Title: Development of a prototype Compton telescope for space-borne gamma-ray polarimetry

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Gamma-ray polarimetry is a new domain in full expansion. Already probed by measurements with the INTEGRAL and ASTROSAT missions, this approach can offer us an insight into the emission mechanisms responsible for high energy astrophysical phenomena. Polarimetry was slow to be adopted by the X-ray and gamma-ray astrophysicist community due to the technical constraints this type of measurement entails.

Gamma-ray Polarimetry presents multiple technical challenges. In the soft gamma-ray range, low Z materials sensible to the polarization of photons are foregone for high Z materials that improve photon absorption and simplify design. For higher energies, Compton telescopes become a viable option for polarimetry measurement but mission parameters and particular detector designs haven't been optimized for this type of measurement in the past. Additionally, this is coupled with the fact that the atmosphere is opaque for electromagnetic radiation that is more energetic than ~100 eV which means that direct observation can be achieved solely by space-borne instruments.

Our aim is to build a Compton telescope prototype sensible in keV to MeV range. This will be achieved by coupling a scattering layer based on Double Strip Silicon Detectors (DSSDs) developed at CEA with a CeBr3 calorimeter currently developed at CSNSM or a Caliste calorimeter developed by the CEA. A DSSD test-bench is currently in development and the focus of this research. A 9.8cmx9.8cm, 1.5mm thick, and 64 strips silicon detector is coupled with IdeF-X BD ASICs to form the "tracker" portion of the telescope. The performance of the detector will be evaluated at different temperatures before being coupled with a calorimeter. The prototype telescope will then be calibrated at the European Synchrotron Facility in Grenoble in order to evaluate its performance and the achievable scientific goals. This prototype will also be installed in the Nice hospital's experimental area, in order to test its ability to be used for hadron therapy monitoring. Indeed, Compton telescopes are a likely candidate for this as they should be more sensitive than traditional methods, such as PET, and thus reduce the duration of the treatment and the radiation dose administered to the patient.

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