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

**Stephen L. O'Dell
Giovanni Pareschi**
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Contents

| | |
|------|-----------------------------|
| xiii | <i>Conference Committee</i> |
| xv | <i>Introduction</i> |

SESSION 1 TELESCOPE SYSTEMS

- 6688 02 **Constellation-X mirror technology development [6688-01]**
W. W. Zhang, J. Bolognese, NASA Goddard Space Flight Ctr. (USA); K. W. Chan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County (USA); D. A. Content, NASA Goddard Space Flight Ctr. (USA); T. J. Hadjimichael, C. He, NASA Goddard Space Flight Ctr. (USA) and Ball Aerospace and Technologies Corp. (USA); M. Hong, NASA Goddard Space Flight Ctr. (USA) and Stinger Ghaffarian Technologies, Inc. (USA); J. P. Lehan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County (USA); J. M. Mazarella, NASA Goddard Space Flight Ctr. (USA) and Stinger Ghaffarian Technologies, Inc. (USA); D. T. Nguyen, NASA Goddard Space Flight Ctr. (USA); L. Olsen, NASA Goddard Space Flight Ctr. (USA) and Stinger Ghaffarian Technologies, Inc. (USA); S. M. Owens, R. Petre, T. T. Saha, NASA Goddard Space Flight Ctr. (USA); M. Sharpe, NASA Goddard Space Flight Ctr. (USA) and Stinger Ghaffarian Technologies, Inc. (USA); J. Sturm, T. Wallace, NASA Goddard Space Flight Ctr. (USA); M. V. Gubarev, NASA Marshall Space Flight Ctr. (USA) and Universities Space Research Association (USA); W. D. Jones, S. L. O'Dell, NASA Marshall Space Flight Ctr. (USA); W. Davis, M. Freeman, W. Podgorski, P. B. Reid, Smithsonian Astrophysical Observatory (USA)
- 6688 03 **Thin-foil multilayer-supermirror hard x-ray telescopes for InFOCUS/SUMIT balloon experiments and NeXT satellite program [6688-02]**
Y. Ogasaka, K. Tamura, T. Miyazawa, Y. Fukaya, T. Iwahara, N. Sasaki, A. Furuzawa, Y. Haba, Y. Kanou, D. Ueno, H. Kunieda, K. Yamashita, Nagoya Univ. (Japan); R. Shibata, Nikon Corp. (Japan); T. Okajima, J. Tueller, P. Serlemitsos, Y. Soong, K.-W. Chan, NASA Goddard Space Flight Ctr. (USA); E. Miyata, H. Tsunemi, Osaka Univ. (Japan); K. Uesugi, Y. Suzuki, JASRI/SPring-8 (Japan); Y. Namba, Chubu Univ. (Japan)
- 6688 04 **Development of a prototype nickel optic for the Constellation-X hard x-ray telescope [6688-03]**
S. Romaine, Harvard-Smithsonian Ctr. for Astrophysics (USA); S. Basso, Istituto Nazionale di Astrofisica (Italy); R. J. Bruni, Harvard-Smithsonian Ctr. for Astrophysics (USA); W. Burkert, Max-Planck-Institut für extraterrestrische Physik (Germany); O. Citterio, V. Cotroneo, Istituto Nazionale di Astrofisica (Italy); D. Engelhaupt, The Univ. of Alabama in Huntsville (USA); M. J. Freyberg, Max-Planck-Institut für extraterrestrische Physik (Germany); P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics (USA); M. Gubarev, Universities Space Research Association (USA); G. Hartner, Max-Planck-Institut für extraterrestrische Physik (Germany); F. Mazzoleni, Istituto Nazionale di Astrofisica (Italy); S. O'Dell, NASA Marshall Space Flight Ctr. (USA); G. Pareschi, Istituto Nazionale di Astrofisica (Italy); B. D. Ramsey, NASA Marshall Space Flight Ctr. (USA); C. Speegle, Raytheon-ITSS (USA); D. Spiga, Istituto Nazionale di Astrofisica (Italy)

6688 05

EDGE: explorer of diffuse emission and gamma-ray burst explosions [6688-04]

