Search for Variations in the Strength and Frequency of Earth's Gravitational Field Using a Homemade Fiber Optic Gravitometer

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Extraterrestrial gravity is a unique force that impacts Earth’s tides. Measuring the impacts of gravity are most often observed with tides but still require further research to determine the nature of gravitational fields of the Earth and extraterrestrial objects. The objective of this research study was to develop a gravity measuring instrument that was able to detect high frequency and low frequency variations in Earth’s gravitational fields and extraterrestrial gravitational field. The instrument was based on a critically damped spring balance that supported a 2.7 kilogram test mass. The force related parameter in the spring balance was the displacement of the test mass in the direction of the gravitational force. The displacement was measured with a novel fiber optic bundle displacement sensor that utilized lock-in data acquisition. Calibration of the force constant was obtained by measuring the spring balance natural period of oscillation and the mass. The extraterrestrial force was distinguished from the terrestrial gravitational force by the measurement of the force related parameter over an extended period of time. The time dependent modulation over long periods of time, 24-48 hours, revealed the extraterrestrial gravitational force. Observations of shorter periods of time confirmed the existence of rapidly varying gravitation with a time constant of one to twenty seconds. The origin of these variations is unknown. The results of the experimental observations over longer periods of time confirmed that the greatest extraterrestrial gravitational force was that due to the sun.

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