Abstract Submitted
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Development of an Atom Interferometer Gravity Gradiometer for Earth Sciences[1] AKASH RAKHOLIA, ALEX SUGARBAKER, ADAM BLACK[2], AOSense, Inc., MARK KASEVICH, Stanford University, AOSense, Inc., BABAK SAIF, SCOTT LUTHCKE, LISA CALLAHAN, BERNARD D. SEERY, LEE FEINBERG, JOHN C. MATHER, RITVA KESKI-KUHA, NASA Goddard Space Flight Center — We report progress towards a prototype atom interferometer gravity gradiometer for Earth science studies from a satellite in low Earth orbit. The terrestrial prototype has a target sensitivity of 8×10^{-2} E/Hz$^{1/2}$ and consists of two atom sources running simultaneous interferometers with interrogation time $T = 300$ ms and $12\hbar k$ photon recoils, separated by a baseline of 2 m. By employing Raman sideband cooling and magnetic lensing, we will generate atomic ensembles with $N = 10^6$ atoms at a temperature of 3 nK. The sensitivity extrapolates to 7×10^{-5} E/Hz$^{1/2}$ in microgravity on board a satellite. Simulations derived from this sensitivity demonstrate a monthly time-variable gravity accuracy of 1 cm equivalent water height at 200 km resolution [3], yielding an improvement over GRACE by 1-2 orders of magnitude. A gravity gradiometer with this sensitivity would also benefit future planetary, lunar, and asteroidal missions.

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[3]S.B. Lutchke, *et al.* In proceedings of the American Geophysical Union Fall Meeting, San Francisco, California, 2016

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