J. W. den Herder, SRON, the Netherlands Institute for Space Research (Netherlands); L. Piro, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); T. Ohashi, Tokyo Metropolitan Univ. (Japan); L. Amati, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); J. Atteia, Observatoire Midi-Pyrénées (France); S. Barthelmy, NASA GSFC (USA); M. Barbera, INAF, Istituto di Astrofisica Spaziale (Italy); D. Barret, Ctr. d'Etude Spatiale des Rayonnements (France); S. Basso, INAF, Osservatorio Astronomico Brera (Italy); M. Boer, Observatoire de Haute Provence (France); S. Borgani, INAF, Osservatorio Astronomico (Italy); O. Boyarskiy, CERN (Switzerland); E. Branchini, Univ. Roma III (Italy); G. Branduardi-Raymont, Univ. College London (United Kingdom); M. Briggs, Univ. of Alabama in Huntsville (USA); G. Brunetti, INAF-IRA Bologna (Italy); C. Budtz-Jorgensen, Technical Univ. of Denmark (Denmark); D. Burrows, Penn State Univ. (USA); S. Campana, INAF, Osservatorio Astronomico Brera (Italy); E. Caroli, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); G. Chincarini, INAF, Osservatorio Astronomico Brera (Italy); F. Christensen, DNSC, Technical Univ. of Denmark (Denmark); M. Cocchi, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); A. Comastri, INAF, Osservatorio Astronomico Bologna (Italy); A. Corsi, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); V. Cotroneo, P. Conconi, INAF, Osservatorio Astronomico Brera (Italy); L. Colasanti, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); G. Cusamano, INAF, Istituto di Astrofisica Spaziale (Italy); A. de Rosa, M. Del Santo, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); S. Efferi, INAF, Osservatorio Astronomico Bologna (Italy); Y. Ezoe, Institute of Space and Aeronautical Science, JAXA (Japan); L. Ferrari, Istituto Nazionale di Fisica Nucleare (Italy); M. Feroci, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); M. Finger, Univ. Space Research Association (USA); G. Fishman, Marshall Space Flight Ctr (USA); R. Fujimoto, Institute of Space and Aeronautical Science, JAXA (Japan); M. Galeazzi, Univ. of Miami (USA); A. Galli, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); F. Gatti, Istituto Nazionale di Fisica Nucleare (Italy); N. Gehrels, NASA GSFC (USA); B. Gendre, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); G. Ghirlanda, G. Ghisellini, INAF, Osservatorio Astronomico Brera (Italy); P. Giommi, ASI Data Ctr. (Italy); M. Girardi, INAF, Osservatorio Astronomico (Italy); L. Guzzo, INAF, Osservatorio Astronomico Brera (Italy); F. Haardt, Univ. di Insubria (Italy); I. Hepburn, Univ. College London (United Kingdom); W. Hermsen, H. Hoovers, SRON, the Netherlands Institute for Space Research (Netherlands); A. Holland, Univ. of Brunel (United Kingdom); J. In't Zand, SRON, the Netherlands Institute for Space Research (Netherlands); Y. Ishizaki, Nagoya Univ. (Japan); H. Kawahara, Univ. of Tokyo (Japan); N. Kawai, Tokyo Institute of Technology (Japan); J. Kaastra, SRON, the Netherlands Institute for Space Research (Netherlands); M. Kippen, Los Alamos National Lab. (USA); P. A. J. de Korte, SRON, the Netherlands Institute for Space Research (Netherlands); C. Kouveliotou, Marshall Space Flight Ctr. (USA); A. Kusenko, Univ. of California, Los Angeles (USA); C. Labanti, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); R. Lieu, Univ. of Alabama in Huntsville (USA); C. Macculi, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); K. Makishima, Tokyo Univ. of Science (Japan); G. Matt, Univ. Roma III (Italy); P. Mazotta, Univ. de Roma Tor Vergata (Italy); D. McCammon, Univ. of Wisconsin (USA); M. Méndez, SRON, the Netherlands Institute for Space Research (Netherlands); T. Mineo, INAF, Istituto Astrofisica Spaziale (Italy); S. Mitchell, Marshall Space Flight Ctr. (USA); K. Mitsuda, Institute of Space and Aeronautical Science, JAXA (Japan); S. Molendi, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); L. Moscardini, INAF, Osservatorio Astronomico Bologna (Italy); R. Mushotzky, NASA GSFC (USA); L. Natalucci, F. Nicastro, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); P. O'Brien, J. Osborne, Leicester Univ. (United Kingdom); F. Paerels, Columbia Univ. (USA); M. Page, Mullard Space Science Lab., UCL (United Kingdom); S. Paltani, Integral Science Data Ctr. (Switzerland); G. Pareschi, INAF, Osservatorio Astronomico Brera (Italy); E. Perinati, INAF, Istituto Astrofisica

