Panel Astronomia

Chair: Immacolata Donnarumma (ASI)

Co-Chair: Roberto Della Ceca (INAF)

Ten Proposals

Most of the proposals (9/10) rely on the strong Italian heritage in the field of the High Energy Astrophysics, both in science and technology. The proposals are aimed at providing new diagnostics and/or new instrument configuration to study the Extreme Universe from a few keV up to tens MeV:

- Broad-Band polarimetry (**SPEAR, SWIPE**, **ASTENA, ASTROGAM)**
- Broad-Band Timing (**STROBE-X**) and Spectroscopy (**STROBE-X, ASTENA**, **ASTROGAM**)
- Multi-messenger Astrophysics (**XGIS**, **ALBATROS**, **DAMA**, **Cristal Eye, ASTENA, STROBE-X, ASTROGAM)**
- Distributed Architectures for Multi-messenger Astrophysics (**ALBATROS**, **DAMA**, **Cristal Eye**)
- Fundamental Physics (**ALBATROS, STROBE-X, ASTENA, XGIS, ASTROGAM**)
- High-precision Asteroseismology of Dense Stellar Fields (**HAYDN**)

Main Science Drivers (list not completed…):

Nuclear Astrophysics:

- the production of radioactive and stable isotopes in supernova (SN) explosions and neutron star mergers events (poorly developed field in experimental astronomy).
- Nuclear line spectroscopy as a powerful diagnostic of SN explosion physics.
- The origin of the 511 keV positron annihilation line observed in the direction of the Galactic Centre is still **a 50-year-long mystery** essentially because its emission remains unresolved with the current poor angular resolution instruments at these energies**.**

These science cases could be addressed by both **ASTENA** and **ASTROGAM**. In particular, **ASTENA** with the Narrow Field Telescope (NFT) based on a Laue lens, operating in the 50-600 keV range, will provide an **unprecedented** angular resolution combined with polarimetric capabilities, and sensitivity, that will uniquely address this science topic in the future.

Constraining the non-thermal processes in X-rays with broad-band polarimetric measurements:

e.g., reflection from disk or from coronae in compact objects, cyclotron lines from neutron star binaries, hard tail emission from magnetars and non-thermal emission from Supernova Remnants.

All these topics require a broader energy coverage with respect to IXPE (in particular, it’s worth mentioning the Comptorn Polarimeter). The **SPEAR** mission.

Main Science Drivers (list not completed…):

Constraining the magnetic field in transient sources:

The standard model predicts a fundamental role of the magnetic field to launch the outflow that originates the prompt and afterglow emission, but many aspects are still debated (and alternative models, applicable at least to a fraction of GRBs, do exist). Polarimetry would allow to settle this question, as a different amount of polarization, in some cases extremely high, is expected depending of the magnetic field topology. Broad-band coverage combined with a large FoV X-ray polarimetry (New generation photoelectric polarimeter + Compton Polarimeter). The **SWIPE** mission.

Gamma-ray burst physics:

GRBs as cosmological probes (**XGIS**), electromagnetic counterparts of gravitational wave sources (**DAMA, Albatros, Cristal-eye, XGIS, ASTENA, STROBE-X**), probes for quantum gravity theories (**ALBATROS, XGIS**).

Black hole spin measurements and constraints on Equation of State of NStar:

These science cases require large area detector, as the collimated silicon drift detectors aboard several mission concepts, eXTP, **STROBE-X** (Italian leadership in terms of technology, suited for an ESA medium size mission and a NASA Probe in an expanded configuration, i.e. **STROBE-X**).

Main Science Drivers (list not completed…):

Asteroseismology:

High-precision, high-cadence, long photometric series of large samples of coeval and initially-chemically-homogeneous stars in open and globular clusters (GCs) and to push exquisite asteroseismic inference of stellar properties to dense stellar fields in the Milky Way and beyond (typical ESA medium size mission). The **HAYDN** mission.

Interdisciplinary science:

Multiple nanosatellite architecture in LEO suited fo both Earth and Universe observations. A dual approach: muti-messenger Astrophysics and a multi-point nanosatellite architecture to provide unique capabilities for disaster mitigation. Possible Synergies with the PNRR PE-15 program (Space activities). The **DAM**A mission.

These science drivers, the heritage in terms of scientific and technological know-how and the testified national leadership (both scientific community and industry) in this field, offer (at a very preliminary view) two very interesting possibilities:

- A mission profile already having a high TLR with a timely science driver and strong synergies within the national community. This mission could be **NOW** strongly competitive in the international context.
- A pathfinder of a more ambitious mission profile: it has to preserve the scientific breakthrough (an *unicum* in the international context) of the scaled-up idea