Abstract Submitted
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Trapped ion vibrational lasing from resonant illumination with a mode locked laser[1] CONRAD ROMAN, ANTHONY RANSFORD, MICHAEL IP, XUEPING LONG, University of California - Los Angeles, ANDREW JAYICH, University of California - Santa Barbara, WESLEY C. CAMPBELL, University of California - Los Angeles — Atomic transitions can resolve the structure of a resonant optical frequency comb if the excited state lifetime is significantly longer than the pulse repetition period. In the intermediate regime where the atomic state lifetime and pulse repetition period are comparable, we demonstrate Doppler cooling of a trapped Yb ion by a single tooth of a frequency-doubled optical frequency comb. These broadband pulses with high instantaneous intensities can be readily frequency-doubled to the ultraviolet with enough power to allow loading and Doppler cooling of atomic ion crystals without the need for a CW Doppler cooling laser. We additionally find that a multi-tooth effect gives rise to lasing of the ions harmonic motion in the trap, verified by acoustic injection locking. The gain saturation of this phonon laser action leads to a comb of steady-state oscillation amplitudes, permitting continued confinement despite the presence of hundreds of blue-detuned teeth.

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