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Continuous BECs and superradiant clocks with strontium[1] SHAYNE BENNETTS, CHUN-CHIA CHEN, RODRIGO GONZALEZ-ESCUDERO, FRANCESCA FAMA, SHENG ZHOU, BENJAMIN PASQUIOU, FLORIAN SCHRECK, University of Amsterdam — We have demonstrated a steady-state Bose-Einstein Condensate (BEC), a BEC for which losses are compensated by stimulated gain from a continuously refilled thermal reservoir surrounding the condensate. By continuously streaming a beam of strontium atoms through a sequence of laser cooling stages [1, 2] we cool the gas to 1μK while simultaneously increasing its density to reach the quantum regime. After switching the system on, steady-state is reached within 8 seconds after which we always destructively detect a BEC of $\sim$15000 atoms at randomly chosen times up to 5 minutes. This represents a critical step towards developing steady-state atom lasers and interferometers which may offer advantages for some applications like gravitational wave detection. The same concepts used to create a steady-state degenerate gas can also be applied to generate high phase-space density beams [3] and samples opening the door for demonstrating a continuous active optical clock on a clock transition. We will describe our progress towards a superradiant optical clock in strontium. [1] Bennetts et al., PRL 119, 223202 (2017). [2] Stellmer et al., PRL 110, 263003 (2013). [3] Chen et al., Phys. Rev. Applied 12, 044014 (2019).

[1]NWO Vici 680-47-619, EU Horizon 2020: www.iqClock.eu 820404

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