QUANTUM REFLECTION OF BOSE-EINSTEIN CONDENSATES

Yong-il Shin
Research Laboratory of Electronics, MIT

We observed quantum reflection of ultracold atoms from the attractive potential of a solid surface. Extremely dilute Bose-Einstein condensates of ^{23}Na, with peak density 10^{11}-10^{12} atoms/cm^3, confined in a weak gravitomagnetic trap were normally incident on a silicon surface. Reflection probabilities of up to 20% were observed for incident velocities of 1-8 mm/s. The velocity dependence agrees qualitatively with the prediction for quantum reflection from the attractive Casimir-Polder potential. A patterned silicon surface with a square array of pillars was investigated to generate a weaker attractive potential, resulting in high reflection probabilities. The reflection probability was measured to saturate near 60%. We attribute this saturation to the mean-field interactions of a condensate, suppressing quantum reflection at low velocity.