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Reversible mixing, persistent oscillation, and other dynamics in tunable atom chip waveguides RUDOLPH KOHN, JAMES STICKNEY, Space Dynamics Laboratory, BRIAN KASCH, SPENCER OLSON, MATTHEW SQUIRES, Air Force Research Laboratory — In a magnetic trap with no anharmonic terms, cold atoms exhibit persistent non-equilibrium dynamics, even in the presence of collisions. A trap with tunable harmonic and quartic terms, with all other terms minimized, can produce several other unusual behaviors, such as reversible mixing. Earlier work suggested that precise placement of current-bearing wires on an atom chip could produce such a trap, and our recent work realizes that theory. We explore several interesting behaviors of atoms in these traps, including persistent non-equilibrium oscillations ("sloshing"), controlled elimination of persistence by tuning the quartic term, as well as controlled dephasing, rephasing, and "phase-freezing" of the cloud's position and size oscillations by changing the sign and/or magnitude of the quartic term during the experiment. The ability to tune the trap shape means that undesired variations can be minimized by simple feedback, which may improve the feasibility of trapped atom interferometers.

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