Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Electron-hole sound: Observation of coherent acoustic plasmons in photoexcited GaAs PRASHANT PADMANABHAN, STEVE YOUNG, MEREDITH HENSTRIDGE, SISHIR BHOWMICK, PALLAB BHATTACHARYA, ROBERTO MERLIN, The University of Michigan — Three-dimensional multi-component plasmas involving species with very different masses are expected to show a new branch of charge density fluctuations with a frequency dispersion that is linear with respect to the wave vector [1]. Not to be confused with similarly named modes of metallic surfaces [2], these bulk excitations are known as *acoustic plasmons*. In the past, they have been identified in some gas plasmas [3] and, notably, also in electron-hole plasmas in GaAs via spontaneous Raman scattering [4]. Here, we present the first observation of *coherent* acoustic plasmons in photoexcited GaAs. We utilize an ultrafast double pump-probe scheme to probe, in the time domain, the oscillations in the sample reflectivity associated with these modes. Results agree well with theoretical calculations based on the random phase approximation. The data also suggests that the coherent acoustic oscillation is driven by the interaction with modes resulting from the coupling between the longitudinal-optical-phonons and the conventional optical plasmons of the electrons. [1] J. Appel and A. W. Overhauser, Phys. Rev. B 26, 507 (1982). [2] B. Diaconescu, et al., Nature 448, 57 (2007). [3] A. Y. Wong, R. W. Motley, and N. D'Angelo, Phys. Rev. 133, A436 (1964). [4] A. Pinczuk, J. Shah, and P. A. Wolff, Phys. Rev. Lett. 47, 1487 (1981).

Prashant Padmanabhan
The University of Michigan

Date submitted: 28 Nov 2012 Electronic form version 1.4