

Abstract Submitted
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Evidence for Patch Effect Forces on the Gravity Probe B Gyroscopes¹ DALE GILL, SAPS BUCHMAN, Stanford University — During the course of the GP-B on-orbit experiment the effect of anomalous forces were observed in the motion of the gyroscope rotors. A likely explanation for the origin of these forces is the existence of patch effect charges on the surface of the rotor. The effects observed were: a) increased misalignment torques; ~ 1 arcsec/deg/day, b) forces along the direction of the spin axis; 10^{-7} m/s², c) spin-down rates in excess of residual gas induced spin-down; 0.4-1.5 μ Hz/hr, d) charge measurement effects, e) modulation of control effort and position in excess of the ones caused by rotor geometry. While varying from gyroscope to gyroscope all effects are consistent with patches of 20-100mV with extent up to dipole configuration. This poster will present data from analysis of on-orbit performance and ground based experimentation to show that the effects arise from variations in the work function of the rotor's niobium coating. This poster will include details of the process for application of the coating onto the rotor. The results of a ground based experiment to map variation in the work function of flight spare rotors will also be presented. Finally some possibilities to mitigate these effects on future instruments will be presented.

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