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Geometry of Negative Heat Capacity Designed by Nature

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Abstract: In nature, patterns of different sizes and forms are ubiquitous, ranging from the micro- and nano-worlds to the scale of galaxies and the universe itself. Life is intertwined with various geometric forms, such as the angles of atomic bonds within molecules, which determine configuration and, consequently, molecular reactivity. On a larger scale, this is evident in the spherical shape of cells, the helical spirals of DNA, and the lattice patterns of crystals and supramolecular assemblies. Nanostructured materials possess properties that depend on size and shape, distinctly differing from their bulk counterparts. In this account, we present experimental studies that reveal the effect of nanostructured geometry and its size on heat capacity. Beyond the fundamental importance of uncovering the geometrical constraints that could lead to the emergence of negative heat capacity in condensed systems, the study we present offers the possibility of tailoring heat capacity at will by manipulating the geometry without altering the chemistry of the system.