CONFÉRENCE DE PHYSIQUE

The Search for Spin-Liquid Ground States in Real Materials

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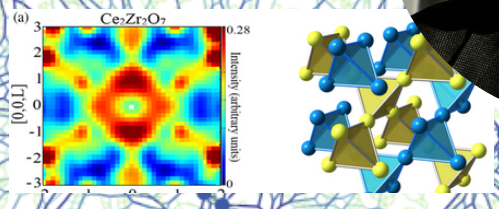

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Most materials have a disordered, entropy-dominated, state at high temperatures and an ordered, energy dominated, state at low temperatures, but there are exceptional examples of materials which maintain disorder down to the lowest temperatures. Liquid He is one such material which stays in a liquid state to T=0. This occurs as the He atoms interact with each other only weakly, and are very light, so they are prone to strong quantum zero point motion. The net result is that a superfluid state exists in liquid He at the lowest temperatures and ambient pressures. Physicists have argued and speculated about the existence of a magnetic analogy to such a quantum liquid state, but experimental manifestations of such a quantum disordered magnetic state - a quantum spin liquid - have been surprisingly difficult to realize. I will introduce the ideas, mainly based on "geometrical frustration", that have been explored recently in trying to identify such exotic magnetic ground states in real materials, with particular emphasis on "spin ice" and "quantum spin ice" states that likely exist in a class of rare earth transition metal systems, known as rare earth pyrochlores.

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