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Development of transportable atomic gravimeters for field applications

Ken'ichi Nakagawa

Institute for Laser Science, University of Electro-Communications, Japan

Abstract

Atomic interferometers are promising technology for precision measurements of gravity and inertial forces. Atomic gravimeters based on atomic interferometry are expected to be high-precision gravimeters for geodesy, metrology, and geophysics. Transportable atomic gravimeters are required in the field applications such as seismology, gravity mapping. We have developed a transportable atomic gravimeter for the field applications. Our atomic gravimeter is based on an atomic interferometer with cold 87Rb atoms. We have developed a compact sensor head for the 87Rb atomic interferometer using a small glass cell. The sensor head has a height of 60cm and a diameter of 24 cm. We have also developed a compact laser system based on fiber optics and frequency doubling of diode lasers at 1560 nm. Fast frequency switching of diode lasers enables to produce the lasers for cooling, Raman transition, and detection. In our preliminary experiment, we could measure the interferometer fringe signal and determine the gravity acceleration g with a precision of about dg/g = 10-5. By optimizing the system, the sensitivity is expected to be improved by more than two orders. We will discuss the further investigation toward the realization of practical transportable atomic gravimeters for the field applications.