

Fast transport of BECs in a neutral atom accelerator ring

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Abstract

Trapped atom-interferometry and atomtronics carry the promise of vastly increased sensitivity for fundamental (gravitation and even gravitational waves) and practical measurements (acceleration and rotation for navigation). The main obstacle to fulfilling this promise so far is the lack of any method of coherent transport of matter waves and Bose-Einstein Condensates (BEC) over macroscopic distances. Here we demonstrate for the first time an accelerator ring and waveguide for neutral atoms capable of rapid acceleration and coherence preserving transport of ultra-cold atomic clouds and BECs over distances of up to 40 cm. We accelerate the BECs to very high speeds (8x its velocity of sound) and transport them in ultra-smooth magnetic waveguide rings whilst preserving the internal coherence of the BECs.