

Stand-alone vacuum cell for compact ultracold quantum technologies.

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In the drive to develop cold-atom quantum technologies, compact vacuum systems are key to enabling quantum sensing for real world applications. These vacuum systems not only have to be reduced in size, weight, and power compared to their traditional counterparts, but face other challenges.

Eliminating active pumping addresses both size and power, but introduces the issue of helium gas permeation as passive vacuum pumping techniques do not remove noble gases. Here we present a centilitre-scale vacuum cell, constructed from low helium permeable materials, with an integrated grating magneto-optical trap optic. This small vacuum cell can form the basis of a compact cold-atom source, when used in conjunction with a quadrupole

magnetic field and a single laser beam. This is step towards cold-atom sources being an off-the-shelf component, much like lasers are sources of coherent light.

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