Spaziale (Italy); C. Perola, Univ. Roma III (Italy); T. Ponman, Univ. of Birmingham (United Kingdom); A. Rasmussen, KIPAC, Stanford (USA); M. Roncarelli, INAF, Osservatorio Astronomico Bologna (Italy); P. Rosati, ESO (Germany); O. Ruchayskiy, Institut des Hautes Etudes Scientifiques (France); E. Quadrini, KIPAC, Stanford (USA); I. Sakurai, Nagoya Univ. (Japan); R. Salvaterra, Univ. di Insubria (Italy); S. Sasaki, Tokyo Metropolitan Univ. (Japan); G. Sato, NASA GSFC (USA); J. Schaye, Univ. of Leiden (Netherlands); J. Schmidt, Univ. of Hamburg (Germany); S. Scioritino, INAF, Istituto Astrofisica Spaziale (Italy); M. Shaposhnikov, Ecole Polytechnique Fédérale de Lausanne (Switzerland); K. Shinozaki, Tokyo Metropolitan Univ. (Japan); D. Spiga, INAF, Osservatorio Astronomico Brera (Italy); Y. Suto, Univ. of Tokyo (Japan); G. Tagliaferri, INAF, Osservatorio Astronomico Brera (Italy); T. Takahashi, Institute of Space and Aeronautical Science, JAXA (Japan); Y. Takei, SRON, the Netherlands Institute for Space Research (Netherlands); Y. Tawara, Nagoya Univ. (Japan); P. Tozzi, INAF, Osservatorio Astronomico (Italy); H. Tsunemi, Osaka Univ. (Japan); T. Tsuru, Kyoto Univ. (Japan); P. Ubertini, INAF, Istituto Astrofisica Spaziale Fisica Cosmica (Italy); E. Ursino, Univ. of Miami (USA); M. Viel, INAF, Osservatorio Astronomico (Italy); J. Vink, Univ. of Utrecht (Netherlands); N. White, NASA GSFC (USA); R. Willingale, Leicester Univ. (United Kingdom); R. Wijers, Univ. of Amsterdam (Netherlands); K. Yoshikawa, Univ. of Tokyo (Japan); N. Yamasaki, Institute of Space and Aeronautical Science, JAXA (Japan)

- 6688 06 **GRI: focusing on the evolving violent universe** [6688-05]
 J. Knödlseder, P. von Ballmoos, Ctr. d'Etude Spatiale des Rayonnements, UPS, CNRS (France); F. Frontera, Univ. of Ferrara (Italy); A. Bazzano, INAF-IASF, Rome (Italy); F. Christensen, Danish National Space Ctr. (Denmark); M. Hernanz, Univ. Autònoma de Barcelona (Spain); C. Wunderer, Univ. of California, Berkeley (USA)
- 6688 07 **A wide-field hybrid x-ray telescope for a lunar-based gamma-ray burst observatory** [6688-06]
 P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics (USA)
- 6688 08 **A diffraction-limited dual-band x-ray telescope** [6688-41]
 C. Braig, P. Predehl, Max-Planck-Institut für extraterrestrische Physik (Germany)

