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**Columnar and superfluid order in an extended Shastry-Sutherland model** KEOLA WIERSCHEM, PINAKI SENGUPTA, Nanyang Technological University — The low temperature magnetic properties of several rare-earth tetraborides have been shown to be well-characterized by an extension of the Shastry-Sutherland model (SSM). This extension includes additional next-nearest-neighbor bonds, and the exchange interaction along all bonds is anisotropic with strictly ferromagnetic transverse exchange. The extended SSM is thus equivalent to a system of hard-core bosons and is free of the quantum Monte Carlo (QMC) sign problem. Using large scale QMC simulations, we study the phase diagram of the extended SSM in a new parameter regime that stabilizes a zero-field columnar antiferromagnetic state. We show how application of an external magnetic field can induce a phase transition to a spin supersolid phase. We compare the overall magnetization process to experimental observations of  $\text{ErB}_4$ , a rare-earth tetraboride with ground state columnar antiferromagnetic ordering. Finally, we speculate that if the zero-field columnar order present in  $\text{ErB}_4$  is driven by similar interactions it may also possess a field-induced supersolid phase.

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