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Title: Phase diagram of active brownian particles in two dimensions

Abstract

We will analyze the phase diagram of active disks and dumbbells only interacting by excluded volume potential [1,3].

For disks, at small activity, we find that the 2D melting behavior of passive hard disks still holds with continuous Halperin-Nelson transition between the solid and hexatic phases, and a first order transition between the hexatic and liquid phases, when density or packing fraction are decreased at constant temperature.

By increasing activity, hexatic-liquid coexistence reduces to a critical line that reaches at high activity another coexistence region where clusters of particles and a dilute phase are observed. These clusters are made of a mosaic of hexatic microdomains whose size does not coarsen indefinitely, with a typical microphase separation behavior [2].

We also study the statistics of topological defects showing the occurrence of a percolation transition of clusters of defects close to the hexatic-liquid transition, for different activity strengths.

Finally, we show the differences with the phase diagram of active dumbbells where the coexistence region continuously extend from the passive limit to high activity [3].

1. P. Digregorio, D. Levis, A. Suma, L. Cugliandolo, G. Gonnella, I. Pagonabbaraga, Phys. Rev. Lett. 121, 098003 (2018).
2. C.B Caporusso, P. Digregorio, D. Levis, L. Cugliandolo, G. Gonnella, Phys. Rev. Lett. 125, 178004 (2020).
3. G. Gonnella, L. Cugliandolo, A. Suma, P. Digregorio, Phys. Rev. Lett. 119, 268002 (2017).