SESSION 2 TELESCOPE DESIGN AND OPTIMIZATION

- 6688 09 **Design and optimization of the optics for the EDGE wide-field spectrometer** [6688-07]
 I. Sakurai, Y. Tawara, Nagoya Univ. (Japan); J.-W. den Herder, SRON-Netherlands Institute for Space Research (Netherlands); M. Barbera, G. Cusumano, Univ. degli Studi di Palermo (Italy); T. Mineo, INAF-Istituto di Astrofisica Spaziale (Italy); E. Perianati, INAF-Osservatorio Astronomico G.S. Vaiana di Palermo (Italy)
- 6688 0B **An alternative optical design for x-ray telescopes** [6688-09]
 F. E. Zocchi, D. Vernani, Media Lario Technologies (Italy)
- 6688 0C **Symbol-X: x-ray baffle for stray-light reduction** [6688-10]
 G. Cusumano, M. A. Artale, T. Mineo, V. Teresi, INAF-IASF-Pa (Italy); G. Pareschi, V. Cotroneo, INAF Osservatorio Astronomico di Brera (Italy)

- 6688 OD **A hard x-ray telescope science enhancement package for the Constellation X-Ray mission** [6688-40]
B. Ramsey, NASA Marshall Space Flight Ctr. (USA); P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics (USA)
- 6688 OE **Thermal shielding of the SIMBOL-X mirror assembly** [6688-50]
A. Collura, INAF-OAPA (Italy); P. Attinà, Thales Alenia Space (Italy); M. Barbera, DSFA Univ. di Palermo (Italy) and INAF-OAPA (Italy); G. Costa, A. Ferri, Thales Alenia Space (Italy); G. Pareschi, INAF-OAB (Italy); E. Perinati, INAF-OAPA (Italy); F. R. Powell, Luxel Corp. (USA)

SESSION 3 PERFORMANCE PREDICTION AND CALIBRATION

- 6688 OF **Establishing the response function of the x-ray telescopes onboard the Suzaku satellite** [6688-11]
S. Okada, M. Ebara, Institute of Space and Astronautical Science (Japan); H. Mori, Kyoto Univ. (Japan); R. Iizuka, Nishi-Harima Astronomical Observatory (Japan); H. Inoue, M. Ishida, Y. Maeda, R. Nakamura, K. Suzuki, K. Someya, Institute of Space and Astronautical Science (Japan); Y. Ishisaki, T. Hayashi, T. Shirata, Tokyo Metropolitan Univ. (Japan)
- 6688 OG **The swift-XRT imaging performances and serendipitous survey** [6688-12]
A. Moretti, INAF-Osservatorio Astronomico di Brera (Italy); M. Perri, M. Capalbi, ASI-ASDC (Italy); A. F. Abbey, Univ. of Leicester (United Kingdom); L. Angelini, NASA-GSFC (USA); A. Beardmore, Univ. of Leicester (United Kingdom); D. N. Burrows, Pennsylvania State Univ. (USA); S. Campana, INAF-Osservatorio Astronomico di Brera (Italy); G. Chincarini, INAF-Osservatorio Astronomico di Brera (Italy) and Univ. degli Studi di Milano (Italy); O. Citterio, INAF-Osservatorio Astronomico di Brera (Italy); G. Cusumano, INAF-IASF (Italy); P. A. Evans, University of Leicester (United Kingdom); P. Giommi, ASI-ASDC (Italy); M. R. Goad, O. Godet, University of Leicester (United Kingdom); C. Guidorzi, INAF-Osservatorio Astronomico di Brera (Italy) and Univ. degli Studi di Milano (Italy); D. Grupe, Pennsylvania State Univ. (USA); J. E. Hill, NASA-GSFC (USA); J. A. Kennea, Pennsylvania State Univ. (USA); V. La Parola, V. Mangano, T. Mineo, INAF-IASF (Italy); D. C. Morris, J. A. Nousek, Pennsylvania State Univ. (USA); J. P. Osborne, K. L. Page, Univ. of Leicester (United Kingdom); C. Pagani, J. Racusin, Pennsylvania State Univ. (USA); P. Romano, INAF-Osservatorio Astronomico di Brera (Italy) and Univ. degli Studi di Milano (Italy); G. Tagliaferri, INAF-Osservatorio Astronomico di Brera (Italy); F. Tamburelli, ASI-ASDC (Italy)
- 6688 OH **HEW simulations and quantification of the microroughness requirements for x-ray telescopes by means of numerical and analytical methods** [6688-13]
D. Spiga, INAF, Osservatorio Astronomico di Brera (Italy); G. Cusumano, INAF, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); G. Pareschi, INAF, Osservatorio Astronomico di Brera (Italy)
- 6688 OI **Grazing incidence reflection and scattering of MeV protons** [6688-14]
B. Aschenbach, Max-Planck-Institut für extraterrestrische Physik (Germany)
- 6688 OJ **SIMBOL-X: the problem of calibrating a 0.5–80 keV 20m focal length focussing telescope** [6688-42]
S. Basso, D. Spiga, G. Pareschi, O. Citterio, INAF-Osservatorio Astronomico di Brera (Italy); G. Malaguti, INAF-IASF-Bologna (Italy); W. Burkert, M. Freyberg, Max Planck Institut für extraterrestrische Physik (Germany)

