DEVELOPMENT OF A NEW SMALL ABSOLUTE GRAVIMETER

James E. Faller and Artyom Vitouchkine

JILA, National Institute for Standards and Technology and University of Colorado, Boulder, Colorado 80309-0440 USA (fallerj@jila.colorado.edu; fax: 303-492-5235)

We report here on the development of a small absolute gravimeter that is intended to facilitate gravity’s use in a variety of field applications. This free-fall absolute instrument (The position of a freely falling "mirror" in a Michelson-type optical interferometer is measured as a function of time.) uses a double-cam mechanism to generate a drop every 0.3 seconds. The instrument is inertially compensated through the use of the second cam that drives a balancing mass in the form of a second cart whose motion keeps the center of mass of the instrument fixed throughout the entire (cam-driven) release-drop-catch-return (measurement) cycle. As a result, there are (theoretically) no phase-related-to-the-drop recoil effects to introduce systematic errors into the measurement. The total dropping distance used for the measurement is short (presently 2.4 cm.); but the data rate is fast (200 drops per minute). Furthermore, the measurement rate is faster than the (carefully chosen) 1.2 second period of the SIMPLE spring that is used to isolate the reference corner cube. As a result, a "super-spring" type of isolator for the reference (stationary) mirror is not required. The beauty of this instrument is its simplicity together with its relatively small size. In addition, because it is an absolute instrument, it neither drifts nor evidences tares as do all relative gravimeters. This new gravimeter is intended to offer an absolute alternative to relative gravimeters for virtually all applications. Measurement results achieved with this instrument will be presented.