Scientific sessions will be held at the:
**Portola Hotel and Spa**
2 Portola Plaza
Monterey, CA 93940

**HEAD Paper Sorters**
Keith Arnaud
Joshua Bloom
Joel Bregman
Paolo Coppi
Rosanne Di Stefano
Daryl Haggard
Chryssa Kouveliotou
Henric Krawczynski
Stephen Reynolds
Randall Smith
Jan Vrtilek
Nicholas White

**Session Numbering Key**
100’s Monday and posters
200’s Tuesday
300’s Wednesday
400’s Thursday

Please Note: All posters are displayed Monday-Thursday.

**Current HEAD Officers**
Joel Bregman  Chair
Nicholas White  Vice-Chair
Randall Smith  Secretary
Keith Arnaud  Treasurer
Megan Watzke  Press Officer
Chryssa Kouveliotou  Past Chair

**Current HEAD Committee**
Daryl Haggard  2013-2016
Henric Krawczynski  2013-2016
Rosanne DiStefano  2011-2014
Stephen Reynolds  2011-2014
Jan Vrtilek  2011-2014
Joshua Bloom  2012-2015
Paolo Coppi  2012-2015
**Registration**
De Anza Foyer
Sunday: 1:00pm-7:00pm
Monday-Wednesday: 7:30am-6:00pm
Thursday: 8:00am-5:00pm

**Poster Viewing**
Monday-Wednesday: 7:30am-6:45pm
Thursday: 7:30am-5:00pm
Please do not leave personal items unattended. HEAD is not responsible for lost or stolen property.
Posters not removed by 5:00pm on Thursday will be discarded.

**De Anza Ballroom I Events**
Morning Coffee Break
Monday-Thursday: 10:00am-10:30am
Happy Hour: Poster Sessions
Monday-Wednesday: 5:45pm-6:45pm

**Speaker Ready Desk**
De Anza
Sunday: 1:00pm-7:00pm
Monday-Wednesday: 7:30am-6:00pm
Thursday: 8:00am-3:00pm

**Grab-and-Go Breakfast**
Lower Atrium
Monday-Wednesday, 7:00am-8:30am

**Grab-and-Go Lunch**
Lower Atrium
Monday: 12:30pm-2:00pm
Tuesday: 12:00pm-1:30pm
Using Your Own Laptop While At The Meeting

• All devices are required to be running the most up-to-date virus and spyware protection.
• No device should be running as a server for offsite clients.
• Absolutely no routers can be attached to the network without prior authorization from the HEAD IT Staff.
• The network will be monitored throughout the Meeting and the HEAD Staff reserves the right to disconnect any device that is causing network problems.
• Wireless connection information will be printed on the back of your badge.

HEAD would like to thank our Meeting Sponsor

Ball Aerospace & Technologies Corp.
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<tr>
<td>7:00pm</td>
<td>Opening Reception</td>
<td>Portola Hotel and Spa</td>
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Sunday, 7 April 2013
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<td>Speaker Ready, 7:30am-6:00pm, De Anza Foyer</td>
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<td>Poster Viewing, 7:30am-6:45pm, De Anza Ballroom I</td>
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<td>8:00am</td>
<td><strong>100 Opening Remarks</strong>, 8:20am-8:30am, De Anza Ballroom II-III</td>
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<td>8:30am</td>
<td>**101 AGN I: Winds/Jets/Accretion (obs) and Variability, 8:30am-10:00am, De Anza Ballroom II-III</td>
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<td>10:00am</td>
<td>Break, 10:00am-10:30am</td>
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<td>10:30am</td>
<td><strong>102 Plenary</strong> HEAD Dissertation Prize Talk, 10:30am-11:00am, De Anza Ballroom II-III</td>
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<td>11:00am</td>
<td>**103 Stellar Compact I: CVs, Isolated Neutron Stars, Planetary Nebula, 11:00am-12:30pm, De Anza Ballroom II-III</td>
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<td>Poster Session I, 12:30pm-2:00pm, De Anza Ballroom I</td>
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<td>1:00pm</td>
<td>**104 Future Instrumentation And Missions in X-Ray Astronomy, 2:00pm-3:45pm, De Anza Ballroom II-III</td>
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<td>2:00pm</td>
<td>**105 On the Detection of the Extragalactic Background Light, 2:00pm-3:45pm, Portola Room</td>
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<td>Break, 3:45pm-4:15pm</td>
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<td>4:15pm</td>
<td>**106 Public Policy; Working Internationally, 4:15pm-5:45pm, De Anza Ballroom II-III</td>
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<td>5:45pm</td>
<td>Happy Hour: Poster Session II, 5:45pm-6:45pm, De Anza Ballroom I</td>
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<td>**131 Astrostatistics in High Energy Astrophysics - Session in Memory of Alanna Connors, 7:30pm-9:00pm, Portola Room **</td>
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**Monday, 8 April 2013**

