Magnetic transport of cold atoms over a large distance

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We report the transport of magnetically trapped cold atoms over a large distance. Atoms are first captured in a magneto-optical trap and loaded into a magnetic quadrupole trap. The quadrupole potential is then moved over a distance of 20 cm into a UHV chamber with a chain of quadrupole coils (Fig. 1). By running suitable currents through the quadrupole coil pairs it is possible to maintatin the aspect ratio of the potential during the transport process, thus minimizing heating of the trapped atom cloud. Due to the spatial separation of the final magnetic trap in the UHV chamber and the magneto-optical trap we have been able to capture atoms in the magneto-optical trap, while storing magnetically trapped atoms in the UHV chamber. By repeating the transfer process it is therefore in principle possible to repeatedly deliver cold atoms into the UHV chamber.

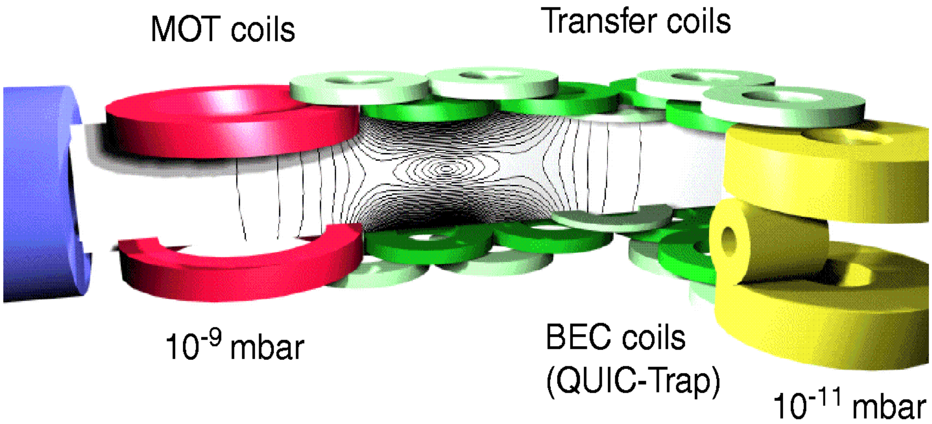

Figure 1: Experimental setup for the magnetic transfer of atoms.

So far we have been able to transfer 6×10^8 ^{87}Rb atoms from a vapor cell magneto-optical trap region ($p \approx 10^{-9}$ mbar) into the UHV chamber ($p = 1.8 \times 10^{-11}$ mbar) within a transfer time of 1 s at a temperature of 210 μK. The final magnetic trap in the UHV chamber provides perfect optical access from all six directions.

This novel experimental approach combines a compact and simple setup with features which are well suited for the production of single or mixed species Bose-Einstein condensates or maybe even a continuously operated Bose-Einstein condensate.