

Local and Global Stability of the Universe

Marcelo Samuel Berman, Fernando de Mello Gomide

Instituto Albert Einstein/Latinamerica, Curitiba, Brazil

Email: msberman@institutoalberteinstein.org, marsambe@yahoo.com

Received January 23, 2013; revised March 5, 2013; accepted April 8, 2013

Copyright © 2013 Marcelo Samuel Berman, Fernando de Mello Gomide. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

We prove, by a general relativistic derivation, that the Universe is locally and globally, stable, resembling an extreme Kerr-white-hole—Universe.

Keywords: Stability; Universe

1. Introduction

Berman and da Costa [1] have shown that our Universe, even when endowed with a Universal Rotating state, is locally and globally stable. The proof involved the reparameterization of a generalized Robertson-Walker’s metric, into a Minkowski form, which is known to be stable.

Another proof, is going to be presented now. It is made out of the consideration that the Universe may be a rotating Kerr white-hole. More, we shall consider an “extreme” white-hole. Notice that local and global stability was, and will be established, when only Classical General Relativity is considered.

Let M, c, G, R stand respectively for the mass, speed of light in vacuo, Newtonian gravitational constant, and “radius” of the Universe. The resulting angular momentum, L , was formulated by Berman [2,3], by means of a theory that involved time-varying fundamental constants, as,

$$L = MRc = MR^2\omega, \quad (1)$$

where, of course,

$$\omega = c/R. \quad (2)$$

We shall see in the sequence, that extreme Kerr white holes, present this same angular momentum relation.

2. The Universe as a Kerr-White-Hole

Consider, the rotational parameter of Kerr’s white-hole,

$$a^2 \equiv \frac{J^2}{c^2 M^2}. \quad (3)$$

According to MTW [4], an isolated Kerr b.h. is Classi-

cally, stable, and the horizon is given by,

$$r_{\pm} = \frac{G}{c^2} \left[M \pm \sqrt{M^2 - a^2 c^2 / G^2} \right]. \quad (4)$$

Extreme black or white holes, are attained when spin is maximum, and the square root above is zero. Thus, we find, for the Universe,

$$R = GM/c^2, \quad (5)$$

and,

$$L = GM^2/c = RMc. \quad (6)$$

3. Experimental and Astrophysical Observations of Rotation

Birch [5,6] has been one of the first researchers who reported possible Universal Rotation data.

Now let us see some of the recent experimental evidence on the rotation or vorticity in the Universe.

1) Su and Chu [7] obtained, for a particular current model of the present Universe, a superior limit $\omega \leq 4 \times 10^{-17} \text{ rad} \cdot \text{s}^{-1}$.

2) Chechin [8], considering cosmic vacuum, and the global rotation compared with the induced rotation of elliptical galaxies, estimates $\omega \sim 10^{-19} \text{ rad} \cdot \text{s}^{-1}$.

3) With the data for rotation of the polarization of CMBR, which points to an angle of 0.1 rad [9], we find, dividing by the age of the Universe, $\omega \sim 10^{-19} \text{ rad} \cdot \text{s}^{-1}$.

We conclude that the rotation of the Universe, is real, and is the natural explanation for the Pioneers Anomaly. The fact that the sign of the angular speed could be negative, and not positive, makes the General Relativistic theory explain the left-handed preference. The spinning

down of the spacecrafts could also be explained by us, through rotation of the Universe, and then, there is an evidence of a cosmological frame-dragging.

1) Sidharth [10] concludes that numerous observations and studies suggest that Universe have some sort of overall rotation. By citing Pietronero[11], he adopts for the Universe, Berman's [12] angular speed, 3×10^{-18} rad/s.

Sidharth [10] has analysed the angular momentum associated with different scales in the Universe, beginning with stars, galaxies, superclusters, and finally, he extrapolates to the Universe as a whole. For stars, $J_S \sim 10^{34}$ cm-g-cm/s; for galaxies, $J_G \sim 10^{54}$ cm-g-cm/s; for superclusters, $J_C \sim 10^{74}$ cm-g-cm/s, and, then, next scale is the Universe, finding (Berman's [11]), $J_U \sim 10^{93}$ cm-g-cm/s. Of course, for Planck's Universe, we have Planck's constants as the angular momentum.

The logic of his formulae lie on relations of the type:

$$R = \frac{J}{Mv};$$

and, where, the virial theorem yields,

$$v^2 \sim \frac{GM}{R}.$$

There is an empirical relation relating the typical number N of superclusters, galaxies, etc, with each typical size l and its radii R .

$$R \sim l\sqrt{N},$$

the analoges of Compton wavelength.

The data for N is 10^6 for superclusters, 10^{11} for galaxies and stars in a galaxy and 10^{80} for the Universe; the typical size is 10^{25} cm for superclusters, 10^{23} cm for galaxies, etc.

