



## Short- and long-time behavior in (hypo)coercive ODE-systems and kinetic partial differential equations

Franz Achleitner<sup>1</sup>

We will discuss hypocoercivity on the level of ODEs and devise a new way to construct strict Lyapunov functionals: Systems of ODEs  $dx/dt = Ax$  with semi-dissipative matrix  $A$  (i.e. the Hermitian part of matrix  $A$  is negative semi-definite) are Lyapunov stable but not necessarily asymptotically stable. There exist many equivalent conditions, to decide if the ODE system is asymptotically stable or not. Some conditions allow to construct a strict Lyapunov functional in a natural way. We will review these classical conditions/approaches and identify a "hypocoercivity index" which e.g. characterizes the short-time asymptotics of the propagator norm for semi-dissipative ODEs.

Finally, we apply these results to study the long-time behavior of (hypocoercive) nonlinear BGK-type model with constant collision frequency, and (kinetic) Fokker-Planck equations. In particular, we will compare our strict Lyapunov functionals for the linear(ized) kinetic equations with other classical approaches.

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<sup>1</sup>TU Wien. Email:franz.achleitner@tuwien.ac.at