Ring-exchange interactions in solid ^{3}He

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A brief pedagogical review is given on the ring-exchange interactions in solid ^{3}He. Starting from general spin-independent interactions among identical fermions with spin 1/2, we derive an effective spin Hamiltonian for localized fermions [1, 2]. The spin Hamiltonian contains multiple-spin exchange terms, among which two-, three-, and four-particle ring exchange terms are considered to be most important in solid ^{3}He. The u2d2 spin structure found in the bcc solid ^{3}He was nicely explained in terms of four-particle exchange interactions [2]. 2D solid ^{3}He is another example where the ring exchange interactions play an important role. We review some theoretical studies on the ring-exchange model on the triangular lattice [3,4].

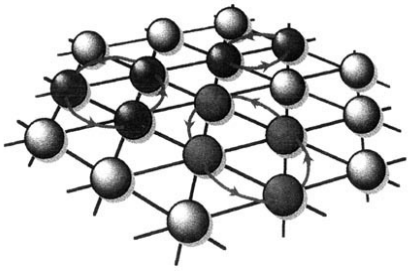

FIG.1: Schematic drawing of two-, three and four-particle exchanges in a triangular lattice.

[1] D. J. Thouless, Proc. Phys. Soc. London **86**, 893 (1965)
[2]M. Roger et al, Rev. Mod. Phys. **55**, 1 (1983)
[3] T. Momoi et al, Phys. Rev. B **59**,9491 (1999)
[4]G. Misguich et al, Phys. Rev. B **60**,1064 (1999)