JATIS Journal of Astronomical Telescopes, Instruments, and Systems

GUEST EDITORIAL

Special Section Guest Editorial: The STROBE-X Probe-Class Mission Concept

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On 31 July 2023 NASA issued an Astrophysics Probe announcement of opportunity (AO) to study two satellites: a far-infrared mission and an X-ray mission. The proposals were expected to be compliant with the resources available for the newly established Probe Explorers class, introduced to fill the gap between flagship and smaller-scale missions in NASA's exploration of the universe program. According to the AO, the selection process is organized in two steps: initially one proposal per each type (far-infrared and X-rays) is selected for a 12 months-long feasibility study starting at the end of 2024; after this study, one proposal is approved for a launch currently expected in July 2032.

The Spectroscopic Time-Resolving Observatory for Broadband Energy X-rays (STROBE-X) proposal was submitted to this NASA AO in the slot of the X-ray mission. The main scientific objective of STROBE-X is the spectroscopy of variable sources on timescales from microseconds to years and in the X-ray energy band between 0.2 and 30 keV. In this sense, STROBE-X represents the Time Domain Astrophysics Program recommended with one of the highest priorities in the Decadal Survey on Astronomy and Astrophysics 2020, aiming to "expand space-based time-domain and [multimessenger] follow-up facilities in space."

STROBE-X is a proposed mission addressing the scientific objective of spectral-timing study of X-ray-emitting astrophysical sources. This special section of the *Journal of Astronomical Telescopes, Instruments, and Systems* presents the STROBE-X mission concept, describes the most relevant characteristics, and discusses the expected scientific performance.

An overview of the STROBE-X mission is given by Ray et al. The authors illustrate how the observatory would include three instruments: a wide field monitor (WFM) to simultaneously observe about one third of the Sky, a low-energy modular array (LEMA) sensitive in the 0.2–12 keV energy band, and a high-energy modular array sensitive (HEMA) in the 2–30 keV energy band. As reported by Ray et al., astrophysical transient and variable sources are the scientific objective of the mission. During operations, STROBE-X would monitor the Sky with the WFM in search of transients or interesting transitions of sources, and, if needed, the rapidly slewing spacecraft would autonomously repoint in a timescale of 7 to 24 min to observe with the narrow field of view instruments LEMA and HEMA. In between transient outbursts, the WFM would continuously measure the flux and spectral activity of thousands of X-ray sources across the sky, while the LEMA and the HEMA would make pointed observations of scheduled sources.

Gendreau et al. show the design and performance of the low-energy modular array. LEMA is a non-imaging pointed instrument consisting of an aligned collection of 60 concentrator optics and commercially available silicon drift detectors, and is based on the heritage of the X-ray timing instrument on the NICER mission of opportunity aboard the International Space Station. The main improvements of LEMA compared to NICER, with the goal of reducing the risk, are an increased size of the X-ray "concentrator" optics, the use of a composite optical bench, modifications to the based onboard event processing and control of detector resets.

The high-energy modular array is a large-area, collimated (non-imaging) instrument operating in the 2 to 30 keV energy range and featuring an effective area of 3.4 m^2 at 8.5 keV, thus complementing the LEMA in the energy region of the Fe-K line (i.e. 6.4 keV). As described by Hutcheson et al., the HEMA is based on a set of identical modules, composed in turn by silicon drift detectors (SDDs), front-end electronics and collimators, and relies on the heritage of the Large Area Detector aboard the LOFT and eXTP missions.

Remillard et al. report how the WFM simultaneously covers about one third of the Sky (field of view of ∼4 sr) in the energy band between 2 and 50 keV. For this purpose, the WFM is composed of four pairs of coded-aperture cameras, each one with source localization accuracy of 1 arcmin or better, depending on the signal-to-noise ratio. Similarly to the HEA, the WFM relies on the heritage of similar instruments proposed for the LOFT and eXTP missions.

The development of a new satellite-borne mission almost always implies the development of some form of new technology. An important technology for STROBE-X is represented by Application Specific Integrated Circuits (ASICs), which have the function of collecting and processing charge pulses produced by the SDDs after the interaction of a photon. De Geronimo et al. describe the design and the main scientific performance of the ASIC developed for the HEMA and WFM.

The STROBE-X mission is designed to address key unanswered questions in high-energy astrophysics. The innovative combination of high time and spectral resolution would provide unprecedented insight into the most extreme environments in the universe, advancing our understanding of the fundamental processes that govern compact objects, relativistic jets, and other high-energy phenomena.

The guest editors would like to thank all the authors and referees who have contributed to this special section, as well as researchers, engineers, and technicians who are part of the STROBE-X team.