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Journal

Physics Letters A, 45(5)

ISSN

0375-9601

Authors

Weber, J
Trimble, V

Publication Date

1973-10-01

DOI

10.1016/0375-9601(73)90234-x

ON THE RESPONSE OF A GRAVITATIONAL RADIATION DETECTOR TO MAGNETIC FIELD FLUCTUATIONS*

J. WEBER
University of Maryland, College Park, USA

and

V. TRIMBLE†
University of California, Irvine and University of Maryland, College Park, USA

Received 24 August 1973

An attempt was made to measure the sensitivity of the Maryland gravitational radiation detector to fluctuating magnetic fields with frequencies of 0.1 to 30 Hertz. No response was found for fields along the cylinder axis and normal to it. For some of the tests, the weakest intensity to which any part of the cylinder was exposed exceeded 100 times the intensity of fluctuations of the earth's magnetic field at these frequencies.

We have studied the response of the University of Maryland gravitational radiation detector to low frequency, variable magnetic fields. The frequencies studied were 0.1 to 30 Hz, and the magnetic field intensity at the detector 0.01 to 0.41 gauss. The 1661 Hz aluminum cylinder antenna was fully operational, with the squared derivative of its power output displayed on a recorder during these experiments.

A variable magnetic field was provided by a coil 1.2 meter in diameter, wound with 200 turns. A fluxmeter at the center of the coil showed that a harmonically varying field with an amplitude of 0.44 ± 0.02 gauss was produced. The coil was switched on and off repeatedly at various fixed frequencies between 0.1 and 30 Hz. In addition, the power was kept on and the frequency swept across this range.

The experiment was tried with the coil in various positions and orientations. It was first placed along the axis of the cylindrical antenna, with the coil plane parallel to the cylinder end face, and 15 cm away from it, outside the vacuum chamber which contains the antenna. Next, it was rotated to a horizontal orientation, with the center of the coil along the cylinder axis and 1 meter from its face. From this position, the coil was rotated about the cylinder axis so that its plane was vertical. The the coil was moved to the side of the vacuum chamber, so that its center was 1.5 meter from the center of the cylinder, and the experiment tried with the coil plane horizontal then with the coil plane vertical and normal to the cylinder axis. Finally the coil plane was placed in a vertical position with plane parallel to the cylinder axis at 0.65 meter from the cylinder axis.

The amplitude of the variable magnetic field over the detector varied from 0.01 to 0.4 gauss for these various positions and orientations.

In no case was any change in the square of the derivative of the detector output observed, which could be ascribed to the applied magnetic field. Since the gravitational radiation detector coincidences involve pulses which are marginally distinguishable on the recorder traces, this implies that a fluctuating field would need to be at least as large as our applied field in order to produce a coincidence (and occur simultaneously at both detectors, of course) if the fluctuations were at these frequencies. The sensitivity of the detector to magnetic field variations at its own resonant frequency and submultiples thereof has been previously measured, and the lack of correlation of the coincidences with local magnetic field fluctuations at these frequencies reported [1].

Fluctuations in the earth's magnetic field at these frequencies have amplitudes of about 10^{-2} of those applied in this experiment. It does not, therefore, seem possible for low frequency geomagnetic field fluctuations to be responsible for the coincidences observed between widely separated gravitational ra-

* Supported in part by the U.S. National Science Foundation.
† Alfred P. Sloan Foundation Research Fellow.

diation detectors. The correlation between number of coincidences per day and the magnetospheric ring current intensity parameter, D_{st} (which measures fluctuations at these frequencies) reported by Tyson et al. [2] is, then, evidently not the result of straightforward causality. Perhaps the geomagnetic fluctuations and the gravitational radiation detector coincidences are in part excited by some common source.

We thank Drs. J.A. Tyson, C.G. Maclennan and L.J. Lanzerotti for permitting us to study their results in advance of publication.

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