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Single-shot, optical-phase-insensitive interferometry with BECs PAUL GRIFFIN, BILLY ROBERTSON, ANDREW MACKELLAR, JAMES HALKET, AIDAN ARNOLD, ERLING RIIS, University of Strathclyde — Atom interferometers allow the measurement of forces through detection of the differential phase shifts induced in the atomic wavefunction by the interaction. The atomic phase can then be readout against a lab-frame reference, typically the spatial phase of an optical standing wave. This readout is a leading limitation to practical measurement, requiring long temporal stability of the optical phase, without which the resolution of the atomic signal can be lost. We have built an atom interferometer that is inherently insensitive to the phase noise of the readout system. Here, we will describe new features developed in our Bose-Einstein condensate system, including tuneable, high-fidelity, symmetric atomic-beamsplitters through a multi-pulse Kapitza-Dirac scheme. We use an atomic homodyne detection that transfers the atomic phase into a temporal atomic beat-note, and show how the entire interferometric signal can be readout in a single shot. Results from the system include measurement of small-angle projection of the gravitational force, as well as the sensitivity of the atomic phase to gradients of magnetic fields.

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