Charge ordering in a pure spin model: spin-ice

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In this talk we discuss the dipolar spin-ice model at fixed density of single excitations, ρ, where processes of creation and annihilation of such excitations are banned. In the very dilute limit this model coincides with the usual dipolar spin-ice model at low temperatures, with the additional advantage that a negligible number of monopoles allows for equilibration even at the lowest temperatures. Thus, the transition to the ordered fundamental state found by Melko *et* al in 2001 is reached using simple local spin flip dynamics. As the density is increased, the monopolar nature of the excitations becomes apparent: the system shows a rich ρ vs. T phase diagram with "charge" ordering transitions analogous to that observed for Coulomb charges in lattices. A further layer of complexity is revealed by the existence of order both within the charges and their associated vacuum, which can only be described in terms of spins –the true microscopic degrees of freedom of the system.