

**MANIPULATING ATOMIC MATTER WAVES BY  
QUANTUM REFLECTION**

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We explore ways of exploiting atomic quantum reflection and reflection-based atom chip devices. The work is based on high performance simulations of Bose-Einstein condensates reflecting from microfabricated surfaces. In particular, we are concerned with understanding the role of inter-atomic interactions in the context of planar reflection, diffraction and focusing. We find that interactions can significantly alter the dynamics, density profiles, and phases of atom clouds when they are manipulated using such devices. However, we are able to establish parameter regimes which approximate single atom behavior well, allowing for clean manipulation and control of condensates.