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Steady-state ultracold Sr with unity phase-space density CHUNCHIA CHEN, SHAYNE BENNETTS, RODRIGO GONZLEZ ESCUDERO, BENJAMIN PASQUIOU, FLORIAN SCHRECK, Van der Waals - Zeeman Institute, Institute of Physics, University of Amsterdam — We demonstrate a way to make a steady state sample of ultracold strontium with a phase-space density approaching degeneracy. This long-standing goal within atomic physics represents a critical step towards demonstrating steady-state quantum gas devices such as atom lasers, interferometers and superradiant lasers which hitherto have only been possible in pulsed operation. Our machine tackles this goal by simultaneously cooling atoms in spatially separated regions on both the broad 30-MHz and narrow 7.4-kHz linewidth Sr transitions [1]. In this way, we are able to continuously load a dipole trap at high phase space density in which a stark shift protected [2] dimple trap collects and concentrates the coldest atoms. We measure a steady-state atomic cloud with a phase-space density above unity. We discuss methods to characterize the atomic sample and search for signs of the existence of a steady-state Bose-Einstein condensate. [1] S. Bennetts et al, Phys. Rev. Lett. 119, 223202(2017). [2] S. Stellmer et al, Phys. Rev. Lett. 110, 263003(2013).

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