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Entropic selection of patchy particle assemblies[1] XIAOMING MAO, University of Pennsylvania, QIAN CHEN, STEVE GRANICK, University of Illinois at Urbana-Champaign — We explore the statistical physics of triblock patchy colloids with degenerate valency, i.e., particles with excessively large attractive areas on two opposite sides, via analytic theory, which has the advantage of revealing fundamental laws of self-assembly more easily compared to the usual "trial-and-error" approach taken in experiments and simulations. From calculations of the free energy of multiple possible ground states, we conclude that the rotational entropy of individual particles favors certain bond angles, whereas vibrational entropy favors open rather than close-packed structures. Our analytic calculation is readily generalizable to other types of patchy particles and provides guidelines for new designs. We conclude that whereas the seemingly unfavorable degenerate valency of patchy colloids can lead to multiple energetic ground states and difficulties in selecting a unique ordered state, it also opens doors to surprising ordering phenomena. This shares pleasing commonalities with the "order-from-disorder" effect in frustrated magnets.

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Xiaoming Mao
University of Pennsylvania

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