Soft Quasicrystals

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Quasicrystals possess long-ranged order but lack periodicity. They attracted large attention in the last three decades due to their sophisticated material properties such as low surface friction and high rigidity. Meanwhile, soft quasicrystals built with colloids or polymer micelles constituents are in the focus of recent studies. By investigating colloidal quasicrystals we obtain new insights into the question why only a few rotational symmetries occur in nature. Furthermore, we study the consequences of the additional degrees of freedom related to the so-called phasons. Phasons correspond to complex rearrangements of the colloids that do not cost free energy in the long-wavelength limit but affect a lot of properties of the quasicrystal. For example, by employing a phase field crystal model we calculate how a quasicrystal grows from a seed and detect two different growth modes, namely defect-free growth of the stable quasicrystal and a mode dominated by phasonic flips which are incorporated as local defects into the grown structure such that random tiling-like ordering emerges. Finally, we explore how the growth started by multiple seeds is affected by the possibility of stress relaxation via the phasonic degrees of freedom.