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Charged Excitations of a Two Dimensional Electron System OLIVER DIAL, RAY ASHOORI, Massachusetts Institute of Technology, LOREN PFEIFFER, KEN WEST, Bell Laboratories, Alcatel-Lucent — Despite the central role that the tunneling (or single-particle) particle density of states (TDOS) plays in our theories of many- body systems, it has proven a difficult quantity to access experimentally in two dimensional electron systems (2DES). We have developed a technique, time domain capacitance spectroscopy, which allows measurement of the TDOS over a range of 30 meV centered about the Fermi surface, revealing the detailed structure present in these systems far from the Fermi energy. Remarkably, we observe a long-lived excitation in the 2DES whose creation requires more energy than is needed to eject an electron from the most tightly bound state in the 2DES. Based on its energy as a function of the 2D electron density and behavior when a magnetic field is applied, we identify this excitation as a hole in the 2DES coupled to a plasmon. Such a "plasmaron" has been predicted in calculations of the density of states for 3D [1] and 2D [2] electron gases, but it has never been definitively observed. These spectra may represent the first observation of this long-predicted quasiparticle in the 2DES. [1] L. Hedin, B.I. Lundqvist, and S. Lunqvist. Solid State Comm. 5, 237239 (1967). [2] P. von Allmen. Phys. Rev. B 46, 13345 (1992).

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