

Abstract Submitted
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Optically levitated nanoparticle phonon laser¹ M. BHATTACHARYA, Rochester Inst of Tech, R. PETTIT, University of Rochester, W. GE, P. KUMAR, Rochester Institute of Technology, A.N. VAMIVAKAS, University of Rochester — We theoretically propose and experimentally realize a phonon laser using an optically levitated nanoparticle. In our system, mechanical gain and nonlinearity are supplied optically. We present theoretical evidence for stimulated emission of phonons, and experimental observations of i) threshold behavior as a function of gain, ii) the transition in phonon statistics from Boltzmann to Poisson across the threshold, and iii) subthermal phonon number squeezing far above threshold. Our data agrees well with a microscopic quantum mechanical theory. Our work represents a substantial advance in the generation of coherent phonons in levitated systems and can be readily extended to other physical platforms.

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