

Active Cluster Crystals

Jean Baptiste Delfau¹, Cristóbal López¹ and Emilio Hernández-García¹

¹IFISC (CSIC-UIB), Campus Universidad de las Islas Baleares, E-07122 Palma de Mallorca, Spain

We study the appearance and properties of cluster crystals, i.e. solids in which the unit cell is occupied by a cluster of particles, in a system of Active Brownian particles with repulsive interactions. Self-propulsion deforms the structure of the clusters by depleting particle density inside, and for large speeds it melts the crystal. Continuous field descriptions at several levels of approximation allow to identify the relevant physical mechanisms [1, 2].

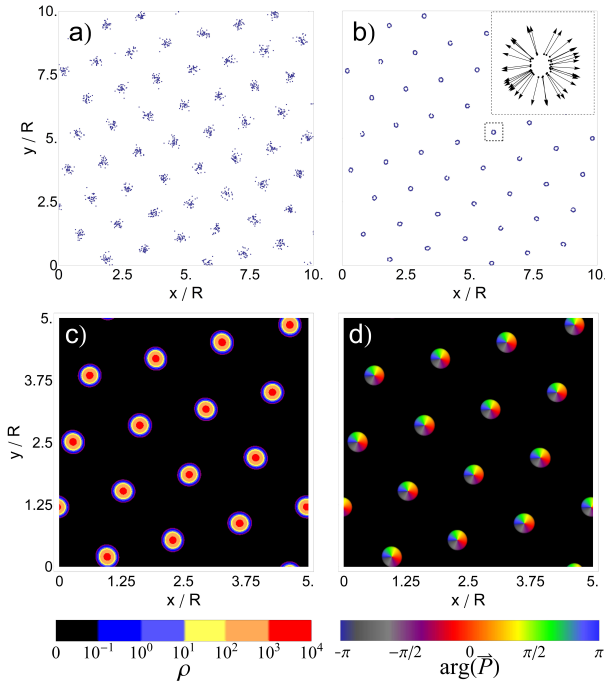


Figure 1: a) and b) Particle simulations: snapshots of the positions of the particles in the steady-state for different parameter values. The top-right inset is a zoom of the boxed cluster showing the orientation vector of the particles inside it. c) and d) Steady-states obtained by numerical integration of the continuum equations for the density and polarization fields. Same parameters as in panel a). c) Local density field. d) Orientation angle of the polarization field, encoded in colors. The modulus of polarization is encoded in the opacity, so that the black areas correspond to very small polarizations.

[1] J.B. Delfau, H. Ollivier, C. López, B. Blasius, E. Hernández-García, Phys. Rev. E **94**, 042120 (1-13) (2016).

[2] J.B. Delfau, C. López, E. Hernández-García, arXiv:1701.02639.