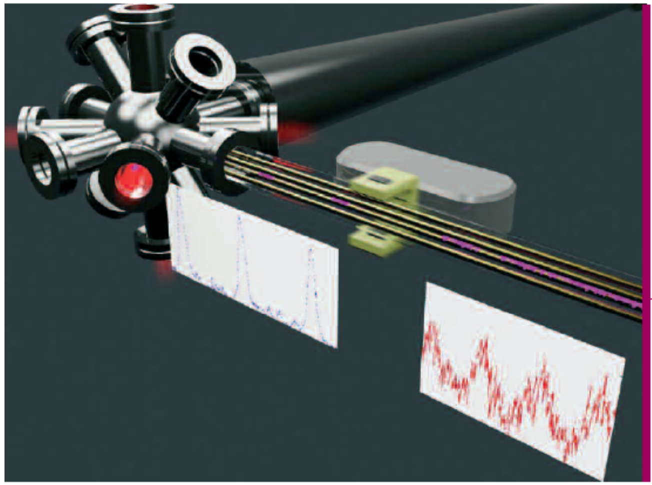
A Mirror to generate a beam

Intense sources of ultracold particles have proven to be a very useful tool for metrology and matter wave optics. In this context, the realization of a slow beam of neutrons through specular reflection on the blades of a rotor [1] has represented a breakthrough leading to many achievements in neutron optics and interferometry experiments. This scheme was also successfully applied to the slowing down of a supersonic beam of Helium, with the aim of realizing a very intense source for neutral atom optics experiments [2].

G. Reinaudi and coworkers have recently demonstrated the implementation of a similar technique with ultra-cold rubidium atoms. In their experimental setup, a laser-cooled atomic packet is sent into a 4.5 m long magnetic guide at a velocity of 1.7 m/s, and is subsequently slowed down by undergoing an elastic collision with a moving magnetic barrier. This magnetic "mirror" is provided by rare-earth permanent magnets mounted on a U-shaped support, and set in motion at an adjustable velocity by means of the mechanical conveyor belt on which it is fixed (see Figure).

This device permits the removal of up to 95 % of the longitudinal kinetic energy of the incident atomic packet. This technique was also extended to a set of packets periodically injected into the guide, resulting in the formation of a continuous, intense and very slow beam of ultracold atoms. Such a beam is a promising tool for atom-optics experiments including matter-wave interferometry, and is also a prerequisite for the achievement of a continuous "atom laser" [3]. ■



◀ Figure: Laser-cooled atomic packets are injected into a magnetic guide and slowed down by reflection on a moving magnetic barrier. The overlap of the successive slowed packets generates an ultra-slow guided beam.

G. Reinaudi, Z. Wang, A. Couvert, T. Lahaye, and D. Guéry-Odelin, "A moving magnetic mirror to slow down a bunch of atoms', *Eur. Phys. J.* D **40**, 405 (2006)

References

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