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Ferromagnetism and stability of three-fermion clusters in two-dimensional lattices PAVEL KORNILOVITCH, Hewlett-Packard Company — A three-body spin-$\frac{1}{2}$ fermion problem with on-site repulsion and nearest-neighbor attraction is solved on a one-dimensional chain and on a two-dimensional square lattice by discretizing the Schroedinger equation in momentum space. Energies of bound complexes (trions) and their binding conditions are obtained for total spins S = 1/2 and S = 3/2. In the S = 1/2 sector in one dimension, a narrow but finite parameter region is identified where the ground state consists of a stable fermion pair and an unbound fermion [EPL, 103, 27005 (2013)]. In the S = 1/2 sector in two dimensions, a much wider region of pair stability is found. The stability is attributed to the formation of a centrifugal barrier for the third fermion. In the S = 3/2 sector in two dimensions, trions are found to form before triplet pairs indicating "Borromean" coupling. In the strong-attraction limit in two dimensions, the system transitions from an S = 1/2 ground state to a ferromagnetic S = 3/2 ground state in agreement with the Nagaoka theorem for a four-site plaquette.

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