

Realization of Einstein's Machian Program: the Pioneers and fly-by anomalies Part I

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Abstract In a previous paper (Berman, in *Astrophys. Space Sci.*, 2011), we showed how to prove the two Pioneers Anomalies, and now we add the fly-bys, by means of a rotating Universe. We discuss Einstein's Machian program, which we find as being fulfilled. Godlowski et al. (Los Alamos Archives, 2003) idea for a rotating General Relativistic Universe, led us to the adopted model. Updated evidence on rotation is cited (Godlowski, in Los Alamos Archives, 2011; Ni in *Phys. Rev. Lett.* 107(5):051103, 2011). We conclude that a rotating and expanding Universe may be the unique solution to the apparent divergences between Einstein and Mach. This is cosmologically important.

Keywords Cosmology · Einstein · Pioneers anomalies · Fly-by

1 Introduction

The purpose of the present paper is to give a viewpoint of the Einstein's Machian Program, hinting that, under this optics, it may have been already attained, through the possible rotation of the Universe, and, after reviewing an earlier paper (Berman 2011) published by this Journal, whereby the Godlowski method of introducing rotation in Cosmology, was presented, we then solve the three NASA anomalies, which are, the linear deceleration of the Pioneers in outer space, the spin-down of the same space-craft, and the fly-by anomaly that accompanies gravity assists, with a surplus of kinetic energy in the end. In the previous paper, neither

fly-by anomaly, nor the Einstein's program, nor the different kinds of relativistic rotations, had been considered. According to Ni (2011), the ultra-precise Gravity Probe B experiment analysis, leaves open the cosmic polarization rotation (which may be due to a Universal rotational state), and the limit of angular speeds attained by this experiment can be checked from the abstract of his paper, to be around 10^{-17} s^{-1} .

Though Einstein originally recognized Machian ideas as important, Barbour (1990) describes that Einstein concentrated himself first, into the construction of a local gravitational theory, delaying consideration on the relativity of motion, to a future global approach. According to Einstein, one should not speak, in a gravitational theory, on absolute accelerations of a coordinate system, as much as, in the Special Relativity Theory, one could not work with absolute speeds of an observer. This apparent betrayal of Machian ideas, was necessary in order to create the field equations of General Relativity. Mach, on the other side, placed the distinguished accelerated reference frame, within the distant stars, i.e., the local distinguished reference frames, could be identified by looking at the Cosmos as a whole.

Godlowski (2011) has reviewed the universal rotational evidence. Fine-tuning arguments can also be invoked in favour of such rotation. Gamow (1946), considered that a rotation and expansion of the Universe could have the same physical origin, and we equated the angular speed with the Hubble's parameter. Ni (2008, 2009) shows that a rotation of 0.1 radians exists in the polarization of CMBR. If we divide this angle by the age of the Universe, we find about 10^{-19} rad/s . Chechin (2010) finds the same result, by other token. The present author, thinks that it is time ripe now to reconsider the role of the distant stars reference frame as a paradigm of accelerations, and introducing the Universal rotation as proposed by Berman (2007).

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