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Introduction

The conference *Optics for EUV, X-Ray, and Gamma-Ray Astronomy IX* met August 13–15 in San Diego, California, as part of the **SPIE Optics + Photonics 2019** international symposium ***Optical Engineering + Applications***. The Conference provides a forum for discussion of recent progress in imaging and spectroscopic optics for high-energy astronomy. As with previous biennial conferences in this series, the Conference was well-attended by international researchers—importantly including graduate-student and post-doctoral scientists—and comprised approximately 60 oral or poster papers.

The success of the Conference reflects the vitality of the high-energy-astronomy community working in optics and imaging telescopes. The current environment is particularly positive, in that several high-energy missions have been approved for implementation or for advanced study. These include large space-based x-ray observatories—*ATHENA* (selected by ESA as the L2 mission of the Cosmic Vision program) and Lynx (studied by NASA for consideration during the US Decadal Survey Astro2020). They also include several smaller x-ray missions— Spectrum Röntgen Gamma (SRG, launched 2019), Imaging X-ray Polarimetry Explorer (*IXPE*), X-Ray Imaging and Spectroscopy Mission (*XRISM*), *Einstein Probe*, and enhanced X-ray Timing and Polarimetry (*eXTP*). In addition, arrays of imaging atmospheric Cherenkov telescopes—such as the Cherenkov Telescope Array (CTA)—serve as sensitive ground-based gamma-ray observatories.

Monocrystalline-Silicon Optics (Session 2) reported on development, at NASA Goddard Space Flight Center (GSFC), of technologies for next-generation, lightweight, high-resolution x-ray telescopes using monocrystalline-silicon optics. This session provided an overview of the development program, as well as specific reports on mirror fabrication, alignment into mirror modules, structural analysis and testing, and modeling and evaluation of mass-manufacturing procedures.

ATHENA I (Session 3) was the first of three sessions devoted to development of x-ray optics for the Advanced Telescope for High ENergy Astrophysics (ATHENA, ESA 's L2 mission). This session provided an overview of the technology development program for Silicon Pore Optics (SPO) for ATHENA, as well as specific reports on mirror fabrication, optical coating, stacking, and x-ray testing of SPOs.

ATHENA II (Session 4) was the second ATHENA session. This session described assembly, environmental testing, and the current status and performance of SPO mirror modules, plus planning for alignment and integration of mirror modules into the ATHENA mirror assembly. See the Poster Session for an additional paper on this topic.

ATHENA III (Session 5) was the final ATHENA session. This session addressed potential facilities for x-ray testing ATHENA mirror modules or the full mirror assembly, presented a model for predicting the stray x-ray flux reaching the focal plane, and summarized the status of the ATHENA program. See the Poster Session for an additional paper on this topic.

Optical Coatings (Session 6) described coatings and coating methods to improve x-ray performance. See the Poster Session for additional papers on this topic.

Mirror Technologies (Session 7) reported on research to develop or refine technologies for fabricating full-shell or segmented x-ray optics for astronomy. See the Poster Session for additional papers on this topic.

Diffraction Gratings (Session 8) addressed design, fabrication, and performance of various types of diffraction gratings for UV and x-ray high-resolution spectroscopy, as well as applications for rocket experiments and future space-based observatories. Most of the papers described development, primarily at Pennsylvania State University, of off-plane reflection gratings. One paper suggested a novel design, wherein reflection gratings are integral to the secondary mirror of a Wolter-1-like mirror assembly, thus increasing the throughput by reducing the number of reflections from 3 to 2. Another paper reported progress, at the Massachusetts Institute of Technology, in technology development of critical-angle transmission gratings.

Design (Session 9) concerned optimization and predicted performance of grazing-incidence telescopes, including evaluation of effects impacting performance. One paper described an outreach project to demonstrate basic principles of x-ray optics. See the Poster Session for additional papers on this topic.

Testing (Session 10) described capabilities and testing programs at long-beam x-ray test facilities, including some results for specific projects. See the Poster Session for an additional paper on this topic.

Stress Shaping (Session 11) reported on various approaches to correct or to control the figure of an x-ray mirror, by modifying the stress near the back surface of the mirror. Papers discussed active methods—magnetic smart materials and electroactive polymers—and static methods—including laser micromachining. See the Poster Session for an additional paper on this topic.

Optics for Gamma-Ray Astronomy (Session 12) addressed direct and indirect imaging of astronomical gamma rays. The direct method for future space-based hard-x-ray and soft-gamma-ray observatories utilizes bent crystals in a single-Laue-lens configuration for concentrating radiation, or in a double-Laue-lens configuration for true imaging. The indirect method uses ground-based arrays of visible-light telescopes for stereoscopic imaging of Cherenkov light emitted in upper-atmosphere showers initiated by high-energy gamma rays. See the Poster Session for additional papers on the Cherenkov Telescope Array (CTA).

We are grateful to the Program Committee, session chairs, authors, and SPIE staff for their contributions to this successful conference. We look forward to convening again in 2021, for *Optics for EUV, X-Ray, and Gamma-Ray Astronomy X*.

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