

From kinetic models to diffusion equations

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I will talk about a class of nonlinear BGK-type kinetic equations with density dependent collision rates that arise as simplified models of interacting particle systems and closely related to run and tumble equations. We establish global well-posedness and show exponential convergence to equilibrium using classical hypocoercivity methods adapted to the nonlinear setting. From the kinetic model under the diffusive scaling, we rigorously derive nonlinear diffusion equations including the porous medium and fast diffusion equations. I will also report on how we extend this result to derive anisotropic, heterogeneous diffusion equation from the corresponding kinetic model. The talk is based on joint works with Josephine Evans (Warwick), Daniel Morris (TU Delft) and Hoyoun Kim (KAUST).