Special Issue Guest Editorial

X-Ray/EUV Optics

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The July special issue on x-ray/EUV optics begins with a consideration of the application of multilayer mirror technology to astronomy, microscopy, and spectroscopy. The Ultra-High Resolution XUV Spectroheliograph (a complex array of multilayer x-ray telescopes that has been selected for flight on the U.S. space station Freedom) is described. This paper is followed by an overview of advances in multilayer x-ray/EUV optics by one of the pioneers of the field. Normal incidence multilayer x-ray mirrors have applications as optical components for Schwarzschild x-ray microscopes as well as telescopes. The design and analysis of imaging multilayer microscope systems are described. The three papers that follow are concerned with recent advances in the development and fabrication of multilayer diffraction gratings and their applications to x-ray astronomy and synchrotron radiation instrumentation.

Measurements of reflectivity and scattering from gold-coated lacquered aluminum foils are of importance to the development of high throughput grazing incidence x-ray telescopes such as are being developed for the Soviet Spectrum X-Gamma Satellite. An overview of the Extreme Ultraviolet Explorer mission, which uses two Wolter-Schwarzschild Type I telescopes (for studies shortward of 400 Å) and a longer wavelength Type II telescope, is then given. The final three papers in this issue are devoted to x-ray polarimetry. Bragg crystal polarimeters and the off-axis behavior of a scattering polarimeter used in the focal plane of a grazing incidence x-ray telescope, and a focal plane stellar x-ray polarimeter to be flown on the Soviet Spectrum X-Gamma mission are described.

COMING ATTRACTIONS . . .

As was mentioned in last month's editorial, the wealth of fine papers that were accepted in response to my invitation could not all be accommodated in two issues. The x-ray/EUV optics papers scheduled to appear in the August issue include three extensive papers related to synchrotron x-ray optics and test facilities. These include a description of x-ray mirrors for the European Synchrotron Radiation Facility and a performance analysis of synchrotron x-ray monochromators. The Daresbury Synchrotron Radiation Facility, which has been designed for testing astronomical x-ray optics, is also discussed. A review of grazing incidence optics fabrication techniques is presented, as well as a discussion of the effects of scattering, annular diffraction, and rapidly increasing intensity near image center in grazing incidence x-ray optics. The exciting development of the photoemission polarimeter is then described. The final paper discusses techniques for enhancing the reflectivity of W/C multilayer x-ray mirror coatings.

Scheduled to appear in the September issue are two papers detailing the production of high quality, high throughput, replicated grazing incidence x-ray optics for ESA's XMM telescope. A study of the soft electron background in the ROSAT Wide Field Camera (which has just been successfully launched) in near-earth orbit is presented. Theoretical papers describe the prediction of mirror performance from laboratory measurements and the assessment of image defects in grazing incidence optics that arise from surface and alignment errors. The final two papers describe a proposed Advanced Solar Observatory and the measured performance characteristics of multilayer x-ray/EUV/FUV telescopes that will be flown later this year on the Multi-Spectral Solar Telescope Array.

I would like to express my gratitude to the authors who provided this superb collection of papers and to the referees who reviewed the manuscripts. I wish to thank Jack Gaskill and the fine staff at *Optical Engineering* who provided assistance, understanding, and patience in helping me accomplish the many tasks required of a Guest Editor. My appreciation for the work Jack Gaskill performs as Editor of *Optical Engineering* on a continuous basis has increased profoundly.

A list of the August and September papers and their authors follows:

AUGUST

"X-ray mirrors for the European Synchrotron Radiation Facility," Andreas K. Freund, François de Bergevin, Gérard Marot, Christian Riekel, Jean Susini, Lin Zhang, Eric Ziegler

"Performance analysis of high power synchrotron x-ray monochromators," A. M. Khounsary, J. J. Chrzas, D. M. Mills, P. J. Viccaro

"Test facility for astronomical x-ray optics," R. A. Lewis, J. Bordas, F. E. Christensen

"Review of grazing incidence optics fabrication techniques for x-ray astronomy," Melville P. Ulmer

"Near origin divergent brightness behavior of grazing incidence images," Paul Glenn

"Photoemission polarimeter in soft x-ray astronomy," G. W. Fraser, J. E. Lees, J. F. Pearson, M. R. Sims, J. E. Spragg, R. Willingale

"Deposition optimization of W/C multilayer mirrors," A. F. Jankowski

SEPTEMBER

"Development of technologies for production of high quality grazing incidence x-ray mirrors on graphite epoxy substrates," Wilhelm Egle, Horst Bulla, Dietmar Scheulen, Bernd Aschenbach, Heinrich Bräuninger

"Production of the first mirror shell for ESA's XMM telescope by application of a dedicated large area replication technique," Wilhelm Egle, Horst Bulla, Paul Kaufmann, Bernd Aschenbach, Heinrich Bräuninger

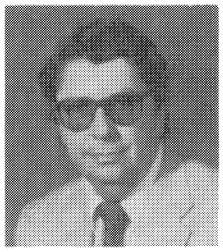
"Soft-electron background in x-ray telescopes using Wolter I grazing-incidence optics in near-Earth orbits," T. J. Sumner

"Prediction of mirror performance from laboratory measurements," E. L. Church, P. Z. Takacs

"Image defects from surface and alignment errors in grazing incidence telescopes," Timo T. Saha

"The Advanced Solar Observatory," Arthur B. C. Walker, Jr., Wayne Bailey, Edward L. Chupp, Hugh S. Hudson, Ronald Moore, William Roberts, Richad B. Hoover, Shi Tsan Wu

"Performance of compact multilayer coated telescopes at soft x-ray/EUV and far ultraviolet wavelengths I," Richard B. Hoover, Troy W. Barbee, Jr., Phillip C. Baker, Joakim F. Lindblom, Maxwell J. Allen, Craig De Forrest, Charles Kankelborg, Ray H. O'Neal, Elizabeth Paris, Arthur B. C. Walker, Jr.



Richard B. Hoover is an astrophysicist at the Space Science Laboratory of NASA's Marshall Space Flight Center. He is currently the principal scientist for the Ultra-High Resolution XUV Spectroheliograph experiment, an array of multilayer x-ray telescopes selected for flight on the first U.S. space station, *Freedom*. Mr. Hoover began work in x-ray optics in 1967 with the x-ray mirrors flown on Skylab experiment S-056. He has developed grazing incidence and normal incidence x-ray telescopes and microscopes and hybrid instruments. He was co-investigator for the Stanford/MSFC X-Ray Spectroheliograph, which produced the first high resolution images of the sun with multilayer x-ray telescopes, and is now working on the Multi-Spectral Solar Telescope Array.

Mr. Hoover is internationally known for his work with diatoms. At the invitation of the Royal Zoological Society of Antwerp, Belgium, he researched their diatom collection and produced several thousand photomicrographs. Many were published in his article in the June 1979 *National Geographic*, others appeared in books, and some are now on display in the Smithsonian Museum of Natural History. Diatoms will be some of the first test objects for the Schwarzschild multilayer x-ray microscopes he is currently developing. He has authored more than a hundred papers on diffraction, x-ray optics, x-ray telescopes, photography, microscopy, astrophysics, and solar physics and holds 11 U.S. patents (related to x-ray optical systems, photographic film, and photomicroscopy systems), with 12 other patents pending. Mr. Hoover is on the summer faculty staff at Dauphin Island SEALAB and is a member of the graduate faculty with the University of Alabama at Birmingham. He is a member of SPIE and is listed in *American Men of Science*.