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Transitions between homogeneous phases of polar active liquids OLIVIER DAUCHOT, CNRS, UMR Gulliver, PSL University, KHANH DANG NGUYEN THU LAM, ESPCI-Paris Tech, PSL University, MICHAEL SCHINDLER, CNRS, UMR Gulliver, PSL University, EC2M TEAM, PCT TEAM
— Polar active liquids, composed of aligning self-propelled particle exhibit large scale collective motion. Simulations of Vicsek-like models of constant-speed point particles, aligning with their neighbors in the presence of noise, have revealed the existence of a transition towards a true long range order polar-motion phase. Generically, the homogenous polar state is unstable; non-linear propagative structures develop; and the transition is discontinuous. The long range dynamics of these systems has been successfully captured using various scheme of kinetic theories. However the complexity of the dynamics close to the transition has somewhat hindered more basics questions. Is there a simple way to predict the existence and the order of a transition to collective motion for a given microscopic dynamics? What would be the physically meaningful and relevant quantity to answer this question? Here, we tackle these questions, restricting ourselves to the study of the homogeneous phases of polar active liquids in the low density limit and obtain a very intuitive understanding of the conditions which particle interaction must satisfy to induce a transition towards collective motion.

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