- 6688 OK **Optical module HEW simulations for the x-ray telescopes SIMBOL-X, EDGE and XEUS** [6688-43]
D. Spiga, INAF-Osservatorio Astronomico di Brera (Italy)

SESSION 4 HARD X-RAY AND GAMMA-RAY IMAGING

- 6688 OL **Hard x-ray telescope concentrator for astrophysical mission Spectrum-X-Gamma** [6688-15]
M. Pavlinsky, V. Arefiev, Space Research Institute (Russia); E. Churazov, M. Gilfanov, Space Research Institute (Russia) and Max-Planck-Institute for Astrophysics (Germany); S. Grigorovich, D. Litvin, All-Russian Scientific Research Institute for Experimental Physics (Russia); I. Lapshov, V. Levin, V. Akimov, N. Semena, A. Tkachenko, Space Research Institute (Russia); A. Vikhlinin, Space Research Institute (Russia) and Harvard-Smithsonian Ctr. for Astrophysics (USA); R. Sunyaev, Space Research Institute (Russia) and Max-Planck-Institute for Astrophysics (Germany); B. D. Ramsey, NASA Marshall Space Flight Ctr. (USA); M. V. Gubarev, Universities Space Research Association (USA); R. F. Elsner, S. L. O'Dell, M. C. Weisskopf, NASA Marshall Space Flight Ctr. (USA)
- 6688 ON **Development status of a Laue lens project for gamma-ray astronomy** [6688-17]
F. Frontera, Univ. of Ferrara (Italy) and INAF, IASF Bologna (Italy); G. Loffredo, A. Pisa, L. Milani, F. Nobili, N. Auricchio, Univ. of Ferrara (Italy); V. Carassiti, F. Evangelisti, Istituto Nazionale Fisica Nucleare (Italy); L. Landi, Univ. of Ferrara (Italy); S. Squerzanti, Istituto Nazionale Fisica Nucleare (Italy); K. H. Andersen, P. Courtois, Institut Laue-Langevin (France); L. Amati, E. Caroli, G. Landini, S. Silvestri, J. B. Stephen, INAF, IASF Bologna (Italy); J. M. Poulsen, Thales-Alenia Italia SpA (Italy); B. Negri, Agenzia Spaziale Italiana (Italy); G. Pareschi, INAF, Osservatorio Astronomico di Brera (Italy)
- 6688 OO **R & D progress on second-generation crystals for Laue lens applications** [6688-18]
N. Barrière, P. von Ballmoos, Univ. Paul Sabatier (France); P. Bastie, Lab. de Spectrométrie (France); P. Courtois, Institut Laue Langevin (France); N. V. Abrosimov, Institut für Kristallzüchtung (Germany); K. Andersen, Institut Laue Langevin (France); T. Buslaps, ESRF (France); T. Camus, Univ. Paul Sabatier (France); H. Halloin, APC, Univ. Paris 7 (France); M. Jentschel, Institut Laue Langevin (France); J. Knödseder, G. Roudil, Univ. Paul Sabatier (France); D. Serre, LA, Observatoire Midi-Pyrénées (France); G. Skinner, NASA-GSFC (USA), Univ. of Maryland (USA), and CESR (France)
- 6688 OP **Adaptive lobster-eye hard x-ray telescope with high-angular resolution and wide field of view** [6688-19]
V. Grubsky, M. Gertsenshteyn, K. Shoemaker, T. Jansson, Physical Optics Corp. (USA)
- 6688 OQ **Salient features of MACA and CMACA systems and their applications** [6688-44]
C. Ratnam, New Science College (India); S. L. Goud, Osmania Univ. (India); V. L. Rao, New Science College (India)

