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Dipolar order by disorder in the classical Heisenberg antiferromagnet on the kagome lattice

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The first experiments on the "kagome bilayer" SCGO triggered a wave of interest in kagome antiferromagnets in particular, and frustrated systems in general. A cluster of early seminal theoretical papers established kagome magnets as model systems for novel ordering phenomena, discussing in particular spin liquidity, partial order, disorder-free glassiness and order by disorder. Despite significant recent progress in understanding the ground state for the quantum $S = 1/2$ model, the nature of the low-temperature phase for the classical kagome Heisenberg antiferromagnet has remained a mystery: the non-linear nature of the fluctuations around the exponentially numerous harmonically degenerate ground states has not permitted a controlled theory, while its complex energy landscape has precluded numerical simulations at low temperature. Here we present an efficient Monte Carlo algorithm which removes the latter obstacle. Our simulations detect a low-temperature regime in which correlations saturate at a remarkably small value. Feeding these results into an effective model and analyzing the results in the framework of an appropriate field theory implies the presence of long-range dipolar spin order with a tripled unit cell.

[1] G.-W. Chern and R. Moessner, Phys. Rev. Lett. **110**, 077201 (2013).