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<td>7:30am</td>
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<td>**101 AGN I: Winds/Jets/Accretion (obs) and Variability, 8:30am-10:00am, De Anza Ballroom II-III</td>
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<td>Happy Hour: Poster Session II, 5:45pm-6:45pm, De Anza Ballroom I</td>
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<td>10:30am</td>
<td>200 Missions and Miscellaneous, 8:30am-10:00am, De Anza Foyer</td>
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<td>201 NuSTAR, 10:30am-12:05pm, De Anza Ballroom I-III</td>
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<td>202 PCOM Town Hall, 12:00pm-1:30pm, Lower Atrium</td>
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<td>203 Plenary, The Fermi Bubbles, 1:30pm-2:15pm, De Anza Ballroom I-III</td>
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<td>204 Stellar Compact II: Stellar Mass Black Holes and X-ray Binary Surveys, 2:15pm-3:45pm</td>
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<td>Break, 3:45pm-4:15pm, De Anza Ballroom I-III</td>
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<td>205 Accretion, Spin, and Feedback: How are AGN Jets Produced? 4:15pm-5:45pm, Portola Room</td>
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<td>Happy Hour: Poster Session II, 5:45pm-6:45pm, De Anza Ballroom I-III</td>
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<td>206 Black Hole in Globular Clusters, 4:15pm-5:45pm, De Anza Ballroom I-III</td>
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<td>Break, 6:45pm-7:30pm, De Anza Ballroom I-III</td>
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<tr>
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<td>207 Science of Future X-ray Missions, 7:30pm-9:00pm, De Anza Ballroom I-III</td>
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<td><strong>300</strong> AGN II: Winds/jets/accretion (theory) and AGN/Galaxy Connections, 8:30am-10:00am, De Anza Ballroom II-III</td>
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<td>Break, 10:00am-10:30am</td>
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<td>10:30am</td>
<td><strong>301</strong> Galaxies &amp; ISM, 10:30am-12:00pm, De Anza Ballroom II-III</td>
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<td>Lunch Break, 12:00pm-1:30pm</td>
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<td><strong>302</strong> Gravitational Wave Mission Plans, 1:30pm-3:00pm, De Anza Ballroom II-III</td>
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<td><strong>303</strong> The Charge Exchange Process in the Solar System and Beyond, 3:30pm-3:00pm, Portola Room</td>
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<td>Break, 3:00pm-3:30pm</td>
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<td><strong>304</strong> Bridging Laboratory and High Energy Astrophysics, 3:30pm-5:00pm, De Anza Ballroom II-III</td>
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<td><strong>305</strong> Understanding Gamma-Ray Bursts Emission Mechanism in the Fermi Era, 3:30pm-5:00pm, Portola Room</td>
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<td>Happy Hour: Poster Session IV, 5:00pm-6:00pm, De Anza Ballroom I</td>
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<td>Break, 6:00pm-7:30pm</td>
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<td>HEAD Banquet, 7:30pm-9:00pm, Portola Hotel and Spa</td>
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<td>400 SNR/GRB, 8:30am-10:00am, De Anza Ballroom II-III</td>
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<td>Break, 10:00am-10:30am</td>
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<td>401 Galaxy Clusters, 10:30am-12:00pm, De Anza Ballroom II-III</td>
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<td>Lunch Break, 12:00pm-1:30pm</td>
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<td>1:30pm</td>
<td>402 Stellar Compact III: X-ray Binaries, Transients and ULX Sources, 1:30pm-3:00pm, De Anza Ballroom II-III</td>
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<td>Break, 3:00pm-3:30pm</td>
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<tr>
<td>3:30pm</td>
<td>403 AGN III: Transients and Low Luminosity/Mass AGN, 3:30pm-5:00pm, De Anza Ballroom II-III</td>
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**Friday**

