SEMPARIS – Séminaires en région parisienne

`http ://string.lpthe.jussieu.fr/semparis/`

Forum de Physique Statistique @ ENS

Mercredi 24 Mai 2023, 14 :00
LPENS, L378
Domaines : cond-mat.stat-mech

Titre : *Statistical mechanics of elastic membranes in classical and quantum regimes*

Orateur : **Achille Mauri (Radboud University)**

Résumé : *The structure of thermally-fluctuating free-standing membranes has been a subject of investigation for several decades and has attracted a renewed interest in connection with graphene and atomically-thin two-dimensional materials. A crucial theoretical prediction is that solid membranes, in absence of applied stress, behave as scale-invariant rough surfaces, with universal scaling properties controlled by an interacting renormalization-group (RG) fixed point. This presentation will address the relation between scale and conformal invariance at the corresponding fixed point. By an analysis within the epsilon expansion, it will be shown that the theory is not symmetric under special conformal transformations, and thus provides an example of a scale-invariant but nonconformal field theory. The second part of the presentation will analyze the role of quantum mechanical effects on the low- temperature behavior of free-standing membranes. By a power-counting analysis, it will be shown that the leading behavior can be described by an effective renormalizable model in which the kinetic energy of in-plane phonons is neglected, alongside other 'irrelevant' terms. The resulting RG equations, combined with arguments of finite-size scaling, will be used to derive general scaling laws for correlation functions and thermodynamical quantities. The results confirm, in a systematic framework, some predictions of earlier investigations. Strictly at T=0, the bending rigidity and the elastic moduli are renormalized logarithmically. At small T, the scaling laws and an explicit analysis of thermal fluctuations corroborate a striking thermodynamical prediction : the thermal expansion coefficient vanishes for T-¿0 as a slow, logarithmic function of T.*
