

Test mass charging and discharging in LISA

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In order to reach the observational goals of LISA, especially at low-frequency, the test masses that serve as the reference mirrors for the pico-meter interferometry measurement must be purely free falling with stray accelerations below $2.4 \text{ fm/s}^2/\sqrt{\text{Hz}}$ around 1 mHz. Forces produced by the electrostatic charge on the LISA test masses are a significant contribution to the acceleration noise budget. The charge builds up due to high-energy cosmic rays and solar energetic particles and can be discharged using photoemission under UV illumination of the gold-coated surfaces of the test mass and its housing. We present measurements of the test mass charging on LISA Pathfinder that allow us to understand the likely force noise and operational constraints related to discharging for LISA. We describe the performance of the LISA Pathfinder discharging system and the technology improvements, made possible by the availability of new semiconductor-based UV light sources that are under development for LISA.