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Quantum Orders and Space-Time Vortices for Spin 2 Atomic Chains ARI TURNER, University of Amsterdam, FRANK POLLMANN, Max-Planck-Institute for the Physics of Complex Systems, ASHVIN VISHWANATH, University of California, Berkeley — Laser cooled atoms with spin can become magnetically ordered, like electrons in solids, but a greater variety of orders is possible in this setting. Spin one atoms can form nematic states with the symmetry of an undirected line segment while spin two atoms can form states with the symmetry of a tetrahedron. Such atoms could be confined to a one-dimensional optical lattice. In one dimension, quantum fluctuations become much more significant, and lead to a few interesting phases. In particular, the nematic state spontaneously breaks translational symmetry. If a state has a Berry's phase of a certain order under rotations, the fluctuations will often be modulated with a period of the same order. I will argue that this connection can be broken for a non-abelian symmetry group–both uniform and periodic phases can be stabilized. As an example, computer calculations (with DMRG) on a tetrahedral state find both a uniform and a period 3 phase.

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