

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

Vendredi 5 Octobre 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Supercritical impurities and atomic collapse in graphene

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Atomic collapse is a relativistic-quantum phenomenon predicted to occur in heavy atoms. The atomic collapse manifests itself in discrete atomic levels diving into the Dirac-Fermi sea and transforming into quasistationary states which have complex-valued energies and decay rapidly. However, the atoms created artificially in laboratory have atomic numbers going only up to $Z = 118$, which falls short of the predicted threshold for collapse. Interest in this problem has been revived with the advent of graphene, where because of a large fine structure constant collapse threshold corresponds to Z of order unity. In this talk we will discuss recent theoretical and experimental work on supercritical impurities in graphene. In particular, collapse can be induced by an Aharonov-Bohm (AB) solenoid positioned at the same location as the point charge producing the Ze/r potential. We show that massless Dirac particles moving in the combined field of the solenoid and the point charge undergo collapse for values Z which can be considerably lower than in the absence of the solenoid. By tuning the solenoid flux the collapse threshold can be lowered to values $Z \ll 1$. Experimentally, collapse has been probed recently using scanning tunneling spectroscopy on artificial nuclei built with charge impurities on graphene surface.

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

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