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Abstract for an Invited Paper
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Geometry and universality in self-assembly[1]

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I will discuss the use of ideas from geometry and topology in combination with the statistical mechanics of self-assembly to classify the possible types of mesoatoms that can constitute a library of raw materials for making mesomolecules and bulk materials. I will concentrate on mesoatoms made up of an ordered two-dimensional monolayer of particles on the surface of a liquid droplet. Both the shape and the topology of the two-dimensional surface can be varied as well as the architecture of the ordering particles. The topology of the surface and the symmetries of the two-dimensional order severely restrict the possible defect structure of the mesoatom, which in turn fixes its valency. Defective regions are natural places for biological activity, chemical linking, unusual elastic response and aggregation of disorder. Specific examples include crystalline and hexatic order of point particles on the sphere, paraboloid, torus and Gaussian bump, nematic order of nematogens on the sphere and torus, and vector order of polar units on the sphere. The Gaussian curvature of the underlying surface may also lead to new features in the ground state, such as extended defect arrays of various kinds and curvature-driven defect unbinding, all of which may be exploited via engineered or spontaneous self-assembly.

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