CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE
Mercredi 08 octobre 2014 à 11h15
Orme des Merisiers SPEC, Salle Itzykson, Bât.774

Oscillating bubbles in a capillary at evaporation/condensation

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Motion of constrained by tube walls bubbles, so called Taylor bubbles, was studied in the past mainly for chemical processing and microfluidics applications. We discuss here not so well-known case of bubble oscillation. The oscillations may be spontaneous in the presence of evaporation-condensation. Such a problem is met in several curious objects such as the toy vapour boat and the pulsating heat pipe (PHP). A heat pipe is a device for transferring heat from heat sources to be cooled to cold spots situated at a certain distance. The pulsating heat pipe (PHP) is a sealed capillary tube bent so that it meanders between condenser and evaporator. It is filled partially by a pure liquid and a sequence of bubbles and liquid plugs forms inside it. Spontaneous oscillations appear in such a system when the temperature difference between the evaporator and the condenser becomes greater than a threshold. The liquid is vaporized at the hot portion of the tube (evaporator) and the energy is stored as the latent heat of the liquid-vapor phase change. The vapor is then transported to the cold part (condenser) and released there during condensation. The PHP appears to be in many respects more advantageous than the classical heat pipes.

We discuss here some the phenomena that determine the bubble oscillation dynamics. In particular, the dynamics of thin liquid films around the Taylor bubbles will be addressed. Next, in the framework of 1D modelling, we try to understand the oscillation threshold for the simplest, single bubble PHP and, finally, analyse the dynamics of more complex multi-bubble configurations.

A coffee break will be served at 11h00. The seminar will be given in English.