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Measuring Newtons Gravitational Constant from Space with LISA Pathnder MENGYU WANG, Iowa State University, JAMES THORPE, JACOB SLUTSKY, Gravitational Astrophysics Lab, NASA Goddard Space Flight Center, LISA PATHFINDER COLLABORATION — The value of Newtons Gravitational Constant (Big G) remains uncertain beyond the third significant digit; numerous experiments have produced results with non-overlapping confidence intervals. Identifying and controlling for systematic effects in Big G experiments is a significant challenge. The relative weakness of the gravitational force allows a myriad of influences to distort experimental results. In this work, we make a first attempt at measuring Big G with LISA Pathfinder (LPF) flight data. All Big G measurements to date have been performed from Earth's surface; a measurement from space presents the possibility to identify systematic errors inherent to terrestrial measurement. LPF has demonstrated the ability to measure differential acceleration between two test masses to femto-scale precision. This level of precision allows for a meaningful measurement of the change in differential acceleration between the test masses due to propellant expenditure. In addition to this direct measurement, mass flow sensor data and a gravitational finite element model of the LPF fuel system are used to develop a mathematical model predicting this propellant effect. A Markov Chain Monte Carlo method then fits this model to the observed data to produce probability distributions of the model

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