Fractionalization in a square-lattice model with time-reversal symmetry

MARCEL FRANZ, CONAN WEEKS, BABAK SERADJEH, University of British Columbia — We propose a two-dimensional time-reversal invariant system of essentially non-interacting electrons on a square lattice that exhibits configurations with fractional charges $\pm e/2$. These are vortex-like topological defects in the dimerization order parameter describing spatial modulation in the electron hopping amplitudes. Charge fractionalization occurs via a mechanism similar to that in graphene with the “Kekule” distortion and is established by a simple electron counting argument, analytical calculation within the effective low-energy theory, and by an exact numerical diagonalization of the lattice Hamiltonian.

$^1$Work supported by NSERC, CIFAR and NSF.