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ASTENA: a mission concept for a deep study of the transient gamma-ray sky and for nuclear astrophysics

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Gamma-ray astronomy is a branch whose potential has not yet been fully exploited. The observations of elemental and isotopic abundances in supernova (SN) explosions are key probes not only of the stellar structure and evolution but also for understanding the physics that makes Type-Ia SNe as standard candles for the study of the Universe expansion properties. In spite of its crucial role, nuclear astrophysics remains a poorly explored field mainly for the typical emission line intensity which is vanishingly small and requires very high sensitivities of the telescopes.
Furthermore, in spite that the Galactic bulge-dominated intensity of positron annihilation line at 511 keV has been measured, its origin is still a mystery due to the poor angular resolution and insufficient sensitivity of the commonly employed instrumentation at MeV and sub-MeV energy domain.
To answer these scientific issues a jump in sensitivity and angular resolution with respect to the present instrumentation is required. Conceived within the EU project AHEAD, a new high energy mission, capable of tackling the previously mentioned topics, has been proposed. This concept mission named ASTENA (Advanced Surveyor of Transient Events and Nuclear Astrophysics), includes two instruments: a Wide Field Monitor with Imaging and Spectroscopic (WFM-IS, 2 keV - 20 MeV) capabilities and a Narrow FIeld Telescope (NFT, 50 - 700 keV). Thanks to the combination of angular resolution, sensitivity and large FoV, ASTENA will be a breakthrough in the hard X and soft gamma–ray energy band, also enabling polarimetry in this energy band. In this talk the science goals of the mission are discussed, the payload configuration is described and expected performances in observing key targets are shown.

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