

# SciNeGHE 2016 High-energy gamma-ray experiments at the dawn of gravitational wave astronomy



Contribution ID: 10

Type: Talk

## HARPO: 1.7 - 74 MeV gamma-ray beam validation of a high-angular-resolution high-polarisation-dilution gas telescope and polarimeter

*Tuesday, 18 October 2016 17:20 (20 minutes)*

A number of groups are developing pair-conversion detector technologies alternative to the tungsten-converter / thin-sensitive-layer stacks of the COS-B / EGRET / Fermi-LAT series, to improve the single-photon angular resolution.

Presently observers are almost blind in the 1-100 MeV energy range, mainly due to the degradation of the angular resolution of e+e- pair telescopes at low energies: to a large extent, the sensitivity-gap problem is an angular-resolution issue.

I will show that gas detectors such as TPCs (time projection chambers) can enable an improvement of up to one order of magnitude in the single-photon angular resolution ( $0.5^\circ$  @ 100 MeV) with respect to the Fermi-LAT ( $5^\circ$  @ 100 MeV), a factor of three better than what can be expected for Silicon detectors ( $1.0-1.5^\circ$  @ 100 MeV).

With such a good angular resolution, and despite a lower sensitive mass, a TPC can close the sensitivity gap at the level of  $10^{-6}$  MeV/(cm<sup>2</sup> s) between 3 and 300 MeV.

In addition, the single-track angular resolution is so good that the linear polarisation fraction and angle of the incoming radiation can be measured.

I will describe the fast-gas (low pile-up), cool-gas (low-diffusion), high pressure (0.5-4 bar) HARPO detector prototype and the results of its high-statistics characterisation in the 1.7-74 MeV fully-polarised or non-polarised gamma-ray beam provided by the BL01 line at NewSUBARU.

The excellent value of the polarisation asymmetry dilution factor that we measured paves the way to the opening of the polarimetry window in the MeV-GeV energy range.

I will end this talk with the presentation of the balloon-flight prototype ST3G (Self-triggered TPC for Space gamma-ray Telescope, pronounced STEG) the design of which is in progress, and of its expected performance.

### Summary

We are founding a new high-performance way to do gamma-ray astronomy and for the first time, polarimetry, in the e+e- pair regime.

**Primary author:** Dr BERNARD, Denis (LLR Ecole Polytechnique)

**Presenter:** Dr BERNARD, Denis (LLR Ecole Polytechnique)

**Session Classification:** Session Ib: High-Energy experiments: reports and connection with Gravitational Waves

**Track Classification:** High-energy experiments: results and connections with Gravitational Waves