XIII. GRAVITATION RESEARCH*

Academic Research Staff

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RESEARCH OBJECTIVES

The research effort in this group is in the field of experimental relativity, in particular, experiments directed toward an understanding of the gravitational interaction and the experimental consequences of cosmological models.

Specific Research Activities

1. Long-term frequency stabilization of the Argon laser by using a molecular-beam reference. Preliminary work on this has been reported in Quarterly Progress Report No. 88, January 15, 1968 (pages 66-67). The scheme shows promise for long-term frequency stabilization to a few parts in 10^{12}. The stabilized laser will eventually be used in laser strain seismometry and a precision "ether" drift experiment.

2. Balloon-borne far infrared radiometer experiment to measure the 3°K black-body isotropic background noise that is alleged to be a remnant of the cosmological "Big Bang." The experiment, which is to be flown soon, will measure the total energy in the band $0 \rightarrow 12\ \mathrm{cm}^{-1}$, as well as a differential spectrum in this region. If the flight is successful, work will then continue in the development of a parametric up-converter infrared detector to measure the far infrared spectrum of the cosmic dust.

3. Gravitational vs atomic clock experiment to test the strong principle of equivalence, in particular to search for evidence for the Brans-Dicke scalar gravitational interaction which violates the strong principle. In this experiment an atomic oscillator and a gravitational oscillator are both placed in a space vehicle. One measures the number of axis crossings of the atomic oscillator per axis crossing of the gravitational field as the space vehicle travels through varying gravitational potentials, for example, from Earth to Jupiter. If the strong principle is satisfied, the ratio of axis crossings is an invariant. But if the Brans-Dicke theory is correct, the ratio changes by a few parts in 10^8 between Earth and Jupiter. At this stage, the entire effort is going into the design of the gravitational oscillator.

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