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The a.c. and d.c. Josephson effects in a Bose-Einstein condensate
JEFF STEINHAUER, SHAHAR LEVY, ELIAS LAHOUD, ITAY SHOMRONI, Technion — We report the first observations of the a.c. and d.c. Josephson effects in a single BEC Josephson junction [1]. We also measure the chemical potential – current relation of the BEC Josephson junction. The coherent tunneling of the BEC is qualitatively altered by the thermal cloud, whose presence is varied. The system reported here constitutes a trapped-atom interferometer with continuous readout, which operates on the basis of the a.c. Josephson effect. This BEC Josephson junction is the first application of our new type of BEC system with ultra high-resolution, capable of applying almost arbitrary potentials and imaging on a tunneling length scale. In the a.c. Josephson effect, a constant chemical potential difference (voltage) is applied, which causes an oscillating current to flow through the barrier. In the d.c. Josephson effect, a small constant current is applied, resulting in a constant supercurrent flowing through the barrier. In a sense, the particles do not "feel" the presence of the tall tunneling barrier, and flow freely through it with no driving potential.

[1] S. Levy, E. Lahoud, I. Shomroni, and J. Steinhauer, *Nature* **449**, 579-583 (2007).

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