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Phase diagram of split 2D dipolar spin ice TOMMASO ROSCILDE, LOUIS-PAUL HENRY, Ecole Normale Superieure de Lyon — Long-ranged dipolar interactions, which are very natural in artificial square-lattice spin ice, can mask some of the most relevant aspects of spin-ice physics, as they remove the extensive degeneracy of the ground state manifold to give a unique ground state, and they bind monopole pairs into localized spin flips. Following an earlier idea of G. Möller and R. Moessner [Phys. Rev. Lett. 96, 237202 (2006)] we investigate how adding a third direction to square ice allows to recover fundamental traits of spin-ice physics even in the presence of dipolar interactions. Using Monte Carlo simulations based on a generalized loop algorithm, we explore the phase diagram of square dipolar spin ice in which horizontal and vertical dipoles are spatially separated in a third direction (split 2D spin ice). As a function of the splitting we recover a two-fold degenerate staggered state for coplanar dipoles, and a four-fold degenerate "Manhattan" state for strongly split dipoles, separated by a first order transition. The competition between the two states at intermediate splitting leads to a strong suppression of the ordering transition temperatures, and makes space for the observation of a hallmark of spin-ice physics in the paramagnetic phase: pinch points in the static structure factor.

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