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Quantum Phases of the Cairo Pentagonal Lattice IOANNIS ROUSOCHATZAKIS, ANDREAS M. LAEUCHLI, RODERICH MOESSNER, Max Planck Institute for the Physics of Complex Systems, NEW STATES OF QUANTUM MATTER TEAM — We present an analytical and numerical study of the spin S=1/2 antiferromagnetic Heisenberg model on the Cairo pentagonal lattice. This is the dual of the Shastry-Sutherland lattice and has been discussed as a possible new candidate for having a spin liquid ground state [1]. More recently a S=5/2 version of this model has been realized in the Bi2Fe4O9 system [2]. Here we use a model with two different types of exchange couplings and investigate the nature of the ground state as a function of their ratio. This strategy allows us to understand the nature of a number of phases and derive effective models for their description with and without a magnetic field. Of particular interest is a surprising interplay between a collinear and a four-sublattice orthogonal phase due to an underlying order-by-disorder mechanism. Furthermore we address the issue of possible non-magnetic ground states such as singlet and spin nematic phases.

[1] K. S. Raman, R. Moessner, and S. L. Sondhi, PRB 72, 064413 (2005)
[2] E. Ressouche, V. Simonet, B. Canals, M. Gospodinov, and V. Skumryev, PRL 103, 267204 (2009)

Ioannis Rousochatzakis
Max Planck Institute for the Physics of Complex Systems

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