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(I) Microscopic Theory of Spin Frustration in Quantum Magnets

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Elementary excitations in highly entangled states such as quantum spin liquids may exhibit exotic statistics, different from those obeyed by fundamental bosons and fermions. Excitations called non-Abelian anyons are predicted to exist in a Kitaev spin liquid - the ground state of an exactly solvable model proposed by Kitaev. Material realization of the spin liquid has been the subject of intense research in recent years. The 4d honeycomb Mott insulator α–RuCl3 has emerged as a leading candidate, as it enters a field-induced magnetically disordered state where a half-integer quantized thermal Hall conductivity was reported. I will present a microscopic theory of generic spin models, including Kitaev and other bond-dependent spin-interactions responsible for disordered phases. Essential ingredients to engineer spin liquids, applications to materials, and the intriguing link to exotic multipolar orders in transition metals will be also discussed.

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