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THE FRACTIONAL ZENER MODEL OF THE SPACETIME

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Abstract. In the last decade topnotch experiments (LIGO and GP-B) have putted into evidence the viscoelastic nature of the space time. In the present work we have applied the viscoelastic constitutive equations for a spacetime model, based on the fractional Zener representation, which is the most general way of thinking about materials. Dispersion and dissipation are discussed in the frame of the spacetime, considered as a viscoelastic material.

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1. Introduction

In the last ten years two very significant experiments have occurred: The LIGO Laser Interferometer Gravitational-Wave Observatory (there are twin LIGO detectors at Livingston Louisiana and Hanford Washington) and the Gravity Probe B (GP-B), both of them dealing with the General Relativity (GR) theory. LIGO [1] is an experiment concerning with the existence of the gravitational waves (GW), a phenomenon which was anticipated by Einstein decades ago. GPB has aimed to put into evidence how the Earth's rotation drags the local spacetime's frame with it (frame dragging was foresighted by Einstein as well). These two experiments were thought many years ago, the only one reason they were not achieved was the technological unsatisfactory level. It was needed a high accuracy because the expected experimental data was very small. For LIGO, it was expected to be finding a change in the arm length (the arm length of the GW detector is 4 km) of the order of 10^{-17} cm. For GP-B they have struggled to measure the drift of the orientation of a gyroscope's spin axis of 6,614.4 milli-arc-seconds per year in the orbital plane of the satellite caring the experiment, due to the curvature of Earth's local spacetime, and the drift of the spin axes of 40.9 milli-arc-seconds per year in a perpendicular