Abstract Submitted
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Testing gravity with Lunar Laser Ranging: An update on the APOLLO experiment[1] JAMES BATTAT, Wellesley College, NICK COLMENARES, University of California, RODNEY DAVIS, Morehouse College, LOUISA HUANG RUIXUE, Wellesley College, THOMAS W. MURPHY, JR., University of California, APOLLO COLLABORATION — The mystery of dark energy and the incompatibility of quantum mechanics and General Relativity indicate the need for precision experimental probes of gravitational physics. The Earth-Moon-Sun system is a fertile laboratory for such tests. The Apache Point Observatory Lunar Laser-ranging Operation (APOLLO) makes optical range measurements to retro-reflectors on the Moon with one millimeter precision. These measurements of the lunar orbit enable incisive constraints on gravitational phenomena such as the Strong Equivalence Principle and dG/dt (among others). Until now, the APOLLO team had not been able to assess the accuracy of our data, in large part because known limitations to lunar range models ensure data-model residuals at the centimeter scale. To directly measure the APOLLO system timing accuracy, we have built an Absolute timing Calibration System (ACS) that delivers photons to our detector at known, stable time intervals using a pulsed fiber laser locked to a cesium frequency standard. This scheme provides real-time calibration of the APOLLO system timing, synchronous with the range measurements. We installed the calibration system in August, 2016. In this talk, we will describe the ACS design, and present present preliminary results from the ACS calibration campaign.

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