

The CIPHER telescope for hard X and soft γ -ray polarimetry

E. Caroli, J.B. Stephen, W. Dusi (TESRE/CNR, Bologna, Italy), G. Bertuccio, M. Sampietro (Dip. di Elettronica ed Informazione, Politecnico of Milano, Italy), A. J. Bird, A. J. Dean (Physics Dept., University of Southampton, UK), V. Reglero (Dpto. de Astronomia y Astrofísica, University of Valencia, Spain), W. Yu, C. Zhang (High Energy Physics Institute, Academia Sinica, Beijing, China), R. M. Curado da Silva, P. Siffert (Laboratoire PHASE/CNRS, Strasbourg, France)

CIPHER (Coded Imager and Polarimeter for High Energy Radiation) is a hard X and soft γ -ray spectroscopic and polarimetric coded mask telescope based on an array of Cadmium Telluride microspectrometers. The position sensitive detector (PSD) will be arranged in 4 modules of 32×32 crystals, each of 2×2 mm² cross section and 10 mm thickness giving a total active area of about 160 cm². The PSD is actively shielded by CsI crystals on the bottom and sides in order to reduce background and can operate over a wide energy range (~ 10 keV to 1 MeV). The mask, based on a modified uniformly redundant array (MURA) pattern, is about 4 times the area of the PSD and, being situated at about 100 cm from the CdTe array top surface, provides a wide field of view. The CIPHER instrument is proposed for a balloon experiment, both in order to assess the performance of such an instrumental concept for a small/medium size satellite survey mission and to perform an innovative measurement of the Crab polarisation level. The CIPHER's wide field of view allows the instrument to keep a single source within the field of view for a long observation period without requiring a precise pointing system. Herein we describe the instrument design, together with results obtained in our development studies on CdTe detectors. Furthermore we present the expected operational performance in terms of image and spectral quality (angular and energy resolution) and polarimetric capabilities for an observation of the Crab pulsar from balloon altitudes.