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Colloids at Curved Fluid Interfaces[1]

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Fluid interfaces are remarkable sites for colloidal assembly. When a colloid attaches to a fluid interface, it distorts a region around it; this distortion has an associated capillary energy, the product of its area and interfacial tension. The particles capillary energy depends on the local interface curvature. By molding the interface, we can define curvature fields that drive microparticles along pre-determined paths. This example captures the emergent nature of the interactions. We discuss curvature fields as analogues to external electro-magnetic fields, and define curvatures that drive particles to well-defined locations, and to equilibrium sites far from boundaries. Particle-particle and particle-curvature interactions can guide particles into structures via interaction among many particles. This work demonstrates the potential importance of curvature capillary interactions in schemes to make reconfigurable materials, since interfaces and their associated capillary energy landscapes can be readily reconfigured. Analogies in other soft systems will be described.

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