Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Silicon Donor Array One-Dimensional Electron Gas[1] CHAO LEI, ALLAN H. MACDONALD, Univ of Texas, Austin — One strategy for establishing robust solid state quantum information processing hardware is to take exploit the relatively simple bound states that surround donors or acceptors in the most well understood semiconductor material, silicon. It is now possible to place donor atoms in a silicon crystal host with an spatial accuracy of close to one lattice constant. Because of the valley degree of freedom possessed by donor levels in silicon, this level of accuracy is not sufficient to avoid important disorder. With this motivation we present a theoretical study of a one-dimensional electron gas derived from the silicon conduction band and formed by electrons bound to a line of approximately equally spaced donors. We present a simple model for the central cell valley-dependent interactions that are responsible for valley splitting of donor levels in bulk silicon, explain how they are important source of disorder even for inaccuracies in donor placement that are only on the lattice constant scale, and explore the competition between interactions and disorder that ensues. Our emphasis is on exploring some of the interesting interacting electron physics that has been enabled by advances in controlling semiconductor donor and acceptor defects made with a quantum information motivation

[1]Department of Energy, Office of Basic Energy Sciences DE-FG02-ER45118 and Welch foundation TBF1473

Chao Lei
Univ of Texas, Austin

Date submitted: 09 Nov 2016 Electronic form version 1.4