**NASA PCOS X-RAY SAG MEETING**

9:00AM-5:30PM

COTTONWOOD ROOM

SEE SCHEDULE ON PAGE 78
SUNDAY EVENTS

Opening Reception
Sunday, 7:00 PM - 9:00 PM, Memory Garden
MONDAY SESSIONS AND EVENTS

100 Opening Remarks
Monday, 8:20 AM - 8:30 AM, De Anza Ballroom II-III

101 AGN I: Winds/jets/accretion (obs) and Variability
Monday, 8:30 AM - 10:00 AM, De Anza Ballroom II-III

Chair
Daryl Haggard
Northwestern University/CIERA.

101.01 Microlensing Constraints on Quasar X-ray Emission Regions
University of Oklahoma, Ohio State University, College of Charleston, US Navy Academy.

101.02 X-ray Reverberation Lags in 1H0707-495 and IRAS 13224-3809
Erin Kara
Institute of Astronomy, United Kingdom.

101.03 X-ray Reverberation Mapping in AGN
Abderahmen Zoghbi, C.S. Reynolds, A.C. Fabian, E. Cackett
University of Maryland, University of Cambridge, United Kingdom, Wayne State University.

101.04 Fermi LAT Observations of Gamma-ray Flaring in the Gravitationally Lensed Blazar B0218+357
Chi (Teddy) C. Cheung, J.D. Scargle, R.H.D. Corbet, Fermi-LAT Collaboration
NRL, NASA Ames, UMBC, NASA/GSFC.

101.05 Emergence of an Outflow in the Seyfert Galaxy Mrk 335 Revealed by XMM-Newton and HST
ESAC XMM-Newton SOC, Spain, MIT Kavli Institute, Universidad Nacional Autonoma de Mexico, Mexico, Space Telescope Science Institute, Department of Astronomy and Physics, St. Mary’s University, Canada, Department of Astronomy and Astrophysics, Pennsylvania State University, Max Planck Institut fuer Radioastronomie, Germany, Department of Astronomy, Ohio State University.

101.06 Unification of X-ray Winds in Seyfert Galaxies: From Ultra-fast Outflows to Warm Absorbers
Francesco Tombesi, M. Cappi, J. Reeves, R. Nemmen, V. Braito, M. Gaspari, C.S. Reynolds
University of Maryland, NASA/Goddard, INAF-IASF, Italy, Keele University, United Kingdom, INAF-OA Brera, Italy, MPA, Germany.

101.07 Zooming in on the Central Regions of a Radio-loud AGN -- 3C120
Anne M. Lohfink, C.S. Reynolds, E.D. Miller, R. Mushotzky, L. Brenneman
University of Maryland, MIT, Kavli Institute for Astrophysics, Harvard-Smithsonian Center for Astrophysics.
**101.08 Proper Motion and Relativistic Velocities in the Optical Synchrotron Jet of M87**
Eileen T. Meyer\(^1\), W.B. Sparks\(^1\), R.P. Van Der Marel\(^1\), J. Anderson\(^1\), J.A. Biretta\(^1\), M. Nakamura\(^2\), C.A. Norman\(^3\), S. Sohn\(^1\)

\(^1\)Space Telescope Science Institute, \(^2\)Academia Sinica, Institute of Astronomy and Astrophysics, Taiwan, \(^3\)The Johns Hopkins University.

**101.09 The Solid Redshift Lower Limit of the Most Distant TeV-Emitting Blazar PKS 1424+240**
Amy Furniss\(^1\), C. Danforth\(^2\), D.A. Williams\(^1\), M. Fumagalli\(^3\), J.R. Primack\(^1\), J.T. Stocke\(^2\), C.M. Urry\(^4\)

\(^1\)Department of Physics, University of California Santa Cruz, \(^2\)Center for Astrophysics and Space Astronomy, University of Colorado, \(^3\)Department of Astrophysics, Princeton University, \(^4\)Department of Astronomy, Yale University.

