

Abstract Submitted  
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**A Sounding Rocket Payload to Test the Weak Equivalence Principle<sup>1</sup>** ROBERT D. REASENBERG, JAMES D. PHILLIPS, Harvard-Smithsonian Center for Astrophysics / SAO — We are developing SR-POEM, a payload for detecting a possible violation of the weak equivalence principle (WEP) while on a sounding rocket's free-fall trajectory. We estimate an uncertainty of  $\sigma(\eta) \leq 10^{-17}$  from a single flight. The experiment consists of calibration maneuvers plus eight 120 s drops of the two test masses (TMs). The instrument orientation will be reversed between successive drops, which reverses the signal but leaves most systematic errors unchanged. Each TM comprises three bars and a Y-shaped connector. The six bars are in a hexagonal housing and stand in a plane perpendicular to the symmetry axis (Z axis) of the payload and close to its CM. At a distance of 0.3 m along the Z axis, there is a highly stable plate that holds six of our tracking frequency laser gauges (TFGs), which measure the distances to the bars. The TMs are surrounded by capacitance plates, which allow both measurement and control of TM position and orientation. A central theme of the design is the prevention and correction of systematic error. Temperature stability of the instrument is essential and, during the brief night-time flight, it is achieved passively.

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