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Kinetic SDEs and kinetic Fokker-Planck equations with critical Morrey-type drifts, and local blow-ups

In this talk, I will present a detailed weak solution theory for kinetic SDEs with singular drifts in a broad class that, in particular, can produce local blow-ups due to strong position-velocity alignment. The condition on the drift is given e.g. by essentially the largest possible critical Morrey class. For our proofs, we develop a new approach to the Sobolev theory of kinetic forward (Fokker-Planck) and backward equations based on a nonlocal decomposition of the Duhamel series and kinetic Adams-type estimates. This is joint work with Jean-François Jabir and Damir Kinzebulatov.