Skalenkaskaden in komplexen Systemen

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Nonlinear diffusion: From particles to thermodynamics

Abstract:

In many applications, one has a 'small-scale' model which is simple but computationally intractable, and wishes to derive an effective (computable) 'large-scale' description. This talk will study this problem of scale-bridging from a thermodynamic perspective, focusing on gradient flows. We discuss the interplay between particle models and their thermodynamic description at hand of a class of nonlinear diffusion equations. It will first be shown how an underlying particle model can reveal an underlying (geo-)metric structure of the governing PDE, notably a gradient flow setting for a class of nonlinear diffusion equations. Connections to large deviation theory from probability will be made, and it will be discussed how this can link mesoscopic fluctuations and stochastic PDEs in a way that can allow to derive stochastic "corrections" for deterministic PDEs.