

CEA - Saclay 91191 Gif-sur-yvette Cedex  
Service de Physique de l'Etat Condensé  
SÉMINAIRE

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Mercredi 9 avril 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Reversibility and self-organization in non-Brownian suspensions

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Many-body systems often exhibit irreversible behavior even though the governing equations of motion are reversible. Nevertheless, it is unusual to encounter a physical system in which the transition from reversible to irreversible behavior can be explored experimentally.

Recent experiments in our lab. on periodically sheared non-Brownian suspensions show a sharp transition from reversible to irreversible chaotic behavior above a concentration dependent threshold strain amplitude [1]. The observation of a sharp threshold is puzzling as the initial distribution of particles is random, with no obvious length scale for the onset of irreversibility.

We develop a simple model, explored through simulation and mean field theory, that captures the salient behavior of the experiments. For small strain amplitude, the model reveals that random displacements of colliding particles can cause the system to self-organize into a reversible state that avoids further collisions. This model and additionnal experiments show that the strain threshold actually corresponds to the critical point of a nonequilibrium phase transition between absorbing and active fluctuating states [2]. These results provide new insights into how microstructures can spontaneously develop and how random encounters can help a system evolves towards a stable fixed point.

References: [1] Pine D. J., Gollub J. P., Brady J. F., Leshansky A. M., Nature **438**, 997-1000 (2005). [2] Corté L., Chaikin P. M., Gollub J. P., Pine D. J., Nature Physics, at press (2008).

Un café sera servi dans le hall à 11h.