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Field-operation of an atomic gravimeter for geodesy and metrology XUEJIAN WU, ZACHARY PAGEL, BOLA MALEK, HOLGER MLLER, University of California, Berkeley — Gravimeters are important in geodesy and metrology for gravity surveys, mineral exploration, natural disaster monitoring, and gravity determination for realizing the kilogram with the Watt balance. Compared to gravimeters based on springs, superconducting coils, microelectromechanical system devices, or falling cubes, atomic gravimeters are based on light-pulse atom interferometry. Since laser wavelength defines the photon momentum with high precision and no mechanical movement is involved with the measurement, atomic gravimeters can be more accurate and have better long-term stability. However, state-of-art atomic gravimeters are complicated and their application is usually restricted to well-controlled laboratories. Here, we report field-operation of an atomic gravimeter based on a simple laser system and a novel pyramidal magneto-optical trap. In the laboratory, we have measured the tidal gravity variation with a sensitivity of 370 $\mathrm{nm/s^2}/\sqrt{\mathrm{Hz}}$. The results show that the ocean tide loading is proportional to the water level in the San Francisco Bay. In the field operation, we have measured the absolute gravity on Berkeley hills. The atomic gravimeter has been transported in a trail of ˜4.7 km and measured absolute gravity with a variation of about 1 $\mathrm{mm/s^2}$. Field-deployable atomic gravimeters will bring precise absolute gravity measurements to geodesy and metrology.

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