



Contribution ID: 3

Type: **not specified**

Passive Charge Management of Floating Test Masses in Inertial Sensors

Tuesday, 21 May 2019 17:15 (15 minutes)

Summary

Floating test masses (TM) accumulate charge through cosmic radiation and the triboelectric effect thereby downgrading the measurement precision of high sensitivity instruments. Instruments of interest include accelerometers, drag-free sensors and interferometers. For the TM requiring very low residual charge, 0.1 pC to 10 pC, a control loop consisting of a TM, a charge measurement system and a source of charges is presently utilized. However, the charge measurement system adds to the instrument complexity, is limiting the range of critical design parameters and is in itself a source of disturbance for the measurement. Through ground testing and space flight validation we demonstrate a passive bipolar charge reduction system using UV generated photo-electrons. The system converges to less than 0.1 pC from both positive and negative charges and does not require TM charge measurement. It can be conceptualized as a “free-electrons grounding wire”

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Session Classification: Tu PM 3