Abstract Submitted
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Precision Measurements of Quantum Scattering Phase Shifts through Feshbach Resonances[1] AARON BENNETT, KURT GIBBLE, Pennsylvania State Univ — We present precision measurements of quantum scattering phase shifts through a series of Feshbach resonances. Using an atomic fountain clock, we scatter ultracold cesium atoms in a coherent superposition of the clock states off target atoms in all the other F, m_F states. Excluding the forward scattering and detecting only scattered atoms with velocity sensitive Raman transitions, we measure Ramsey fringes with a phase shift that is the difference of the clock states' s-wave quantum scattering phase shifts for scattering off of the target atoms [1,2]. We measure the magnetic field dependence of this differential phase shift and our low spread in collision energy yields phase variations of order $\pm\pi/2$ through a series of narrow Feshbach resonances. These measurements give a precise picture of cesium interactions, which in turn is expected to reduce the current uncertainty of the ultracold collision frequency shift below 100nK for laser-cooled space clocks and could also lead to stringent limits on the time variation of fundamental constants [3].

[1] R. A. Hart et al. Nature **446**, 892 (2007).
[2] S. D. Gensemer et al. Phys. Rev. Lett. **109**, 263201 (2012).
[3] C. Chin et al., Phys. Rev. Lett. **96**, 230801 (2006)

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