LNCMI

LNCMI-Toulouse

Optical tests of quantum electrodynamics

Summary *(400 caractères maxi)*

The BMV project (Vacuum Magnetic Birefringence) is an ambitious experimental project whose goal is to check in laboratory predictions for vacuum energy in quantum electrodynamics. This theory predicts that vacuum, in the presence of a magnetic field, behaves as a birefringent medium. The experiment is based on intense pulsed magnetic fields and a sensitive optical apparatus, mainly consisting of a high finesse cavity.

Detailed subject *(1200 caractères maxi dont une figure possible)*

Classical electrodynamics, modified during the beginning of the XXth century to take into account quantum mechanics, gave rise to quantum electrodynamics. This is up to now the best tested theory in the world (with the measurements of the anomalous magnetic moment of the electron, the Lambshift, the Rydberg constant, the hydrogen hyperfine structure, …). Nevertheless, new phenomena predicted by this theory but never observed still remain, such as the vacuum non linearity and more precisely its birefringence in presence of a magnetic field. The value of this birefringence, is very small and its experimental measurement is very challenging. It now seems possible thanks to last years technological improvements in Toulouse to observe this phenomenon for the first time.

The BMV experiment

The principle of our experiment is to measure the ellipticity acquired by an incident linearly polarized light travelling in vacuum through an intense magnetic field region.
Results have already been obtained with magnetic birefringence measurements on nitrogen, argon and helium gaz. Long series of magnetic pulses have been performed for vacuum. First results show that we have an experiment with one of the best sensitivity in the world. A new set-up is ready.

Publications linked to the theme

A. Cadène, P. Berceau, M. Fouché, **R. Battesti, and C. Rizzo**, "Vacuum magnetic linear birefringence using pulsed fileds: status of the BMV experiment", Eur. Phys. J. D 68, 16 (2014).

Background and skills expected :

General physics, Experimental physics, Optics

Supervisor : Carlo RIZZO

Contacts - Tel : 05.62.17.29.81 **E-mail:** carlo.rizzo@lncmi.cnrs.fr