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Designing colloids for alignment REMI DREYFUS, CNRS, Compass Lab, TYCHO SLEATOR, NYU, KENNY MAYORAL, THOMAS G. MASON, UCLA, PAUL M. CHAIKIN, NYU — Inducing the spontaneous association of microscopic building blocks into macroscopic structures has been a promising way to create new materials for a variety of useful applications. Such fabrication processes typically require interactions between microscopic building blocks. The interactions that govern the assembly of these microscopic building clocks: electrostatic, magnetic, Van der Waals, depletion, and DNA interactions, are all currently being investigated. For all these cases, the attractive energy between the particles is proportional to the overlapping surface between the colloids. Controlling the positions and orientations of the microscopic building blocks is a critical issue in such processes. To date there has been no efficient or reliable process that enables such spontaneous assembly of building blocks. For the successful alignment of any particles that we desire to self-assemble, a shape with unique physical and mathematical properties must be identified. Under the assumption that energy is reduced in proportion to area overlap, we present a geometrical shape which, when encountering a similar shape from any initial configuration, is forced into a single relative orientation maximizing the overlap. The unique minimum of energy in the energy landscape drives the particles to self-assemble in a controlled orientation.

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