. INTRODUCTION

Copernicus' view was significant – step forward towards an understanding of gravitation, for it started that gravity not only existed on the earth, but affected the other celestial bodies. Next, it was necessary to a falling body depended on its mass. Galileo is said to have started experimenting with different weights released simultaneously from the top of the leaning tower of Pisa in about 1589.Johannes Kepler (1571-1630) contribution was also important. His first scientific study, "The Cosmographic Enigma" which was published in 1596, was essentially a search for a numerical relationship between the various characteristics of the planetary orbits in the solar system.In 1602, Kepler discovered the second law of planetary-motion, viz, the radius-vector from the sum to any planet sweeps equal areas in equal intervals of time.In 1602, Kepler discovered the law later called the "first". Viz, the orbits of the planets are ellipses with the Sun at a focus.It is thought that Newron discovered the universal – law of gravitation F=G. Between 1667 to 1670, but he did not publish his discovery for a long time. At about the same time Robert Hooke (1635-1703), Giovanni Borelli (1608-1679) and Christian Huygens (1629-1695) all came under closeness in discovering the law, too. Hooke published an essay on the Earth's motion in 1674, in which he formulated the universal law of gravitation under the statement that the force was inversely proportional to the first power of the distance.

Consequently, we need a space-time, whose metric-tensor has components g(x) that change from point to point, i.e., the space-time should be curved. This enables us to consider geometrical properties of space – time that change at different points. The next problem is to determine the specific nature of the relationship between the values of the component's g and the properties of gravitational interactions. This was the task that Einstein & Grossmann formulated and began work on in their article. In the section "Physics", which Einstein wrote, he stated: "Thus we come the conclusion that in a general case the gravitational field is characterized be ten space-time functions. These ten functions replace Newton's Single gravitational potential [1-5].

II. GENERAL THEORY OF RELATIVITY

In "general Theory of Relativity", Einstein made a clear-cut relationship between gravitation and the principle of equivalence and accelerated frames. It has been known since Galileo's time that all bodies in the gravitational field of the earth have same acceleration, no matter what their individual properties (e.g. mass, substance, shape) are. Consequently, their accelerations depend on the points is space where they happen to be. Can we, therefore, attribute the gravitational characteristics (acceleration) to the points in space, where the bodies are, rather than to the bodies themselves? However, Minkowaski; s flat space- time does not have the properties needed to implement this idea- "it is homogeneous, that is everywhere uniform and isotropic (metric tensor) g are constant (their individual module are either zero or unity).That is, in a general case, only ten of its components are independent. These components are the main "bricks" for building the general relativity. One may ask why the interval is given in terms of a square/ This is mainly due to the symmetry properties of the interval with respect to the direction between two adjacent points (AB-BA) [3-5].

How do bodies move in a curved – spaced – time? It was quickly realized that test bodies (those with small masses) move along geodesics in curved-space time. In order to obtain a geodesic, the external path between two points must be found by setting the variation of the path between the two points equal to zero it the ends of the path are fixed.

III. COSMOLOGICAL MODEL OF COPERNICUS

The cosmological model of Copernicus required that the distance to stars be very much larger than an astronomical unit; otherwise, the parallax of the stars as the Earth goes around on its orbit, would be large enough to see with the naked eye.

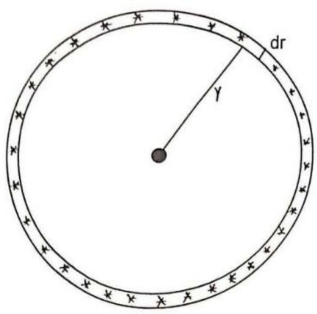

Figure 1 : A Star-filled spherical shell, of radius r and thickness dr, centered on the Earth

Moreover, since the Copernican system no longer requires that the stars be attached to a rotating celestial sphere, the stars can be at different distances from the Sun. These liberating realizations led Thomas Digges, and other post-Copernican astronomers, to embrance a model in which stars are large glowing spheres, like the Sun, scattered throughout infinite space [6-9]. Let's compute how bright we expect the night sky to be in an infinite universe.

