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Atomic scale quantum circuits in Si A. DUSKO, IF, UFRJ, Brazil / DP, uOttawa, Canada, M. KORKUSINSKI, IMS, NRC, Canada, A. SARAIVA, IF, UFRJ, Brazil, A. DELGADO, DP, uOttawa, Canada, B. KOILLER, IF, UFRJ, Brazil, P. HAWRYLAK, DP, uOttawa, Canada — The atomic scale circuits in Si are now realized by manipulation of dangling bonds on Si surface or incorporating dopant atoms in Si by STM techniques. We describe the electronic properties of these atomic scale quantum dot circuits (QDC) by the extended Hubbard-Kanamori Hamiltonian (HK), including on site Coulomb repulsion (U) and interdot hopping (t), direct interaction (V) and exchange (J) terms. The interdot terms strongly depend on dopant position (R_D) in Si lattice—small changes in R_D strongly impact t, $V$and J. We study how disorder in R_D impacts QDC electronic properties, in particular the interplay of disorder and interactions. With no disorder in R_D the energy spectrum (ES) of quantum dot chain at half-filling as a function of $U/t(V, J = 0)$shows a transition from ES dominated by kinetic energy ($U/t << 1$) to ES dominated by Coulomb interactions for $U/t >> 1$. The excited states group by single particle energy spacing (Hubbard bands) for weak (strong) interactions. In the weak interaction regime, disorder leads to localization, which strongly affects the electronic properties. We explore the effect of interactions and disorder on HK atomic scale circuits and potential many-body localized phases using Lanczos and Density Matrix Renormalization Group approaches.

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