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Controlling atomic motion in optical billiards J. LÉPINE, G. PAINCHAUD-APRIL, J. POIRIER, Université Laval, L. J. DUBÉ, Uni. Laval - Uni. Pierre et Marie Curie — We present different scenarios to control atomic motion in optical billiards [1] under conditions where classical chaos is present. Since the billiard boundary is drawn with appropriately deflected beams of light, giving rise to an effective static potential barrier, the motion of the enclosed atoms can be influenced by judiciously chosen small dynamical deviations of the scanning beams. We in fact demonstrate, by realistic numerical simulations, that the, otherwise chaotic behaviour, can be controlled and made stable and predictable. By selecting different cavity shapes (stadium, multipolar deformations of the circle, (smoothed) polygons etc.), we study our stabilization approaches under conditions ranging from mixed to fully chaotic dynamics and analyse the effects of soft boundaries and imperfections on the robustness of the control techniques. This acquired controlled ability offers a new tool for testing fundamental questions at the border of classical and quantum chaos.

[1] V. Milner *et al.*, Phys.Rev. Lett. **86**, 1514 (2001) ; N. Friedman *et al.*, Phys. Rev. Lett. **86**, 1518 (2001).

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