Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Observation and Spectroscopy of a Two-Electron Wigner Molecule in Ultra-Clean Carbon Nanotubes SHARON PECKER, Weizmann Institute of Science, Rehovot 76100, Israel, FERDINAND KUEMMETH, Niels Bohr Institute, University of Copenhagen, DK-2100 Copenhagen, ANDREA SECCHI, MASSIMO RONTANI, CNR-NANO Research Center S3, 41125 Modena, Italy, DAN RALPH, PAUL MCEUEN, Cornell University, Ithaca, New York 14853, USA, SHAHAL ILANI, Weizmann Institute of Science, Rehovot 76100, Israel — Coulomb interactions can have a decisive effect on the ground state of electronic systems. The simplest system in which interactions can play an interesting role is that of two electrons on a string. In the presence of strong interactions the two electrons are predicted to form a Wigner molecule, separating to the ends of the string due to their mutual repulsion. This spatial structure is believed to be clearly imprinted on the energy spectrum, yet to date a direct measurement of such a spectrum in a controllable one-dimensional setting is still missing. Here we use an ultra-clean suspended carbon nanotube to realize this strongly-correlated system in a tunable potential. Using tunneling spectroscopy we measure the excitation spectra of two interacting carriers, electrons or holes. Seven quantum states are identified, characterized by their spin and isospin quantum numbers. These states are seen to fall into two distinctive multiplets according to their exchange symmetries. Interestingly, we find that the splitting between multiplets is quenched by an order of magnitude compared to the non-interacting value. This quenching is shown to be a direct manifestation of the formation of a strongly-interacting Wigner-molecule ground state.

Sharon Pecker
Weizmann Institute of Science, Rehovot 76100, Israel

Date submitted: 20 Dec 2012 Electronic form version 1.4