Abstract Submitted
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**Stimulated Emission of Terahertz Radiation from Internal ExcitonTransitions in $Cu_2O$**[1] B.A. SCHMID, R. HUBER, Y.R. SHEN, R.A. KAINDL, D.S. CHEMLA, Department of Physics, UC Berkeley, and Materials Sciences Division, Lawrence Berkeley National Laboratory — Excitons are among the most fundamental optical excitation modes in semiconductors. Resonant infrared pulses have been used to sensitively probe absorptive transitions between hydrogen-like bound pair states [1,2]. We report the first observation of the reverse quantum process: stimulated emission of electromagnetic radiation from intra-excitonic transitions [3]. Broadband terahertz pulses monitor the far-infrared electromagnetic response of $Cu_2O$ after ultrafast resonant photogeneration of $3p$ excitons. Stimulated emission from the $3p$ to the energetically lower $2s$ bound level occurs at a photon energy of 6.6 meV, with a cross section of $\sim 10^{-14}$ cm$^2$. Simultaneous excitation of both exciton levels, in turn, drives quantum beats which lead to efficient terahertz emission sharply peaked at the difference frequency. Our results demonstrate a new fundamental process of THz quantum optics and highlight analogies and differences between excitonic and atomic systems. [1] R. A. Kaindl et al., Nature **423**, 734 (2003). [2] M. Kubouchi et al., Phys. Rev. Lett. **94**, 016403 (2005). [3] R. Huber et al., Phys. Rev. Lett., to appear.

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