SESSION 5 MULTILAYER COATINGS

- 6688 OR **Reduction of stress and roughness by reactive sputtering in W/B₄C x-ray multilayer films** [6688-20]
D. L. Windt, Reflective X-ray Optics LLC (USA)

- 6688 OS **Characterization of Pt/C multilayer at 200 keV soft gamma-ray** [6688-21]
Y. Ogasaka, T. Iwahara, T. Miyazawa, Y. Fukaya, N. Sasaki, Nagoya Univ. (Japan);
K. Tamura, ISAS/JAXA (Japan); Y. Kanou, H. Kunieda, K. Yamashita, Nagoya Univ. (Japan)
- 6688 OT **Stacked depth-graded multilayer for hard x-rays measured up to 130 keV** [6688-22]
C. P. Jensen, F. E. Christensen, Danish National Space Ctr. (Denmark); S. Romaine, R. Bruni,
Harvard-Smithsonian Ctr. for Astrophysics (USA); Z. Zhong, Brookhaven National Lab. (USA)
- 6688 OU **Carbon overcoatings for soft x-ray reflectivity enhancement** [6688-24]
V. Cotroneo, D. Spiga, INAF-Osservatorio Astronomico di Brera (Italy); M. Barbera, INAF-
Osservatorio Astronomico di Palermo (Italy); R. Bruni, Harvard-Smithsonian Ctr. for
Astrophysics (USA); K. Chen, Institute of High Energy Physics (China); C. Marcelli, INFN-
National Frascati Labs. (Italy); G. Pareschi, INAF-Osservatorio Astronomico di Brera (Italy);
S. Romaine, Harvard-Smithsonian Ctr. for Astrophysics (USA); Y. D. Zhao, L. Zheng, Z. Y. Wu,
Institute of High Energy Physics (China)
- 6688 OV **Optical constants in the hard x-ray/soft gamma ray range of selected materials for
multilayer reflectors** [6688-45]
C. P. Jensen, Danish National Space Ctr. (Denmark); S. Romaine, R. Bruni, Harvard-
Smithsonian Ctr. for Astrophysics (USA); F. E. Christensen, Danish National Space Ctr.
(Denmark); Z. Zhong, Brookhaven National Lab. (USA)

SESSION 6 SPECTROSCOPY

- 6688 OW **Comparison of solar spectra from the Hinode extreme-ultraviolet imaging spectrometer
(EIS) to preflight calibrations** [6688-25]
J. Seely, U. Feldman, C. Brown, G. Doschek, Naval Research Lab. (USA); H. Hara, National
Astronomical Observatory of Japan (Japan)
- 6688 OY **Spectrometer concept and design for x-ray astronomy using a blazed transmission grating**
[6688-27]
K. Flanagan, M. Ahn, J. Davis, R. Heilmann, D. Huenemoerder, A. Levine, H. Marshall,
G. Prigozhin, MIT (USA); A. Rasmussen, Stanford Univ. (USA); G. Ricker, M. Schattenburg,
N. Schulz, Y. Zhao, MIT (USA)
- 6688 OZ **A soft x-ray polarimeter designed for broadband x-ray telescopes** [6688-51]
H. L. Marshall, Massachusetts Institute of Technology (USA)

SESSION 7 MIRROR FABRICATION AND CHARACTERIZATION I

- 6688 IO **Progress in x-ray optics development with formed glass and Si wafers** [6688-28]
R. Hudec, Astronomical Institute (Czech Republic); L. Pina, Ctr. of Advanced X-ray
Technologies (Czech Republic) and Czech Technical Univ. Prague (Czech Republic);
V. Semencova, Ctr. of Advanced X-ray Technologies (Czech Republic) and Institute of
Chemical Technology (Czech Republic); M. Skulinova, Astronomical Institute (Czech
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(Czech Republic); M. Mika, R. Kacerovsky, J. Prokop, Institute of Chemical Technology
(Czech Republic); M. Cerny, Institute of Rock Structure and Mechanics (Czech Republic)