**102 HEAD Dissertation Prize Talk**
Monday, 10:30 AM - 11:00 AM, De Anza Ballroom II-III

**102.01 Winds of Change: The Physics of Accretion, Ejection, and X-ray Variability in GRS1915+105**
Joseph Neilsen\(^1\)

\(^1\)Boston University.

**103 Stellar Compact I: CVs, Isolated Neutron Stars, Planetary Nebula**
Monday, 11:00 AM - 12:30 PM, De Anza Ballroom II-III

Chair
Rosanne Di Stefano\(^1\)

\(^1\)Harvard-Smithsonian CfA.

**103.01 Mysteries and Discoveries from the Chandra Planetary Nebulae Suvery (ChanPlaNS)**
Rodolfo Montez\(^1\), J.H. Kastner\(^2\), ChanPlaNS Team

\(^1\)Vanderbilt University, \(^2\)Rochester Institute of Technology.

**103.02 Finding and Characterizing Compact Binaries via Their Optical Emission**
Thomas A. Prince\(^1\), E. Bellm\(^1\), D.B. Levitan\(^1\), B.H. Margon\(^2\), E.S. Phinney\(^1\), Palomar Transient Factory

\(^1\)Caltech, \(^2\)UC Santa Cruz.

**103.03 The E-Nova Project: New Insights into Mass Ejection in Nova Outbursts**
Thomas Nelson\(^1\), L. Chomiuk\(^2,6\), J.L. Sokoloski\(^3\), K. Mukai\(^4,5\), M.P. Rupen\(^6\), A.J. Mioduszewski\(^6\), J. Weston\(^3\), Y. Zheng\(^3\)

\(^1\)University of Minnesota, \(^2\)Michigan State University, \(^3\)Columbia University, \(^4\)University of Maryland Baltimore County, \(^5\)NASA Goddard Space Flight Center, \(^6\)National Radio Astronomy Observatory.

**103.04 Searching for MSPs with the Fermi Large Area Telescope**
Elizabeth C. Ferrara\(^1,2\), Fermi-LAT Collaboration

\(^1\)NASA/GSFC, \(^2\)University of Maryland.
103.05 X-ray Characterization of Fermi Gamma-ray Pulsars
Angelica Sartori\textsuperscript{1,2}, Fermi Collaboration
\textsuperscript{1}INAF/IASF, Italy, \textsuperscript{2}INFN, Italy.

103.06 Magnetohydrodynamic Simulations of Oblique Pulsar Magnetospheres
Alexander Tchekhovskoy\textsuperscript{1}, A. Spitkovsky\textsuperscript{1}, J.G. Li\textsuperscript{1}
\textsuperscript{1}Princeton University.

103.07 New Results on the Spectral Evolution of Magnetar Bright Bursts
George A. Younes\textsuperscript{1}, C. Kouveliotou\textsuperscript{2}, A. van der Horst\textsuperscript{3}, GBM Magnetar Team
\textsuperscript{1}USRA/NASA-MSFC, \textsuperscript{2}NASA-MSFC, \textsuperscript{3}University of Amsterdam, Netherlands.

103.08 Mass and Radius Constraints Using Magnetar Giant Flare Oscillations
Alex T. Deibel\textsuperscript{1}, A.W. Steiner\textsuperscript{2}, E.F. Brown\textsuperscript{1,3}
\textsuperscript{1}Michigan State University, \textsuperscript{2}Institute for Nuclear Theory, University of Washington, \textsuperscript{3}National Superconducting Cyclotron Laboratory.

103.09 Anti-Glitch in the Magnetar 1E 2259+586
Robert F. Archibald\textsuperscript{1}, V.M. Kaspi\textsuperscript{1}, C. Ng\textsuperscript{2,1}, K.N. Gourgouliatos\textsuperscript{1}, D. Tsang\textsuperscript{1}, P. Scholz\textsuperscript{1}, A.P. Beardmore\textsuperscript{2}, N. Gehrels\textsuperscript{3}, J.A. Kennea\textsuperscript{3}
\textsuperscript{1}McGill, Canada, \textsuperscript{2}The University of Hong Kong, Hong Kong, \textsuperscript{3}University of Leicester, United Kingdom, \textsuperscript{4}Goddard Space Flight Center, \textsuperscript{5}Pennsylvania State University.

