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Elastic Order by Disorder in an Ising Antiferromagnet ANTON SOUSLOV, University of Pennsylvania, YAIR SHOKEF, Weizmann Institute of Science, T.C. LUBENSKY, University of Pennsylvania — By exactly calculating the elastic deformations of the anti-ferromagnetic Ising model on a deformable triangular lattice, we show that the ground state, missed in previous studies [1], has a sub-extensive degeneracy with entropy proportional to the square root of the number or sites. A sample configuration can be visualized as randomly zigzagging stripes [2]. We study the low-temperature behavior of the system by calculating the entropic contributions of phonon excitations to the free energy. Examining several fixed spin configurations, we argue that straight stripes are preferred at low temperature. In other words, the disordered ground-state at zero temperature is converted to an ordered striped state at nonzero temperature via thermal phonon fluctuations: a classic order-from-disorder effect. We use Monte Carlo simulations to back up our analytical results and examine the dynamics of relaxation. Because of large energy barriers between the degenerate ground states, the systems first falls into a glassy randomly zigzagging configuration, which then slowly relaxes to the thermodynamically stable straight stripes. [1] Z.Y. Chen and M. Kardar, J. Phys. C: Solid State Phys. **19**, 6825 (1986). L. Gu *et al.*, Phys. Rev. B **53**, 11985 (1996). [2] Y. Han *et al.*, Nature **456**, 898 (2008). Y. Shokef and T.C. Lubensky, Phys. Rev. Lett. **102**, 048303 (2009).

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