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Xray-CMOS: a wide field of view X-ray polarimeter

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We are going to present the prospects of the Xray-CMOS project (recently funded as Progetto di Ricerca di Rilevante Interesse Nazionale PRIN 2020), for the development of a TPC for wide field of view X-ray polarimetry, in which no requirement is imposed to the orientation of the incoming X-ray with respect to the drift field. This could open a new window of observation on the Universe through the study of rapid transient phenomena, like gamma ray bursts, soft gamma repeaters and transient black holes, among the many.
The Xray-CMOS project will capitalize on the innovative optical 3D readout approach for TPCs recently developed by the CYGNO/INITIUM collaboration in the context of directional Dark Matter searches [1]. This is based on the use of a scientific CMOS (sCMOS) camera and a PMT to readout the secondary scintillation light produced in the TPC amplification stage (typically, by a GEMs stack). Thanks to the proper optics, current sCMOS can image a 100 x 100 mm2 area with 45 x 45 um2 effective pixel size, improving of about a factor 50 with respect to the area of the detectors installed on IXPE while keeping the same granularity [2]. The time profile of the scintillation light measured by the PMT provide the track pattern along the drift direction (dZ), complementing the X-Y projection provided by the sCMOS for 3D track reconstruction, allowing for off-axis sources polarization measurement without significant systematic effects. The use of low diffusion gas mixtures can allow to extend the drift region to about 10 cm without significant degradation of the performances. We will present the experimental results achieved within the CYGNO/INITIUM project and discuss the expected performances of a Xray-CMOS detector based on such principles for X-ray polarimetry.

[1] F. D. Amaro et al, Instruments 6 (2022) 1, 6
[2] L Baldini et al., Astropart.Phys. 133 (2021) 102628

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