Lunch Break and Poster Session I
Monday, 12:30 PM - 2:00 PM, De Anza Ballroom I

104 Future Instrumentation And Missions in X-Ray Astronomy
Monday, 2:00 PM - 3:45 PM, De Anza Ballroom II-III
Chair
Fiona Harrison\textsuperscript{1}
\textsuperscript{1}Caltech.

104.01 Future Development Trajectories for Imaging X-ray Spectrometers Based on Microcalorimeters
Caroline Kilbourne\textsuperscript{1}, S. Bandler\textsuperscript{1,2}
\textsuperscript{1}NASA Goddard Space Flight Center, \textsuperscript{2}University of Maryland.

104.02 The Future of X-ray Optics
Paul B. Reid\textsuperscript{1}, SAO, PSU, MSFC, GSFC, ESTEC
\textsuperscript{1}Harvard-Smithsonian Center for Astrophysics.

The near vision (next 10 years) of X-ray astronomy in Japan
Takaya Ohashi\textsuperscript{1}
\textsuperscript{1}Tokyo Metropolitan University, Japan.
105 On the Detection of the Extragalactic Background Light
Monday, 2:00 PM - 3:30 PM, Portola Room

Chair
Justin Finke¹
¹US Naval Research Laboratory.

105.01 Highlights of Recent Measurements and Constraints of the EBL Using Imaging Atmospheric Cherenkov Telescopes
Matthew Orr¹
¹Iowa State University.

105.02 The Detection of the Cosmic Gamma-ray Horizon
Alberto Dominguez¹, J. Finke², F. Prada¹, J.R. Primack², F.S. Kitaura³, B.D. Siana¹, D. Paneque⁷,⁸
¹University of California, Riverside, ²U.S. Naval Research Laboratory, ³UAM-CSIC, Spain, ⁴IAA-CSIC, Spain, ⁵University of California, Santa Cruz, ⁶AIP, Germany, ⁷SLAC, ⁸Max-Planck, Germany.

105.03 Secondary TeV Gamma Rays from Distant Blazars, and Extragalactic Background Light
Alexander Kusenko¹,²
¹UCLA, ²IPMU, Japan.

105.04 The Imprint of the Extragalactic Background Light in the Gamma-ray Spectra of Blazars
Marco Ajello¹, R. Buehler², A. Reimer², Fermi-LAT Collaboration
¹Berkeley, ²Innsbruck University, Austria, ³Desy Zeuthen, Germany.

105.05 Extragalactic Background Light up to the Epoch of Cosmic Reionization
Yoshiyuki Inoue¹, S. Inoue², M.A. Kobayashi³, R. Makiya⁴, Y. Niino³, T. Totani⁴, Y. Tanaka⁶
¹KIPAC/SLAC/Stanford, ²MIPK, Germany, ³NAOJ, Japan, ⁴Kyoto University, Japan, ⁵Ehime University, Japan, ⁶Hiroshima University, Japan.

106 Public Policy; Working Internationally
Monday, 4:15 PM - 5:45 PM, De Anza Ballroom II-III

Chair
Ann E. Hornschemeier¹
¹NASA GSFC.

106.01 The Atacama Large Millimeter/Submillimeter Array (ALMA) - A Successful Three-Way International Partnership Without a Majority Stakeholder
Paul A. Vanden Bout¹
¹NRAO.

106.02 Building International Space Observatories
Harvey Tananbaum¹
¹Harvard-Smithsonian, CfA.

106.03 NASA's Astrophysics Program
Paul L. Hertz¹
106.04 **ESA’s Astrophysics Program**  
Fabio Favata\(^1\)  
\(^1\)ESA.

106.05 **JAXA’s Astrophysics Program**  
Tad Takahashi\(^1\)  
\(^1\)ISAS/JAXA.