- 6688 11 **Development of lightweight x-ray mirrors for the Constellation-X mission** [6688-29]
W. W. Zhang, NASA Goddard Space Flight Ctr. (USA); K.-W. Chan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County (USA); T. Hajimichael, NASA Goddard Space Flight Ctr. (USA) and Ball Aerospace Corp. (USA); J. P. Lehan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County (USA); S. Owens, R. Petre, T. T. Saha, NASA Goddard Space Flight Ctr. (USA); M. Gubarev, NASA Goddard Space Flight Ctr. (USA) and Universities Space Research Association (USA); W. D. Jones, S. L. O'Dell, NASA Marshall Space Flight Ctr. (USA)
- 6688 12 **X-ray imaging glass micro-pore optics** [6688-30]
M. J. Collon, M. W. Beijersbergen, cosine Research B.V. (Netherlands); K. Wallace, M. Bavdaz, European Space Agency, ESTEC (Netherlands); R. Fairbend, J. Séguy, E. Schyns, Photonis SAS (France); M. Krumrey, Physikalisch-Technische Bundesanstalt (Germany); M. Freyberg, Max-Planck-Institut für extraterrestrische Physik (Germany)
- 6688 13 **Silicon pore optics for astrophysical x-ray missions** [6688-31]
M. J. Collon, R. Günther, S. Kraft, M. W. Beijersbergen, cosine Research B.V. (Netherlands); M. Bavdaz, K. Wallace, European Space Agency, ESTEC (Netherlands); M. Krumrey, Physikalisch-Technische Bundesanstalt (Germany); M. Freyberg, Max-Planck-Institut für extraterrestrische Physik (Germany)
- 6688 14 **The first light of a single-stage MEMS x-ray optic** [6688-32]
M. Koshiishi, Japan Aerospace Exploration Agency (Japan); Y. Ezo, Japan Aerospace Exploration Agency (Japan) and Institute of Physical and Chemical Research, RIKEN (Japan); M. Mita, Y. Maeda, K. Mitsuda, Japan Aerospace Exploration Agency (Japan); M. Suzuki, T. Osawa, A. Hoshino, Y. Ishisaki, Tokyo Metropolitan Univ. (Japan); T. Takano, R. Maeda, Advanced Manufacturing Research Institute, AIST (Japan)
- 6688 15 **Thin plastic foil x-ray optics with spiral geometry** [6688-33]
M. Barbera, UNIPA (Italy) and INAF-Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); T. Mineo, INAF-Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); E. Perinati, INAF-Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); H. W. Schnopper, Smithsonian Astrophysical Observatory (USA); A. Taibi, INAF-Osservatorio Astronomico di Palermo G.S. Vaiana (Italy)
- 6688 16 **New fabrication methods of mirror substrate with multi-stage closed shell for high-throughput x-ray telescope** [6688-46]
Y. Tawara, I. Sakurai, T. Masuda, T. Torii, Nagoya Univ. (Japan); K. Suzui, M. Aoyama, T. Kondo, N. Mizutani, National Institute of Natural Science (Japan)

SESSION 8 MIRROR FABRICATION AND CHARACTERIZATION II

- 6688 17 **X-ray imaging and adaptive optics system for a 13.5-nm telescope** [6688-34]
S. Kitamoto, Y. Ohkubo, M. Tsujimoto, T. Ogita, K. Saitoh, M. Morii, K. Sudoh, N. Gotoh, Y. Shishido, T. Shibata, E. Takenaka, Rikkyo Univ. (Japan)

