LABORATORY EXPERIMENTS ON QUANTUM DETECTION OF NON-NEWTONIAN GRAVITATIONAL EFFECTS†

by

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ABSTRACT

With macroscopic quantum inertial detectors it is now possible to investigate non-Newtonian gravitational effects on a quantum system. In this essay, we explore this new class of experiments, using the Lense-Thirring effect as an example. It is found that a superfluid helium interferometer could afford laboratory measurement of this and other small departures from Newtonian behavior. These highly sensitive differential inertial detectors can be used in investigating a broad class of questions at the juncture of Quantum Mechanics and General Relativity. For example, is there a quantum mechanical Mach's Principle?

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Biographical Sketch

A native of southern California, Dr. Tyson received his undergraduate degree (B.S., Physics) at Stanford University in 1962. In 1967 after receiving the M.S. and Ph.D. in Physics (with minor in astrophysics and astronomy) from the University of Wisconson, he joined the research staff at the University of Chicago as a National Research Council (AFOSR) Postdoctoral Fellow. His thesis and postdoctoral research was in the field of quantum fluids and critical phenomena. After a brief stay as visiting lecturer at Sussex University (England) and The Hebrew University of Jerusalem, he is now a Member of the Technical Staff at Bell Telephone Laboratories. Continuing research on superfluid helium, he is now pursuing laboratory investigation of D.C. and A.C. non-Newtonian gravitational effects. Married and living in the relative wilderness of northwest New Jersey, his other activities involve urban crisis programs, hiking and amateur astronomy/radio.