Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Direct Observation of the Difference of Scattering Phase Shifts RUSSELL HART, XINYE XU, KURT GIBBLE, Penn State University — We directly observe the difference of s-wave scattering phase shifts of Cs atoms in a juggling atomic fountain clock. In our fountain clock, we launch two balls of atoms in rapid succession so that they collide with relative velocities between 5 and 20 cm/s. After launching, the atoms are optically-pumped and cooled to 500 nK with degenerate sideband cooling in a far-detuned optical lattice. One ball, via several microwave transitions and a stimulated Raman transition, is velocity-selected and prepared in a superposition of the two Cs m_F=0 clock states. This coherent superposition scatters off of the atoms in the other ball, which is prepared in an F=4, m_F state. Each atomic state is phase shifted by the scattering. After a second $\pi/2$ pulse, we use a second velocity-selective stimulated-Raman transition to probe the scattered atoms. We vary the phase of the second $\pi/2$ pulse and detect the Ramsey fringes of the scattered atoms. To lowest order, the phase shift of the Ramsey fringes is independent of the atomic density and the interrogation time.

Kurt Gibble
Penn State University

Date submitted: 01 Feb 2006 Electronic form version 1.4