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Ground testing of release impulse for the aluminum test mass based on the compound pendulum

In the space gravitational wave detection program, the locking and releasing of test mass is one of the key technologies. The test mass is locked in during the launch phase of the spacecraft and then released during the scientific exploration phase, allowing it to go into free fall. Among them, the residual release impulse of the test mass is required to be in the order of magnitude of 10^{-5} kg m/s, so that the test mass can be trapped by the electrostatic feedback control. Based on the above content, a compound pendulum is built to measure the release impulse of the test mass. The test mass is locked by two thimbles in the opposite positions, and the release impulse is obtained by the swing of the pendulum. When the aluminum test mass is locked and released by the aluminum and the stainless steel thimbles, the release impulse and its uncertainty are in the order of magnitude of 10^{-5} kg m/s and 10^{-7} kg m/s, respectively. The double-thimble locking and releasing experiment based on the compound pendulum provides a feasible measurement scheme for the test of the release impulse in Tianqin project.

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