Contribution ID: **2** Type: **not specified**

Julien BARRÉ - From interacting particles to fluctuating hydrodynamics with Large Deviations

Friday, June 2, 2023 3:00 PM (45 minutes)

To derive a macroscopic description of a system (in terms of hydrodynamical fields), starting from a microscopic one (in terms of interacting particles), the usual route introduces an intermediate kinetic equation, and takes advantage of the difference of time scales between fast and slow modes to set up a Chapman-Enskog expansion. When finite size effects are important at the macroscopic level, they are taken into account by adding a noise on the hydrodynamical equations, often in an empirical way. We will explain how this whole procedure can be carried out at the level of large deviations functionals, taking the classical example of incompressible Navier-Stokes equations.
In the compressible case, the macroscopic equations are ballistic at leading order. The large deviation structure is more complicated and we will describe a first attempt to understand it using simpler 1D models.

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