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Theory of crystallization and orientational ordering of spherical Janus colloids HOMIN SHIN, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — Amphiphilic Janus particles have two chemically distinct surfaces, one hydrophobic (attractive) and the other hydrophilic (repulsive), resulting in orientationally anisotropic interparticle interactions. In contrast to homogeneous spherical particles, broken rotational symmetry can result in more exotic crystals that possess distinct orientational patterns, and also plastic crystals. We study the rich phase behavior of Janus colloids using a self-consistent phonon theory that includes coupled translational and rotational entropic and enthalpic contributions to the free energy. Ground states are identified based on the compatibility between the patch geometry of particles (e.g., patch coverage, number, shape) and the lattice symmetry. The coupled self-consistent equations for translational and rotational localization parameters are then solved for a given crystal symmetry, thermodynamic state, and patch orientational order, and their stability determined. For two-dimensional diblock AB Janus crystals, we predict the phase sequence of stripes, modulated stripes (zig-zag), and plastic crystals (rotator phases), which depends sensitively on particle chemical composition and pressure. We also study triblock Janus colloids, including the possibility a Kagome lattice.

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