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Transition to collective motion in two-dimensional microswimmer suspensions VIKTOR SKULTETY, ALEXANDER MOROZOV, School of Physics & Astronomy, University of Edinburgh — A collection of microswimmers immersed in an incompressible fluid is characterised by strong orientational interactions due to the long-range nature of the hydrodynimic fields generated by individual organisms. As a result, suspensions of 'pusher' swimmers exhibit a state often referred to as collective motion or 'bacterial turbulence', which is dominated by jets and vortices compromising many microswimmers. The onset of collective motion can be understood within a mean-field kinetic theory for dipolar swimmers. In 3D, the theory predicts that the instability sets in at the largest scale available to the suspension. Here, we present a mean-field kinetic theory for a suspension of dipolar swimmers confined to a 2D plane embedded in a 3D fluid. We analyse the stability of the homogeneous and isotropic state, and find two types of instability: one is the analogue of the orientational instability in 3D systems, while the other is associated with strong density variations absent in 3D. In contrast to 3D suspensions, both instabilities occur at the smallest possible scale, and we discuss their implications for the ensuing collective motion.

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