WWU MÜNSTER

FACHBEREICH PHYSIK

Allgemeines Physikalisches Kolloquium

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Topology of orientational defects of smectic colloidal liquid crystals in extreme confinement

Samples of liquid crystals exhibit a variety of topological defects and can be exposed to external constraints such as extreme confining geometries. Focusing on smectic colloidal liquid crystals, we present a general classification scheme of the intrinsic structure, dictated by the interplay between the intrinsic layering and the externally imposed boundary structure. Thereby, we demonstrate that the topological defects in two [1] and three [2] spatial dimensions emerge in the form of spatially extended grain-boundaries, which are characterized by coexisting nematic and tetratic orientational order. To illustrate these intriguing topological properties, we present particle-resolved results in a large range of confinements, obtained by Monte-Carlo simulations and fundamental-measure-based density functional theory of hard anisotropic bodies, as well as real-space microscopy of colloidal rods, whose structural details agree on a quantitative level. Moreover, in topologically nontrivial domains with additional interior boundaries, we analyze the stability of different competing states possessing a distinct orientational and positional topology [3].

[1] P. A. Monderkamp, R. Wittmann, L. B. G. Cortes, D. G. A. L. Aarts, F. Smallenburg and H. Löwen, Phys. Rev. Lett. 127, 198001 (2021).
[2] P. A. Monderkamp, R. Wittmann, M. te Vrugt, A. Voigt, R. Wittkowski and H. Löwen, Phys. Chem. Chem. Phys. 10.1039/D2CP00060A (2022).
[3] R. Wittmann, L. B. G. Cortes, H. Löwen and D. G. A. L. Aarts, Nat. Commun. 12, 623 (2021).

Institutsgruppe 1
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