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Trapped Flux Mapping for the Gravity Probe B Gyroscopes MICHAEL SALOMON, JOHN CONKLIN, MICHAEL DOLPHIN, G. MAC KEISER, ALEX SILBERGLEIT, PAUL WORDEN, Stanford University — Gravity Probe B uses measurements of the London moment dipole magnetic flux to find the orientation of its science gyroscopes. In this measurement are contributions from the trapped magnetic field generated by point-like field sources (fluxons) in rotor's superconducting coating. While the London moment signal appears at the space vehicle roll frequency (13 mHz), the trapped field appears at harmonics of the rotor spin frequency (60-80 Hz) which is modulated at the polhode period. This generates a time varying projection of the trapped flux along the London moment axis that results in an scale factor change in the orientation measurement system on the order of 0.5% to 3% (rotor dependent). One technique that can be used to remove the effect of this scale factor variation is to map the rotor trapped field pattern by using the spin harmonic signals (high frequency), and then use a dynamic model to assess the trapped flux contribution to the readout scale factor (low frequency). Two representations of this trapped flux map are proposed: 1) an expansion of magnetic potential in the rotor-fixed frame as a spherical harmonic series, and 2) the sum of individual fluxon contributions, each given by the same function of fluxon position relative to the pick-up loop. Specific features of both methods and their most recent results are given.

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