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A Comprehensive Overview of Gravity Measurement Utilizing a SQUID

Thursday 25 July 2024 14:00 (2 hours)

In this study, we present a comprehensive overview of gravity measurement method utilizing SQUID (Superconducting QUantum Interference Device) at cryogenic temperatures, along with the associated equipment. The measurement of gravity is an exceptionally delicate process, susceptible to real-time changes influenced by environmental factors. Therefore, a highly stable and high-resolution measurement system is crucial. To dachieve stable measurements at cryogenic temperatures, we engineered a magnetically shielded liquid helium cryostat. Meticulously designed to ensure optimal magnetic shielding through a superconducting magnetic shield, this cryostat exhibits remarkably high efficiency in maintaining a cryogenic liquid reservoir. Due to the low value of the first critical field (H_{c1}) of niobium, the cryostat is enveloped by traditional high-permeability materials, μ-metal, serving as the primary shielding within the external housing. A superconducting gravimeter is a device designed to detect minute displacements of a proof mass levitated in a superconducting environment, responding to changes in gravity. The proof mass in the superconducting gravimeter module, uniquely developed by KRISS, is levitated through electromagnetic force, with the current in the levitation coil set to persistent mode. We demonstrate the equilibrium position of the levitated proof mass by evaluating the change in the coil inductance. Additionally, we discuss the gravimeter and its superconducting circuits, presenting preliminary results from Earth Tides measurements.

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