Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Clustering instabilities in lattice gas models with isotropic repulsive interactions PAUL BEALE, MATTHEW GLASER, University of Colorado at Boulder — In previous work we have shown that liquid crystalline order arises in systems of particles with purely repulsive, spherically symmetric pair interactions. We have observed a variety of liquid crystalline phases, as well as rich crystalline and quasicrystalline polymorphism, in simulations of two and three dimensional systems of particles with isotropic pair potentials consisting of an impenetrable hard core plus an isotropic penetrable, repulsive soft shoulder. We have further explored the clustering instabilities in the model by using mean field theory and Monte Carlo simulations of lattice gas models with an isotropic soft-shoulder repulsion that extends out many lattice spacings. The lattice gas model maps exactly onto an Ising model with antiferromagnetic interactions. At low temperatures this repulsive soft shoulder leads to the development of structure on the length scale of the repulsion. Mean field theory predicts both layered and solid structures in the temperature/magnetic field (chemical potential) plane. Monte Carlo simulations display liquid phases with short range patterns, layered incommensurate phases with quasi-long-range order, long- range ordered layered solids, hexagonal micellar solids with quasi- long-range ordering of micelles and long-range ordered hexagonal phases.

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Date submitted: 20 Nov 2006

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