SPECIAL SEMINAR

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Crystallography of Wrinkled Shells

Curved crystals cannot comprise of hexagons alone; additional topological defects (pentagons, heptagons, etc.) are required by both topology and energetics. These constraints are present in systems as diverse as virus capsules, soccer balls, and geodesic domes.

In this talk, I will present a self-organization of crystalline dimpled patterns on a compressed thin spherical elastic shell bound to a compliant substrate. Similar to the packing of particles on curved surfaces, it is found that such system relaxes compressive stresses by buckling through the formation of arrays of dimples, and by simultaneously developing topological defects in these patterns. The results of this wrinkling system can be quantitatively mapped into and described within the framework of curved crystallography, albeit with some important differences, because our system is athermal and the resulting pattern is influenced by microscopic shell imperfections. Simple analytical expressions to accurately predict the total number of wrinkling units, their characteristic size, average coordination number and possible engineering applications will be presented.