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Toward a high-accuracy quantum gravimeter using ultra-cold atoms

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Quantum sensors based on cold atoms have demonstrated unprecedented sensitivity, accuracy, and long-term stability that outcompetes "classical"sensors presently used for GPS-free positioning, navigation, and timing (PNT) systems. A crucial part of autonomous navigation is an accurate map of the local gravitational field. Portable absolute quantum gravimeters will enable higher-resolution gravity maps to be realized in airborne surveys, particularly in remote regions of Canada. We present the first results from a table-top quantum gravimeter using atom interferometry with laser-cooled rubidium atoms. This instrument employs optical Raman pulses to coherently split, reflect, and recombine atomic wavepackets in a Mach-Zehnder-like interferometer geometry. The phase shift of the resulting interference pattern provides a sensitive measurement of the gravitational acceleration experienced by the free-falling atoms. This instrument will serve as a high-accuracy gravity reference for future portable gravimeters.

Keyword-1

Quantum Sensing

Keyword-2

Matter-Wave Interferometry

Keyword-3

Laser Cooling and Trapping

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