**Happy Hour: Poster Session II**  
Monday, 5:45 PM - 6:45 PM, De Anza Ballroom I

**131 Astrostatistics in High Energy Astrophysics - Session in Memory of Alanna Connors**  
Monday, 7:30 PM - 9:00 PM, Portola Room

This astrostatistics session will honor the memory of Alanna Connors who was a pioneer in the investigation and development of statistical methods required for the analysis of high energy data. The session will provide a historical perspective on Bayesian methods, highlight the topics where the contribution made by Alanna were particularly important, summarize current analysis challenges and discuss future perspectives. Details available at: http://hea-www.harvard.edu/AstroStat/HEAD2013/

**Chair**  
Herman Marshall\(^1\)  
\(^1\)MIT.
MONDAY-THURSDAY POSTERS

Posters will be displayed Monday-Thursday. Poster Sessions are scheduled each day.

108 AGN Structure and Variability Poster Session
De Anza Ballroom I

108.01 The Global Implications of the Hard X-ray Excess in Type 1 AGN
Malachi Tatum1, T. Turner1, L. Miller2, J. Reeves3,1
1UMBC, 2University of Oxford, United Kingdom, 3Keele University, United Kingdom.

108.02 Ten-year History of Warm Absorbers in Mrk 290: COS and FUSE Observations
Shuinai Zhang1, L. Ji1, T. Kallman2, Y. Yao3, Q. Gu4, C.S. Froning3
1Purple Mountain Observatory, China, 2Goddard space flight center, NASA, 3Department of Astrophysical and Planetary Sciences, University of Colorado, 4School of Astronomy and Space Science, China.

108.03 Simulating the Spectra of BAL QSOs with a Biconical Wind
Nicholas Higginbottom1, K.S. Long2, C. Knigge1, S. Sim2
1University of Southampton, United Kingdom, 2Space Telescope Science Institute, 3Queens University, United Kingdom.

108.05 A Half-Megasecond X-ray Study of the ULIRG Mrk 231
Stacy H. Teng1, S. Veilleux2, D. Rupke3
1NASA/GSFC, 2University of Maryland, 3Rhodes College.

108.06 Chandra and VLA Observations of Supermassive Black Hole Outbursts in M87 and Implications for Feedback in Early-Type Galaxies
William R. Forman1, E. Churazov2,3, C. Jones1
1SAO-CfA, 2MPA, Germany, 3IKI, Russian Federation.

108.07 Do Unification Models Explain the X-ray Properties of Radio Sources?
Belinda J. Wilkes1, J. Kuraszkiewicz1, M. Haas2, P. Barthel3, S.P. Willner1, C. Leipski4, D. Worrall5, M. Birkinshaw2, R.R.J. Antonucci6, M. Ashby1, R. Chini1, G.G. Fazio1, C.R. Lawrence6, P.M. Ogle9, B. Schulz10
1Harvard-Smithsonian, CfA, 2Astronomisches Institut, Ruhr-University, Germany, 3Kapteyn Institute, University of Groningen, Netherlands, 4MPIA, Germany, 5H.H. Wills Physics Laboraroty, University of Bristol, United Kingdom, 6Department of Physics, University of California, 7Instituto de Astronomia, Universidad Catolica del Norte, Chile, 8JPL, 9Spitzer Science Center,Caltech, 10IPAC, Caltech.

108.08 Inclination-Dependent Active Galactic Nucleus Flux Profiles From Strong Lensing of The Kerr Spacetime
Bin Chen1, X. Dai1, E.A. Baron1, R. Kantowski1
1University of Oklahoma.

108.09 Charged Off-equatorial Structures in Astrophysical Gravitational and Magnetic Fields
Jiri Kovar1, P. Slany1, V. Karas2, Z. Stuchlik1
1Institute of Physics, Silesian University in Opava, Czech Republic, 2Astronomical Institute, Academy of Sciences, Czech Republic.

108.10 First Statistical Tests for Clumpy Torii Models: Constraints
from RXTE Monitoring of Seyfert AGN
Alex Markowitz\textsuperscript{1,2}, M. Krumpe\textsuperscript{3,1}, R. Nikutta\textsuperscript{4}
\textsuperscript{1}UC, San Diego, \textsuperscript{2}Karl Remeis Sternwarte, Germany, \textsuperscript{3}European Southern Observatory, Germany, \textsuperscript{4}Universidad Andres Bello, Chile.

