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HARPO - A Gaseous TPC for High Angular Resolution Gamma-Ray Astronomy and Polarimetry from the MeV to the TeV

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We are developing a new concept of gamma-ray telescope above pair-creation threshold, with an angular resolution improved by one order of magnitude wrt Fermi / EGRET, polarisation sensitivity, and an effective area of several squared meters/ton.

Improving the angular resolution is the key factor to lowering the sensitivity limit for point-like faint sources and fill the “sensitivity gap” between the low energy Compton telescopes and the present high energy pair-based telescopes. In particular the mapping of $E > 70$ MeV emission from the π_0 induced by hadronic interactions would help tracking the emission sources of the highest energy cosmic rays (protons) in the universe.

Polarimetry of cosmic gamma ray sources has never been achieved in the energy range. It would provide new insight in understanding the emission mechanisms at work inside sources such as pulsars, AGN and GRB.

Conservation of the linear polarisation of X-ray photons from GRB, along their path to us, is the most sensitive test of Lorentz invariance violation to date.

Extending the energy range to gamma rays would further improve the sensitivity limit of these searches.

The active target is a high-pressure TPC, with micromegas amplification and crossed-strips collection.

A demonstrator has been built and is being tested with cosmic rays in the laboratory.

We are planning to characterize its performance with a beam of polarized gamma rays.

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