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Quantum simulation of Fermi-Hubbard models in semiconductor quantum-dot arrays NA YOUNG KIM[1], Stanford University, TIM BYRNES, National Institute of Informatics, KENICHIRO KUSUDO, National Institute of Informatcis, YOSHIHISA YAMAMOTO, Stanford University — We propose a solid-state quantum simulator device to investigate a Fermi-Hubbard model including long-ranged Coulomb interactions. The device consists of an array of coupled quantum dots in a GaAs-based two-dimensional electron gas system. We launch an artificial lattice potential electrostatically by applying DC voltage to a periodically patterned thin film on top of the two-dimensional electron gas system. We tune both two competing energy terms – Coulomb interaction energy and kinetic energy- and the density of electrons independently, which enables us to construct a Hubbard phase diagram via differential conductance measurements. We consider the case of high average trapped electron density where more than the first bands are occupied. In this case, high mobility is still preserved and the effects of the Hubbard model would not be masked by impurities or disorder. We believe that a metal-Mott insulator quantum phase transition and a *d*-wave superconducting phase are observable in our proposed device according to the estimates of Hubbard parameters.

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