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Classical Torques on Gravity Probe B Gyroscopes[1] ALEX SILBERGLEIT, G. MAC KEISER, YOSHIMI OHSHIMA, Stanford University — Classical torques are a source of systematic error in Gravity Probe B experiment, so they were intensively studied throughout the whole program, which resulted in the detailed pre-flight Error Tree for each GP-B gyroscope. Extended classification of torques, their theory and examples are presented. Post-flight on-orbit calibrations showed unexpectedly large torque proportional to the spin-to-roll axis misalignment (proportionality up to $\sim$1 deg misalignment; misalignment through the science period within 50 arc-sec). The torque may be explained by a non-uniform distribution of electric potential over the rotor and housing surfaces (patch effect due to the micro-crystal structure, and/or dipole layer on the surface, etc.). A complete theory of the patch effect torque is established. It implies the corresponding signal model that allows one to separate the relativistic drift from the classical one and remove the effect of the latter, obtaining the desired accuracy of the relativistic drift rate determination. The most recent post-flight upper bound of the drift rate from all other classical torques is also given.

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