



## SEMINAIRE

(de 13 h à 14 h, Salle Belledonne, IMEP, MINATEC,  
ouvert aux chercheurs des autres laboratoires)

Jeudi 10 avril 2008

“The OSQAR Experiments at CERN for Low Energy Laser-based  
Particle Physics”

par Pierre PUGNAT

**Abstract:** Since its prediction in 1936 by Euler, Heisenberg and Weisskopf in the earlier development of the Quantum Electrodynamics (QED), the measurement of the Vacuum Magnetic Birefringence (VMB) is still a challenge for optical metrology. According to QED, the vacuum permeated by a transverse magnetic field is an active medium able to change the polarisation of light from linear to elliptical. Contributions to the VMB could also arise from new light scalar/pseudo-scalar particles like axions that couple to photons and this would manifest itself as a sizeable deviation from the pure QED prediction. On one side the interest in axion, providing the answer to the so-called strong-CP problem, lies beyond Particle Physics and overlaps with Cosmology since such particle is considered as a serious dark matter candidate. On the other side, the domain of Physics that will be investigated is guaranteed by the QED, which aimed to be tested down to an unprecedented level for a scientific theory, *i.e.* at the level of  $10^{-22}$  that corresponds to the relative difference of the vacuum refractive indices in a 9.5 T field. By re-using major achievements of the Large Hadron Collider (LHC) now close to completion at CERN, like superconducting dipoles and test infrastructure, the unique opportunity to launch an innovative research programme in the emerging field of laser-based Particle Physics has been proposed and receives strong support from the CERN-SPSC scientific committee. Collaboration between seven European Institutes and CERN, including a team from IMEP-LAHC, is now working on a new “2-in-1”, laser-based Particle Physics experiments for *Optical Search of QED vacuum magnetic birefringence, Axions and photon Regeneration* (OSQAR). The preliminary phase of OSQAR is dedicated to a photon regeneration experiment that aims to confirm or invalidate the interpretation of the recent PVLAS result regarding the discovery of a new light scalar/pseudo-scalar particle. The status of this phase will be reported together with first results as well as the short and long term perspectives of the overall OSQAR project.

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