Complex phases from spherically-symmetric repulsive pair-potentials MATTHEW A. GLASER, University of Colorado at Boulder, STEVEN A. KADLEC, NIST and University of Colorado at Boulder, JULIA M. SANTOS, University of Colorado at Boulder, PAUL D. BEALE, University of Colorado at Boulder, NOEL A. CLARK, University of Colorado at Boulder — We report computer simulation studies and zero temperature analyses of two and three-dimensional systems of particles interacting via spherically symmetric, monotonically-repulsive pair-potentials. We have examined both bounded potentials and potentials with hard cores. We find that a very large class of potentials of this type display extraordinarily rich phase behavior. We observe a variety of complex modulated crystalline phases, commensurate and incommensurate phases solid phases (both achiral and chiral), structured isotropic liquids, micellar liquids and solids, and dodecagonal quasicrystals. These phases display a variety of phase transitions, including reentrant melting and freezing transitions, and commensurate-incommensurate phase transitions. The complexity arises because of multiple length scales due to the hard core (if present), the range of the potential, and spinodal length scales (Likos, et. al.[1]) in the Fourier tranform of the pair potential. This rich polymorphism dramatically expands the range of possible models of colloidal self-assembly, and raises the interesting prospect of control of colloid self-assembly by rational design of pair potentials using grafted polymers or complex solvents. [1]C.N. Likos, et. al, Phys Rev E 63, 031206 (1998).

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