The general idea is that every subset in the Universe has spin, so we may extrapolate for the whole Universe. Asimmetry and anisotropy in cosmic microwave background flutuations were analysed by WMAP data and were studied by Palle [12].

2) Godlowski [13] also studied observationaly the situation in different structures of Universe relating angular momentum and their sizes. It involves the question of individual cosmic structure rotations on various scales—from subatomic particles to stars and galaxies and he starts by asking a reasonable question is whether the Universe also rotates as a whole. Birch [5], considered position angles and polarizations of classic bright double radio sources and found that the differences in position angles and their polarization are correlated with their position on the sky. There followed ample discussion pros and cons, until empirical confirmation of the rotation of the Universe was undertaken by Nodland and Ralston, who studied correlactions between the directions and distances to galaxies and angle between the

polarization direction and their larger axis and found an effect which they interpreted as rotation of the polarization plane dependent on the distance.

Recently, Pontzen and Challinor, examining effects of cosmic microwave background radiation polarization induced by global rotation demonstrated that they could determined constraints on it. Su and Chu [7] obtained a limit by analysing the second order Sachs-Wolfe effects. Chechin [14] investigated the rotational effects of cosmic vacuum and he estimated from the induced rotation of elliptical galaxies that the angular speed of the Universe was about 10^{-19} rad/s. Ni [15] has reported a rotation of the polarization of CMBR around 0.1 rad which induces if considered through the age of the Universe, a similar angular speed. Ni [16] reported the giroscope Stanford GP-B which includes an uncertainty near 10^{-17} rad/s. This author admits the possibility of a cosmic universal rotation.

4. Conclusion

The rotating Universe is a peculiar “extreme” Kerr-white-hole, and, being isolated, is stable, both locally and globally.

5. Acknowledgements

MSB thanks Newton C. A. da Costa, Fernando M. Gomide, Nelson Suga, Mauro Tonasse, Antonio F. da F. Teixeira, and for the important incentive offered by Miss Solange Lima Kaczyk, now a brand new advocate, continued during the last five years of his research in Cosmology.

REFERENCES

- [1] M. S. Berman and N. C. A. da Costa, *Journal of Modern Physics*, Vol. 3, 2012, pp. 1211-1215. [doi:10.4236/jmp.2012.329156](https://doi.org/10.4236/jmp.2012.329156)
- [2] M. S. Berman, *RevMexAA*, Vol. 45-2, 2009, p. 139.
- [3] M. S. Berman, *RevMexAA*, Vol. 46-1, 2010, p. 23.
- [4] C. W. Misner, K. S. Thorne and J. A. Wheeler, “Gravitation,” Freeman, San Francisco, 1973.
- [5] P. Birch, *Nature*, Vol. 298, 1982, pp. 451-454. [doi:10.1038/298451a0](https://doi.org/10.1038/298451a0)
- [6] P. Birch, *Nature*, Vol. 301, 1983, p. 736. [doi:10.1038/301736a0](https://doi.org/10.1038/301736a0)
- [7] S. C. Su and M. C. Chu, *The Astrophysical Journal*, Vol. 703, 2009, p. 354. [doi:10.1088/0004-637X/703/1/354](https://doi.org/10.1088/0004-637X/703/1/354)
- [8] L. M. Chechin, *Astronomy Reports*, Vol. 54, 2010, pp. 719-723. [doi:10.1134/S1063772910080044](https://doi.org/10.1134/S1063772910080044)
- [9] W.-T. Ni, *Progress of Theoretical Physics, Supplement*, Vol. 172, 2008, pp. 49-60.
- [10] B. G. Sidhart, “Is the Universe Rotating?” Los Alamos Archives, arxiv:1004.4837.

- [11] L. Pietronero, *Nuovo Cimento*, Vol. B20, 1974, pp. 144-148. [doi:10.1007/BF02721115](https://doi.org/10.1007/BF02721115)
- [12] D. Palle, *Nuovo Cimento*, Vol. B119, 2004, p. 1121.
- [13] W. Godlowski, *International Journal of Modern Physics D*, Vol. 703, 2011, pp. 354-358.
- [14] L. M. Chechin, In: J. R. O. Connell and A. L. Hale, Eds., *The Big-Bang-Theory, Assumptions and Problems*, Nova Science Publishers, New York, 2012, pp. 103-171.
- [15] W.-T. Ni, *IJMP*, Vol. A24, 2009, pp. 3493-3500.
- [16] W.-T. Ni, *PRL*, Vol. 107, 2011, Article ID: 051103. [doi:10.1103/PhysRevLett.107.051103](https://doi.org/10.1103/PhysRevLett.107.051103)