2019 Master 2 internship, may be extended by a thesis:

Non-Equilibrium Statistical Physics in macroscopic dissipative systems.

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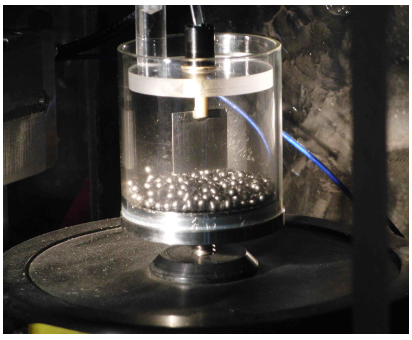
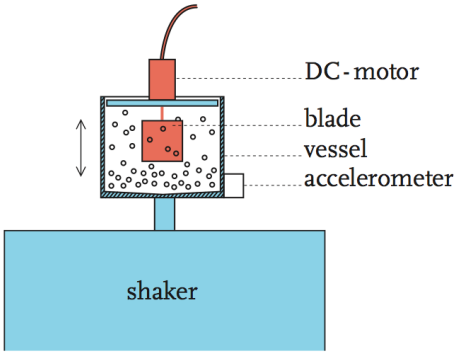
Context: Stochastic thermodynamics, which describes fluctuation dominated dynamic states, is in full swing. However, experimental contributions are still recent and few. We carry out model experiments, a priori technically simple, as test benches for theoretical propositions and possibly to inspire developments.
In this perspective of simplicity, we develop, for instance, a study of granular gases, but also wave turbulence in thin vibrated plates, or hydrodynamic turbulence.
We have verified that certain theoretical propositions describing equilibrium processes are still valid in such systems where yet a part of the energy is dissipated: Fluctuations theorem [1], Fluctuation-Dissipation theorem [2], Hatano-Sasa equality [3] (which generalizes the Clausius inequality), and some transport properties [4].
Through these different experiments, we have defined and measured the 'temperature' of a non-equilibrium steady state, $kT_{eff.}$, which typical value is around 10^{-9} and 10^{-6} J. These temperatures are considerably larger than those of molecular systems ($k_BT \sim 10^{-21}$ J).
We thus realize at the macroscopic scale behaviors specific to the molecular scale! ...





Subject: We continue our experiments in granular gases, vibrated plates and in turbulent fluids. Until now we have been interested in stationary properties. We now wish to explore on the one hand non-stationary dissipative states, and on the other hand the relations between information theory and non-equilibrium statistical physics.
An interested student must like statistical physics and especially experimental work. He or she will have a practical mind because part of the work will be instrumental design.

Keywords: Non-Equilibrium Stat. Phys., irreversibility/dissipation, global/detailed balance, entropy production rate, Landauer principle, house-keeping heat/excess heat, etc.

Références :
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[4] Lecomte C.-E. and Naert A., J. Stat. Mech., P11004 (2014),
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