The fluid-solid phase transition on a curved surface

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I will discuss experiments examining how spherical colloidal particles crystallize on the surface of a sphere. To study how the curvature affects the phase transition, we use a model experimental system consisting of micrometer-scale colloidal particles that are bound to the interior surfaces of water droplets with varying radii. The structure and dynamics of these particles can be imaged directly using confocal microscopy. We find that the particles form crystalline domains that are long, slender, and ribbon-like, as opposed to the more isotropic domains that grow on flat surfaces. Interestingly, they contain no topological defects. I will show that these crystallization patterns arise from the Gaussian curvature of the droplet and the resulting size-dependent elastic stress. Our results, which show that curvature can fundamentally alter the growth of ordered domains, may have implications for self-assembly on other curved manifolds, such as vesicles or viral capsids.