Characterizing an ultra-high sensitivity atom interferometry gravimeter

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Precisely measuring gravity acceleration g is of great interest for both fundamental research and practical applications. Instruments used to measure the absolute value of g have been highly developed during the last decades. In the recent development of gravimetry, cold-atom interferometry gravimeters play a crucial role for their high sensitivity and advantage of performing long time measurements. For high-precision gravity measurements and gravitational experiments, a cold-atom interferometry gravimeter with the aimed resolution of sub-micro Gal is being built in our cave laboratory. An atomic fountain based absolute gravimeter with a sensitivity of 4.2 $\mu\text{Gal}/\sqrt{\text{Hz}}$ is demonstrated after dramatically suppression of the vibration noise. The main noise sources are analyzed, and a sensitivity calibration experiment is performed. The accuracy of this sub-micro Gal atom gravimeter depends on the analyzing of systematic errors. The systematic errors induced by some physical effects, such as the alignment of the Raman laser, the light shift, the gravity gradient and so on, have been measured with modulation experiments.

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