

Abstract for an Invited Paper
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A steady-state superradiant laser with less than one intracavity photon¹

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We have demonstrated the quasi-continuous operation of a Raman laser that operates deep into the superradiant or bad-cavity regime.³ In this laser, laser-cooled Rb atoms act as the flywheel for phase information, in place of the photons in a good-cavity laser. The system can operate with as few as 0.2 intracavity photons and with an effective excited state decay linewidth < 1 Hz. This model system demonstrates key physics for future active optical clocks⁴ (similar to masers) that may achieve frequency linewidths approaching 1 mHz due to greatly reduced sensitivity to thermal and environmental mirror noise.

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⁴D. Meiser, J. Ye, D. R. Carlson, M. J. Holland, *Phys. Rev. Lett.* **201**, 163601-163604 (2009)