Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

A table-top demonstration of an exact mechanical analog of a magnetic mirror PATRICIO ARRANGOIZ, PAUL BELLAN, California Institute of Technology — Long thought of as a peculiarity of electromagnetism, the well-known phenomenon of magnetic mirroring can now be understood as a property of any 2D Hamiltonian system having fast oscillatory motion in one direction and slow motion in the other. This property has recently been shown to apply to a much wider class of multidimensional systems with a periodic variable [R.J. Perkins and P.M. Bellan, PRL **105**, 124301 (2010)]. The purpose of this project is to build a table-top system that is an exact mechanical analog of a magnetic mirror. The system involves a small ball that is set in rolling motion on a saddle-like surface. The surface has a downhill parabolic profile (slow direction), with a groove of parabolic cross-section (fast direction) that narrows as one moves away from the center of the hill. The dynamics of the system is such that the adiabatic invariance effectively produces a return force opposing gravity. This return force prevents the ball from falling and makes it oscillate about the top of the hill. This behavior has been verified numerically for a variety of ball masses and surface parameters. Machining possibilities such as CNC microstepping on aluminum and 3D printing techniques are being investigated.

Paul Bellan
Caltech

Date submitted: 11 Jul 2012 Electronic form version 1.4