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A Steady-State Bose-Einstein Condensate RODRIGO GONZALEZ ESCUDERO, CHUN-CHIA CHEN, SHAYNE BENNETTS, BENJAMIN PASQUIOU, FLORIAN SCHRECK, University of Amsterdam — We have created a steady-state Bose-Einstein condensate (BEC), a BEC in which losses are continuously balanced by adding atoms to a thermal reservoir surrounding it. We create a steady-state BEC by streaming a beam of strontium atoms through a sequence of spatially separated laser cooling stages. Cooling the gas to 1μK while simultaneously increasing its density. After precooling on a MHz-wide transition, we capture atoms in a steady-state narrow-line (kHz) MOT [1]. A beam of atoms is then coupled into a dipole guide and transported to a laser cooled reservoir [2]. In the final stage, atoms accumulate in a "dimple" trap, in which they are protected from resonant light by a transparency beam that shifts the atomic energy levels out of resonance [3]. The dimple provides a density increase while temperature is maintained by elastic collisions with atoms from the reservoir. The result is a phase-space density enhancement reaching quantum degeneracy. Steady-state is reached within 8s after which we always destructively detect a BEC of 15000 atoms for randomly chosen times up to 300s. This research opens new possibilities in the fields of quantum sensors and open dissipative quantum systems.[1]PRL 119, 223202 (2017). [2]Phys.Rev.Applied 12,044014 (2019).[3]PRL 110, 263003 (2013).

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