Abstract Submitted
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Space-based Approaches to Resolving the Neutron Lifetime Anomaly[1] DAVID LAWRENCE, JACK WILSON, Johns Hopkins University Applied Physics Laboratory, VINCENT EKE, JACOB KEGERREIS, Durham University, PATRICK PEPLOWSKI, Johns Hopkins University Applied Physics Laboratory — Free neutrons decay via the weak interaction with a mean lifetime of around 882 s. Knowledge of this lifetime is important as it provides constraints on the unitarity of the CKM matrix and is a key parameter for studies of Big Bang nucleosynthesis. Two classes of experiments have successfully made measurements of neutron lifetime: the 'Beam' class involve measuring the activation of cold neutron beams and the 'Bottle' class uses storage (material, magnetic and/or gravitational) to trap neutrons and measure the rate of decay during storage. However, there currently exists a 4-sigma disagreement between the 'beam' and 'bottle' measurements. Here, we discuss new techniques to measure the neutron lifetime using space-based neutron spectroscopy. We will present several possible designs for space-based experiments suitable for use at the Moon or terrestrial planets. These instruments are based on detectors previously flown on NASA planetary science missions including Lunar Prospector and MESSENGER. We will discuss the scale of expected systematics and place constraints on the mass, power and orbital characteristics required to make a measurement of neutron lifetime with sufficiently small uncertainty to help resolve the current discrepancy.

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