Ecole Doctorale PHENIICS PhD proposal 2016

- Laboratory/ research team : **LLR** (Laboratoire Leprince-Ringuet)

Ecole Polytechnique & CNRS/IN2P3, γ-astronomy group, HARPO project.

- Title :

High-performance γ-ray astronomy and polarimetry in the MeV-GeV energy range with a Time Projection Chamber (TPC).

Study of the performances of a flight module. AGN polarimetry.

- Overview of the research :

Current gamma-ray telescopes suffer from a gap in sensitivity between 1 and 100 MeV. Besides, linear polarisation has never been measured in that energy range, and could prove a strong tool to understanding particle acceleration and γ-ray emission phenomena in objects such as active galactic nuclei (AGN).

We are developing a new detector concept for high-resolution and high-sensitivity γ-ray astronomy in the e^+e^- pair-creation regime [NIM A 701 (2013) 225], the first with sensitivity to polarization [NIM A 729 (2013) 765]. We have built a time projection chamber (TPC) demonstrator [SPIE2014, arXiv:1406.4830] that we have exposed to a fully polarized gamma-ray beam from 1.7 to 74 MeV (NewSUBARU Japan, Nov. 2014) [TPC2014, arXiv:1503.03772].

The **M2 internship** student will contribute to the analysis of these data and to their publication, in particular, the first measurement of the photon pair conversion polarisation asymmetry in the low part of the energy range where the cosmic-source signal has most of its statistics.

During the **Ph. D** the student will participate in the design of a flight model. In particular from the analysis of geant4-simulated data of the interactions of γ-rays (signal) and cosmic-rays (background) in the detector, he/she will design, simulate and optimize a trigger algorithm based on the real-time multiplicity signal provided by the AGET chip developed and recently validated at CEA.

The performance for astrophysical observations will be evaluated for the study of gamma-ray blazars. By measuring their polarisation, it will be possible to determine whether their emission is due to leptonic or to hadronic processes [Ap.J. 774, 18 (2013)], a long-standing question in blazar astrophysics.

- Contact :

Denis BERNARD, HdR. 01 6933 5534, denis.bernard @ llr.in2p3.fr

Deirdre HORAN, 01 6933 5535, deirdre.horan @ llr.in2p3.fr

Philippe GROS, 01 6933 5573, philippe.gros @ llr.in2p3.fr

site : http://llr.in2p3.fr/~dbernard/polar/HARPO_En.html

links : http://llr.in2p3.fr/~dbernard/polar/harpo-t-p.html