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# Microfabricated Magnetic Waveguides for Bose-Einstein Condensates

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## Personnel

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A Bose-Einstein condensate of atomic vapor can be used to build an atom laser - a source of coherent matter waves of unprecedented brightness. Atom lasers may well initiate a revolution in atom optics similar in scope to that brought about by the invention of the optical laser. Atom laser beams can be confined and shaped by magnetic fields, so that a magnetic waveguide can act as the analog of an optical fiber. Such waveguides can be constructed using micron-scale current-carrying wires deposited on an insulating substrate to form an "atom chip." MTL has fabricated a prototype atom chip, which we used to perform the first demonstration of guided flow of coherent matter waves. The wires were 50  $\mu\text{m}$  wide and were electroplated with copper to a thickness of 10  $\mu\text{m}$ . They were capable of carrying currents up to 1 A, enabling the high magnetic fields necessary for atom laser guiding. We may be able to use more sophisticated atom chips to construct on-chip atom interferometers for measurements of gravity gradients, acceleration, and rotation. Since large-scale atom interferometers already provide some of the best available measurements of these quantities, small and mobile atom interferometers would find a wide range of technical applications.

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