

#31 Topic: Geometric frustration in soft materials and power grids

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Geometric frustration occurs when local order cannot propagate through space / the system due to geometric constraints. A common example is the surface of a soccer ball, which cannot be tiled with hexagons only. Geometric frustration can also be present in materials. In fact, geometry can act as an instrument to design the mechanical, optical or physical properties of fluids and solids. I will present two examples: 1) liquid crystals confined to droplets of various shapes and sizes. The droplet shape determines the orientation of the liquid crystal molecules and in turn its response to light. 2) fracture mechanics of curved elastic sheets. By tuning the curvature of the sheets, the critical length at which the crack starts growing as well as the direction of crack growth can be controlled. Finally, I will discuss geometric frustration in power grids: adding an extra transmission line may impact the performance of the electricity network negatively.