Riddles of the sphinx tilings: chirality, entropy, and thermodynamics

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Abstract:
Are there subtle laws underlying the interactions of chiral building blocks subject to constraints? In this talk, I will explore the chiral interactions of the sphinx tile, a simple, non-symmetrical shape which possesses some unique and minimal properties. Its left and right enantiomers are forced to interact in crowded 2d spaces to produce tilings — including crystalline, quasicrystalline, and a much broader class of disordered states. A succession of exact methods are devised to find these states for small system sizes. For larger systems, the numbers of configurations become so large that statistical mechanics obtains and thermodynamic quantities can be calculated. A Monte Carlo (MC) method based on fundamental shapes ("f-polyads") has been developed to sample the space of tilings. These explorations into the spatial interactions of chiral objects raise a number of new questions which will be discussed.