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Accumulator for Low-Energy Laser-Cooled Particles[1] KEVIN MERTES, PETER WALSTROM, MICHAEL DI ROSA, Los Alamos National Laboratory, LANL COLLABORATION — An accumulator builds phase-space density by use of a non-Hamiltonian process, thereby circumventing Liouville's theorem, which states that phase-space density is preserved in processes governed by Hamilton's equations. We have built an accumulator by a simple magneto-static cusp trap formed from two ring shaped permanent magnets. In traps with a central minimum of $|B|$, the stored particles are in a field-repelled (FR) Zeeman state, pushed away by $|B|$ and oscillating about its minimum. After laser-cooling our particles and before entering the trap, we employ the non-hamiltonian process of optical pumping: A FR particle approaches the trap and climbs to the top of the confining potential with a finite velocity. There, it is switched to a field seeking (FS) state. As the switch does not change the velocity, the particle proceeds into the trap but continues to lose momentum because, now in the FS state, the particles sees the decreasing field as a potential hill to climb. Before it comes to a halt, the particle is switched back to a FR state for storage. The process repeats, building the trapped number and density. A simple consideration of potential and kinetic energies would show the trapped particles to have less kinetic energy than those injected.

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