DIRECTION DES SCIENCES DE LA MATIÈRE
SERVICE DE PHYSIQUE THÉORIQUE
Unité de recherche associée au CNRS

COURS DE PHYSIQUE THÉORIQUE DU SPHT
ANNÉE 2005-2006

Les vendredis de 14h30 à 16h00 au SPhT, Orme des Merisiers, Bat.774, Salle Itzykson

Time-related issues in statistical mechanics

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Organisé en commun avec l'École Doctorale de Physique de la Région Parisienne (ED107)

Model systems – both classical and quantum – exhibiting apparent irreversibility will be studied. Recurrence and time-symmetry paradoxes will be examined. With this understanding of de facto irreversibility, a connection will be sought to larger time asymmetries, in particular the cosmological one (other purported arrows of time will also be discussed). The relation between thermodynamics and cosmology will introduce further mathematical issues, in particular the solving of two-time boundary value problems.

In contrast to equilibrium statistical mechanics, dynamical issues are of paramount importance when systems are out of equilibrium temporarily or permanently, the latter characteristic of open systems. Such systems exhibit phase transitions, but traditional criteria (such as analyticity) run into difficulties when attempting to describe them. On the other hand, if a system can be described by stochastic dynamics, many of its properties, including phase transitions, the identification of order parameters and of macroscopic variables, follow directly from the dynamical rules. The paradigm is no longer analyticity, but asymptotics.

Finally, I will examine the consequences of assuming time-symmetry globally, both for classical and quantum systems. The possibility of using this perspective for ascertaining cosmological features in a way that is conceptually independent of existing methods will be taken up. At the quantum level, one can obtain definite measurement results, notwithstanding the absence of anything but pure unitary dynamics.

Les cours sont de nature introductive et accessibles aux étudiants en deuxième année de troisième cycle. Ils sont ouverts aux physiciens de toute discipline et à toute personne intéressée.

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