- 6688 18 **Toward a complete metrologic solution for the mirrors for the Constellation-X spectroscopy x-ray telescope** [6688-35]
J. P. Lehan, Univ. of Maryland, Baltimore County (USA) and NASA Goddard Space Flight Ctr. (USA); S. Owens, NASA Goddard Space Flight Ctr. (USA); T. Hadjimichael, M. Hong, NASA Goddard Space Flight Ctr. (USA) and Ball Aerospace (USA); K.-W. Chan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County (USA); T. T. Saha, NASA Goddard Space Flight Ctr. (USA); P. Reid, Harvard-Smithsonian Ctr. for Astrophysics (USA); W. W. Zhang, NASA Goddard Space Flight Ctr. (USA)
- 6688 19 **Testing of the mirrors for the Constellation-X spectroscopy x-ray telescope with a refractive null** [6688-36]
J. P. Lehan, Univ. of Maryland (USA) and NASA Goddard Space Flight Ctr. (USA); T. Hadjimichael, NASA Goddard Space Flight Ctr. (USA) and Ball Aerospace (USA); C. Skocik, NASA Goddard Space Flight Ctr. (USA) and ManTech Corp. (USA)
- 6688 1A **Experimental results on slumped glass x-ray mirror segments** [6688-47]
M. Vongehr, P. Friedrich, H. Bräuninger, W. Lieb, M. Fürmetz, A. Mazur, Max-Planck-Institut für extraterrestrische Physik (Germany); K. Veit, P. Ettl, X. Laboureux, 3D-Shape GmbH (Germany)
- 6688 1B **Characterization of thin plastic foils for applications in x-ray optics technology** [6688-48]
A. Taibi, Univ. di Ferrara (Italy) and INAF-Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); M. Barbera, INAF-Osservatorio Astronomico di Palermo G.S. Vaiana (Italy) and Univ. di Palermo (Italy); G. Pareschi, INAF-Osservatorio Astronomico di Brera (Italy); H. W. Schnopper, Smithsonian Astrophysical Observatory (USA); G. Sironi, R. Valtolina, INAF-Osservatorio Astronomico di Brera (Italy)

SESSION 9 ALIGNMENT AND MOUNTING

- 6688 1C **Breadboard micro-pore optic development for x-ray imaging** [6688-37]
K. Wallace, ESA-ESTEC (Netherlands); M. J. Collon, M. W. Beijersbergen, cosine Research B.V. (Netherlands); S. Oemrawsingh, cosine Science & Computing BV (Netherlands); M. Bavdaz, ESA-ESTEC (Netherlands); E. Schyns, Photonis (France)
- 6688 1D **An alignment and integration technique for mirror segment pairs on the Constellation-X telescope** [6688-38]
T. Hadjimichael, Ball Aerospace (USA); S. Owens, NASA Goddard Space Flight Ctr. (USA); J. Lehan, NASA Goddard Space Flight Ctr. (USA) and Univ. of Maryland, Baltimore County; L. Olsen, Ball Aerospace (USA); T. Saha, T. Wallace, W. Zhang, NASA Goddard Space Flight Ctr. (USA)
- 6688 1E **Mechanical and thermal analysis of the spectroscopy x-ray telescopes for the Constellation-X mission** [6688-39]
K.-W. Chan, Univ. of Maryland, Baltimore County(USA) and NASA Goddard Space Flight Ctr. (USA); J. Bolognese, T. Saha, J. Sturm, W. Zhang, NASA Goddard Space Flight Ctr. (USA)
- 6688 1F **Mounting and alignment of full-shell replicated x-ray optics** [6688-49]
M. Gubarev, Universities Space Research Association (USA) and MSFC/NASA (USA); W. Arnold, Jacobs ESTS Group (USA) and MSFC/NASA (USA); C. Benson, T. Kester, D. Lehner, B. Ramsey, MSFC/NASA (USA); R. Upton, ERC, Inc., (USA) and MSFC/NASA (USA)

Author Index

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Bernd E. Aschenbach, Max-Planck-Institut für extraterrestrische Physik (Germany)
Paul Gorenstein, Harvard-Smithsonian Center for Astrophysics (USA)
- 3 Performance Prediction and Calibration
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- 4 Hard X-Ray and Gamma-Ray Imaging
Jürgen Knödlseeder, Centre d'Etude Spatiale des Rayonnements, UPS/CNRS (France)
Mikhail N. Pavlinsky, Space Research Institute (Russia)
- 5 Multilayer Coatings
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David L. Windt, Reflective X-Ray Optics LLC (USA)
- 6 Spectroscopy
John F. Seely, Naval Research Laboratory (USA)
- 7 Mirror Fabrication and Characterization I
Finn E. Christensen, Danish National Space Center, Technical University of Denmark (Denmark)
William W. Zhang, NASA Goddard Space Flight Center (USA)
- 8 Mirror Fabrication and Characterization II
Webster C. Cash, Jr., University of Colorado, Boulder (USA)
- 9 Alignment and Mounting
Brian D. Ramsey, NASA Marshall Space Flight Center (USA)

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-weight 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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