

# Service de Physique Nucléaire



## Séminaire

le vendredi 27 février 2015 à 11h00

CEA Saclay, Orme des Merisiers, Bât. 703, Salle 135

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### Tests of classical and quantum electrodynamics with intense laser fields

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Classical electrodynamics (CED) and quantum electrodynamics (QED) are well established theories and their predictions have been confirmed experimentally in various regimes. However, there are still areas of CED and of QED that deserve theoretical and experimental investigation, especially when processes occur in the presence of "strong" background electromagnetic fields, i.e., of the order of the so-called critical field of QED [1]. In view of the increasingly stronger available laser fields it is becoming feasible to employ them to test CED and QED under the extreme conditions supplied by intense fields [1]. After a broad introduction on the typical scales of CED and QED, we will describe different regimes of laser-matter interaction at ultra-high laser intensities and experimental efforts to test the two theories under such extreme conditions. As a prominent theoretical example of open problems which can be addressed also experimentally, we focus on the so-called "radiation reaction" problem : classically, when a charged particle is accelerated by an external field, it emits radiation and this emission alters the motion of the charge itself. The problem of finding a self-consistent equation of motion in the realm of CED has resulted in unphysical equations, which have raised a long-standing, still open debate on the subject already at a classical level. Also, the quantum origin of radiation reaction will be discussed, by relating radiation reaction itself to the emission by a charge of multiple photons.

[1] A. Di Piazza, C. Müller, K. Z. Hatsagortsyan, and C. H. Keitel, Rev. Mod. Phys. 84 (2012) 1177.

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*Le café sera servi 10 minutes avant*

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