Emergence of long-range order in anisotropic systems

D.Martin[1]

[1] *University of Chicago*
E-mail: dgmartin@uchicago.edu

In statistical physics, whenever the two-point function of a quantity ϕ decays algebraically with the distance $|\mathbf{x}|$ as $\langle\phi(\mathbf{x})\phi(0)\rangle \propto |\mathbf{x}|^{-\alpha}$, it is said that correlations are long-ranged, or scale-free. Historically, there has been a large interest in long-ranged correlations, be it at the critical point in equilibrium systems or in the steady state of out-of-equilibrium systems. However, rather surprisingly, long-ranged correlations have rarely been discussed in active matter outside from the ordered phase of the Vicsek model.

As a first step in this direction, I will present a particle-based model with emergent scale-free behaviour. Starting from a microscopic dynamics with anisotropic short-range interactions, I will show the existence of macroscopic long-ranged density correlations. I will then assess the effect of this scale-free decay on the pressure exerted by the system in order to probe for a possible Casimir-like behaviour.

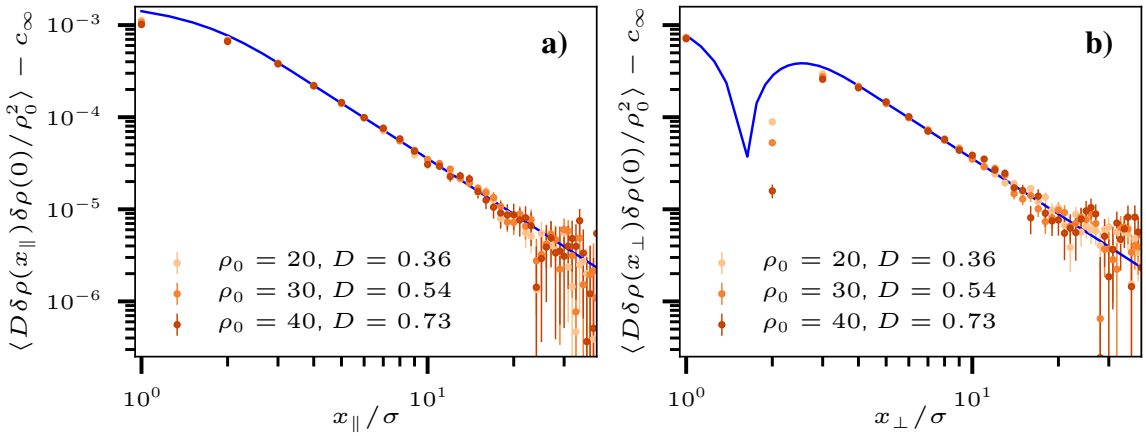

Fig. 1: ***a)*** *Algebraic decay of density fluctuations in the $\parallel$ direction.* ***b)*** *Same graph for the $\perp$ direction. Plain line corresponds to theory while dots are obtained through numerical simulations.*