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Optics for EUV, X-Ray, and Gamma-Ray Astronomy III

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Introduction

The conference *Optics for EUV, X-Ray and Gamma-Ray Astronomy III* met August 29–30 in San Diego, California, as part of the SPIE Optics and Photonics 2007 international symposium *Optical Engineering + Applications*. The range of topics discussed, the calibre of papers presented, and the participation of scientists from many institutions and countries attest to the great interest in optics for high-energy astrophysics and solar physics.

Currently operating space observatories *Chandra* (AXAF), XMM-*Newton*, *Suzaku* (Astro E2), *Swift*, and *Hinode* (Solar B) demonstrate the importance of focusing optics to high-energy astronomy. Collectively, these missions have significantly advanced technologies for high angular resolution, large collecting area, and high spectral resolution. Future missions will require further advances to significantly enhance these capabilities. This conference provided a forum for discussion of recent progress in imaging and spectroscopic optics for EUV, x-ray, and gamma-ray astronomy. Conference sessions covered all areas of optical science and technology relevant to such optics.

Session 1: TELESCOPE SYSTEMS concerns the design, development, and science objectives of x-ray and hard-x-ray telescopes aboard future space missions, on balloon experiments, or from lunar platforms. Most of the papers address new telescope systems proposed or to be proposed to NASA, ESA, or JAXA—e.g., for US *Beyond Einstein* or *Astrophysics Strategic Mission Concept Studies*, or for European *Cosmic Visions* programs.

Session 2: TELESCOPE DESIGN AND OPTIMIZATION involves issues in the design and optimization of optics and optical systems for high-energy astrophysics. Topics include stray-light and thermal baffling and various trade studies to maximize science performance—effective area, grasp, or angular resolution—within the constraints of mass, volume, and cost.

Session 3: PERFORMANCE PREDICTION AND CALIBRATION reports results of in-flight calibration and performance of operational x-ray telescopes—XMM-*Newton*, *Suzaku*, and *Swift* XRT—and plans for on-ground calibration of future telescopes, especially long-focal-length telescopes like Simbol X. In addition, the session includes papers that propose methodologies for computing the x-ray point-spread function (PSF) of future telescopes—XEUS, EDGE, and Simbol X—and for calculating the grazing-incidence reflection of weakly penetrating protons, such as those observed during operation of the XMM-*Newton* and *Chandra* telescopes.

Session 4: HARD-X-RAY AND GAMMA-RAY IMAGING treats conventional (Wolter-1) and nonconventional systems for focusing hard-x and gamma rays. The latter category includes Laue-lens—natural mosaic diffracting crystals arranged in a transmission focusing configuration—and lobster-eye telescopes. Already used for concentrating high-energy photons and neutrons in synchrotron-radiation and nuclear laboratories, Laue lenses provide a promising approach for gamma-ray telescopes.

Session 5: MULTILAYER COATINGS reports improvements in thin-film deposition techniques to control coating stress and microroughness. In addition, it deals with design, development, and characterization of new coatings for x-ray and soft-gamma-ray optics. For improving the low-energy response, low-z overcoatings mitigate the adverse affect of absorption edges in the reflectance of high-density (and high-Z) optical coatings. Similarly, stacked multilayer coatings can lessen the impact of absorption edges on the reflectance. For enhancing the high-energy response, depth-graded multilayers increase the hard-x-ray and soft-gamma-ray reflectance. Indeed, with nanometric spacing, multilayers provide an alternative to crystal diffraction for focusing gamma rays.

Session 6: SPECTROSCOPY addresses current or future diffractive spectroscopic instruments for EUV and x-ray telescopes. Progress in designing and fabricating a new state-of-the-art blazed transmission grating offers the prospect of incorporating such gratings in future spectroscopic or polarimetric missions.

Sessions 7 and 8: MIRROR FABRICATION AND CHARACTERIZATION I & II address alternative approaches for fabricating grazing-incidence mirrors, especially for large mirror assemblies to be used in Constellation X and in XEUS. In particular, the session extensively reported on progress in fabricating and characterizing slumped-glass segments and silicon pore optics. Additional papers report novel alternative approaches—such as the use of low-density materials (e.g., plastic foils) as mirror substrates in a spiral configuration, the application of MEMS technology to fabricate low-weigh x-ray lenses or mirrors, and the use of adaptive systems to enhance the imaging quality of x-ray mirrors. Other papers described the metrology necessary to achieve precision x-ray optics.

Session 9: ALIGNMENT AND MOUNTING involves issues in aligning, supporting, and integrating grazing-incidence mirrors into a thermally and mechanically stable assembly. Such issues are particularly challenging in view of the large number and thinness of mirrors envisioned for many of the proposed applications.

Finally, we express our gratitude to the program committee, the session chairs, the authors, and the SPIE staff for their support and valuable contributions.

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Giovanni Pareschi