Let n be the average number density of stars in the Universe, and Let L be the average stellar luminosity. The flux received here at Earth from a star of

Luminosity L at a distance r is given by an inverse square law:

$$f(r) = \frac{L}{4\pi r^2} \quad (1)$$

Now consider a thin spherical shell of stars, with radius r and thickness dr, centered on the Earth (Figure 1). The intensity of radiation from the shell of stars (that is, the power per unit area per steradian of the sky) will be.

$$f(r) = \frac{L}{4\pi r^2}.n.r^2 dr = \frac{nL}{4\pi}dr. \quad (2)$$

The total intensity of starlight from a shell thus depends only on its thickness, not on its distance from us. We can compute the total intensity of starlight from all the stars in the Universe by integrating over shells of all radii.

$$J = \int_{r=0}^{\infty} dJ = \frac{nL}{4\pi}\int_0^{\infty} dr = \infty. \quad (3)$$

Thus, I have demonstrated that the night sky is infinitely bright [10-12]. This is utter nonsense.

Therefore, one (or more) of the assumptions that went into the above analysis of the sky brightness must be wrong. Let's scrutinize some of the assumptions.

One assumption that we made is that we have an unobstructed line of sight to every star in the universe. This is not true. In fact, since stars have a finite angular size as seen from Earth, nearby stars will hide more distant stars from us from Earth, nearby stars will hide more distant stars from our view. Nevertheless, in an infinite distribution of stars, every line of sight should end at the surface of a star; this would imply a surface brightness for the sky equal to the surface brightness of a typical star [13-15]. This is an improvement on an infinitely bright sky, but is still distinctly different from the dark sky which we actually see. Heinrich Olbers himself tried to resolve Olbers Paradox by proposing that distant stars are hidden from view by interstellar matter which absorbs starlight. This resolution will not work, because the interstellar matter will be heated by starlight until it has the same temperature as the surface of a star. At that point, the interstellar matter emits as much light as it absorbs, and is glowing a brightly as the stars themselves [16,17].

A second assumption we made is that the number density n and mean luminosity L of stars are constant throughout the universe; more accurately, the assumption made in equation (3) is that the product nL is constant as a function of r. This might not be true. Distant stars might be less luminous as less numerous than nearby stars. If we are in a clump of stars of finite size, then the absence of stars at large distances will keep the night sky from being bright. Similarly, if distant stars are sufficiently low in luminosity to the sky brightness. In order for the integrated intensity in equation (3) to be finite, the product nL must fall off more rapidly than nL ∝ 1/er as r ∞.

A third assumption is that the universe is finitely large. This might not be true [18-23]. If the universe only extends to a maximum distance r_{max} from us, then the total intensity of starlight we see in the night sky will be j ~ $nLr_{max}/(4\pi)$. Note that this result will also be found if the universe is infinite in space, but is devoid of stars beyond a distance r_{max}.

A fourth assumption, slightly more subtle than the previous ones, in that the universe is infinitely old. This might not be true. Since the speed of light in finite, when we look farther out in space, we are looking farther out in time. Thus, we see the Sun as it was 8.3 minutes ago, Proxima Centauri as it was 4 years ago, and M231 as it was 2 million years ago [24-27].

If the universe has a finite age t_0, then intensity of starlight we see at night will be at most j ~ $nLct_0$ / (4π). Note that this result will also be found it the universe is infinitely old, but has only contained stars for a finite time t_0.

A fifth assumption is that the flux of light from a distant source is given by the inverse square law of equation (1). This might not be true. The assumption that

$f \propto 1/r^2$ would have seemed totally innocuous to Olbers and other nineteeth century astronomers; after all, the inverse square law follows directly from Euclid's laws of geometry. However, in the twentieth century, Albert Einstein, that great questions of assumptions, demonstrated that the Universe might not obey the laws of Euclidean geometry. In addition, the inverse square law assumes that the source of light is stationary relative to the observer. If the universe is systematically expanding or contracting, then the light from distant sources that will be redshifted to lower photon energies or blue shifted to higher photon energies [28-29].

IV. CONCLUSION

Finally, the infinitely large, eternally old, Euclidean universe which Thomas Digges and his successors pictured simply does not hold up to scrutiny. This is a textbook, not a suspense novel, so, I'll tell, you right now: the primary resolution to Olbers' Paradox comes from the fact that the universe has a finite age. The stars beyond some finite distance, called the horizon distance, are invisible to us because their light hasn't had time to reach us yet. A particularly amusing bit of cosmological trivia is that the first person to hint at the correct resolution of Olber's Paradox was Edgar Allen Poe. In his essay "Eureka: A Prose Poem", completed in the year 1848, Poe wrote, "Were the succession of stars endless, then the background of the sky would present us an [sic] uniform density…. since there could be absolutely no point, in all that background, at which would not exist a star. The only mode, therefore, in which under such a state of affairs, we could comprehend the voids which our telescopes find in innumerable directions, would be by supposing the distance of the invisible background so immense that no ray from it has yet been able to reach us at all.

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