Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Atom interferometry in an optical cavity PAUL HAMILTON, MATT JAFFE, JUSTIN BROWN, LOTHAR MAISENBACHER, BRIAN ESTEY, HOLGER MÜLLER, Univ of California - Berkeley — We have demonstrated the first light pulse atom interferometer using an in-vacuum optical cavity to generate the matter wave beamsplitters. An optical cavity allows for a compact setup with several advantages over traditional atom interferometers. Even with modest laser power, large intracavity intensity should enable high order multiphoton beamsplitters which increase the sensitivity of an interferometer. Clean wavefronts from spatial mode filtering can reduce contrast loss for both light pulse interferometers as well as optical lattice based interferometers. In addition, well-defined spatial modes allow many useful properties such as the beam size, waist position, and divergence to be determined with high accuracy. Finally, the use of high order transverse spatial modes gives multiple self-aligned beams useful in applications such as Sagnac interferometry for rotation sensing. We discuss our recent investigations into novel beamsplitters and interferometer geometries in the optical cavity and the implications for a compact inertial sensor as well as measurements of the gravitational Aharanov-Bohm effect and Newton's gravitational constant.

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Date submitted: 31 Jan 2014

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