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Dynamics of Superradiant Lasers[1]

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A superradiant laser has been shown to operate with less than one photon on average inside of the optical cavity. In this regime, almost all of the phase information of the laser is stored in the atoms rather than the cavity field. As a result, the laser's phase is highly insensitive to both technical and fundamental thermal cavity mirror vibrations. This vibration noise presently limits the coherence of the best lasers as well as the precision of the optical lattice clocks that these lasers interrogate. We have explored the physics of superradiant lasers utilizing Raman transitions between hyperfine states in rubidium to mimic narrow optical transitions. In this talk, we will discuss the amplitude stability of our superradiant Raman laser, and the dynamics of phase synchronization in our system. We will also consider the prospects for future superradiant lasers that would lase on the same highly-forbidden transitions used in optical lattice clocks.

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