Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Proposal of a new type of optical parametric amplifier for efficient X-ray generation WAYNE HUANG, Texas A&M University, ROGER BACH, HERMAN BATELAAN, University of Nebraska-Lincoln, MARLAN SCULLY, Texas A&M University — With an optical parametric amplifier (OPA), one can transfer energy from the pump light to the seeded light via sum parametric resonance (also called parametric down conversion). In this process, coherent light with frequency lower than the pump is generated. Using infrared as pump, one can obtain light in the mid/far-infrared regime. In contrast to OPA, the quantum amplification by super-radiant emission of radiation (QASER) suggests that energy transfer can occur when the pump frequency is equal to the difference of the seeded frequencies [1]. Thus, coherent light with frequency much higher than the pump can be generated. The physical mechanism behind QASER is called difference parametric resonance. We propose to build a new type of optical parametric amplifier based on this concept and transfer energy from infrared to X-ray. In this presentation, I would like to capture the main idea of QASER by discussing the difference parametric resonance in a coupled oscillating system. A perturbation analysis is given to provide insight into the mechanism as well as the conditions for experimental realization. We will also briefly discuss realizations of difference parametric resonance in electronic, mechanical, and acoustic systems. [1] M. O. Scully et al., Phys. Rev X 3, 041001 (2013).

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Date submitted: 13 Nov 2014 Electronic form version 1.4