STATISTICAL ANALYSIS OF THE OCCURRENCE OF PERIODICITIES IN GALAXY REDSHIFT DATA

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Abstract.

We investigate some of Tifft’s recent statistical analyses of periodicities in extragalactic redshift samples. The values of the periodicities are refinements of those predicted by Lehto. The redshifts have been corrected for the apparent motion of the solar system relative to the cosmic background radiation and have been filtered by applying criteria such as 21 cm profile width and redshift. In all cases except one, our Monte-Carlo simulations show general agreement with Tifft’s results. However, we find that one of his analyses is weakened by applying an inappropriate Bernoulli-trials statistic. We apply a new, more straightforward statistic that shows high statistical significance for some of the periodicities. We conclude that although some of Tifft’s procedures seem to be open to some criticism, the periodicities are present at a level that is statistically significant.

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1. Introduction

The concept of extra-galactic redshift periodicities (RSP), first introduced by Tifft (1976), has been discussed for some time now. The idea violates standard cosmology, which interprets the redshift as a continuous velocity. Objections to the work of Tifft and others are usually based on the contention that the statistical methods used are incorrect. In a recent paper on the structure of RSP, Tifft discusses a proposed periodic velocity rule (Lehto 1990, Tifft 1996) and uses it to predict a specific set of redshift periodicities. It is the purpose of this paper to investigate the statistical significance of certain correlations reported in Tifft (1996) between observed periods and those predicted by this formula.

The paper is structured as follows: (a) using the results readily available in the astronomical literature, we check Tifft's data samples; (b) we apply the statistical tests used by Tifft in order to check his numerical results; (c) a Monte Carlo technique is employed to investigate these statistical tests; the tests are examined critically and, where necessary, replaced by more suitable tests; (d) a new, simple test is devised which avoids using one of the free parameters in one of his tests.

2. Preliminary treatment of the data samples

All redshifts used in Tifft's (1996) paper and in this paper are from 21 cm observations. Uncertainties in such data are small. At signal-to-noise levels of 10 or greater, measurements can be repeated to within a fraction of a km s\(^{-1}\). Since most of the discussion is concerned with periods in excess of 4 km s\(^{-1}\), uncertainty in the data is of little consequence.

Tifft (1996) applied two corrections to the catalogued redshifts, which are all given in the literature as heliocentric. He first transformed the redshifts to a galactocentric frame of reference using a Lorentz transformation. The motion of the solar system about the galactic center was assumed to be represented by the velocity \((\theta, \pi, z)\), where \(\theta\) is the tangential component, positive in the direction of galactic rotation toward \(\ell = 90^\circ\). The radial component, \(\pi\), is taken to be positive inward toward \(\ell = 0^\circ\), and \(z\) is the component toward the north galactic pole. The numerical values used are \((232.2, -36.5, 0.2)\) km s\(^{-1}\).

Tifft (1996) has stated that spectral shifts relative to the CBR may not reflect actual kinematic motions. Accordingly, he treated the transformation from the galactocentric frame to the CBR as a Galilean transformation, not a Lorentz transformation. For the data samples discussed here, however, the differences are very slight.

For this transformation Tifft used the velocity \((-243, -31, 275)\) km s\(^{-1}\). The COBE value (Smoot et al, 1992) is \((-245, -23, 275)\) km s\(^{-1}\). For peri-