MM 4: Topical Session: Quasicrystals & Complex Metallic Alloys I

Time: Monday 10:15–11:30 Location: H25

Topical Talk MM 4.1 Mon 10:15 H25

Observation of kinks and antikinks in colloidal monolayers driven across periodic and quasiperiodic surfaces — •Clemens Bechinger — Universität Stuttgart, 2. Physikalisches Institut, Stuttgart

Friction between solids is responsible for many phenomena like earthquakes, wear or crack propagation. Unlike macroscopic objects which only touch locally due to their surface roughness, spatially extended contacts form between atomically flat surfaces. They are described by the Frenkel-Kontorova model which considers a monolayer of interacting particles on a periodic substrate potential. In addition to the well-known slip-stick motion such models also predict the formation of kinks and antikinks which largely reduce the friction between the monolayer and the substrate. Here, we report the direct observation of kinks and antikinks in a two-dimensional colloidal crystal which is driven across different types of ordered substrates [1]. We show that the frictional properties only depend on the number and density of such excitations which propagate through the monolayer along the direction of the applied force. In addition, we also observe kinks on quasicrystalline surfaces which demonstrates that they are not limited to periodic substrates but also occur under more general conditions.

[1] T. Bohlein, J. Mikhael, and C. Bechinger, Observation of kinks and antikinks in colloidal monolayers driven across ordered surfaces, Nature Materials 11, 126 (2012).

MM 4.2 Mon 10:45 H25

Geometric Properties of N-fold Symmetric Quasicrystals — •Johannes Roth — ITAP, Universität Stuttgart

Rhombic quasicrystals with n-fold planar symmetry contain configurations with $2n$- or n-fold point symmetry. These "flowers" or "stars" are very predominant in fivefold quasicrystals and play an important role for example in the stabilization of colloidal quasicrystals. We have determined the number of stars directly up to n=11. We observe that if n increases, the number of stars decreases more than exponentially. Thus we argue that finite tiling patches with very high n up to 30, which many groups study experimentally, should not be called "quasicrystals" since these patches do not form representative samples of a quasicrystal due to the small sample size.

Laser potentials which are generated by the superposition of harmonic waves exhibit local isomorphism classes much like rhombus tilings. While these classes are well known for tilings, we describe them for n-fold symmetric laser fields using the methods of Mermin et al. and show how many free parameters exist.

Topical Talk MM 4.3 Mon 11:00 H25

Recent advances in mathematical diffraction theory — •Uwe Grimm — Department of Mathematics and Statistics, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK

The discovery of quasicrystals called for an extension of classical diffraction results to aperiodic systems. For cut and project sets, it was shown that the diffraction is pure point, and the locations and intensities of Bragg peaks can be calculated explicitly. More recently, rigorous and constructive approaches to the case of diffuse scattering have led to a better understanding of systems with singular continuous and absolutely continuous diffraction. This talk reviews the development of mathematical diffraction theory following the discovery of quasicrystals.