108.11 Tackling the Soft X-ray Excess in AGN with Variability Studies
Anne M. Lohfink\textsuperscript{1}, C.S. Reynolds\textsuperscript{1}, R. Mushotzky\textsuperscript{1}, M. Nowak\textsuperscript{2}
\textsuperscript{1}University of Maryland, \textsuperscript{2}MIT, Kavli Institute for Astrophysics.

108.12 What is Truly the Relationship Between Jet, Accretion Disk and BLR Intensity Changes in FSRQs?
Giovanni Fossati\textsuperscript{1}
\textsuperscript{1}Rice University

108.13 Probing the Evolving X-ray Sources of Accreting Black Holes
Dan Wilkins\textsuperscript{1}
\textsuperscript{1}University of Cambridge, United Kingdom.

108.14 Exploring Plasma Evolution During Flares from Sgr A*
Salome Dibi\textsuperscript{1}, S. Markoff\textsuperscript{1}, R. Belmont\textsuperscript{1}, J. Malzac\textsuperscript{2}, M. Nowak\textsuperscript{3}, F.K. Baganoft\textsuperscript{3}, J. Neilsen\textsuperscript{4}
\textsuperscript{1}Astronomical Institute Anton Pannekoek, Netherlands, \textsuperscript{2}IRAP, France, \textsuperscript{3}MIT, \textsuperscript{4}Boston University.

108.15 Modeling X-ray Absorbers in AGNs with MHD-Driven Accretion-Disk Winds
Keigo Fukumura\textsuperscript{1}, D. Kazanas\textsuperscript{2}, C.R. Shrader\textsuperscript{2}, F. Tombesi\textsuperscript{2,3}, J. Contopoulos\textsuperscript{5}, E. Behar\textsuperscript{4}
\textsuperscript{1}James Madison University, \textsuperscript{2}NASA/GSFC, \textsuperscript{3}NASA/GSFC/UMD, \textsuperscript{4}Technion, Israel, \textsuperscript{5}Academy of Athen, Greece.

108.16 First Results from the NuSTAR AGN Physics Program
Laura Brenneman\textsuperscript{1}, F. Fuerst\textsuperscript{3}, G. Matt\textsuperscript{2}, D. Walton\textsuperscript{4}, G.M. Madejski\textsuperscript{5}, A. Marinucci\textsuperscript{2,1}, M. Elvis\textsuperscript{1}, G. Risaliti\textsuperscript{10,11}, F. Harrison\textsuperscript{5}, D. Stern\textsuperscript{5}, S. Boggs\textsuperscript{6}, F. Christensen\textsuperscript{1}, W.W. Craig\textsuperscript{8}, W. Zhang\textsuperscript{9}, NuSTAR Team
\textsuperscript{1}Harvard-Smithsonian Center for Astrophysics, \textsuperscript{2}Dipartimento di Matematica e Fisica, Universita Roma Tre, Italy, \textsuperscript{3}Kavli Institute for Particle Astrophysics and Cosmology, SLAC National Accelerator Laboratory, \textsuperscript{4}Cahill Center for Astronomy and Astrophysics, California Institute of Technology, \textsuperscript{5}Jet Propulsion Laboratory, California Institute of Technology, \textsuperscript{6}Space Sciences Laboratory, University of California, \textsuperscript{7}DTU Space - National Space Institute, Technical University of Denmark, Denmark, \textsuperscript{8}Lawrence Livermore National Laboratory, \textsuperscript{9}NASA Goddard Space Flight Center, \textsuperscript{10}INAF - Osservatorio Astrofisico di Arcetri, Italy.

108.17 NuSTAR Observations of Blazar Mkn 421
Mislav Balokovic\textsuperscript{1}, M. Ajello\textsuperscript{2}, R.D. Blandford\textsuperscript{2}, S.E. Boggs\textsuperscript{3}, K. Boydstun\textsuperscript{1}, F. Christensen\textsuperscript{4}, W.W. Craig\textsuperscript{3}, A. Furniss\textsuperscript{2}, P. Giommi\textsuperscript{6}, C.J. Hailey\textsuperscript{2}, M. Hayashida\textsuperscript{2}, B. Humensky\textsuperscript{7}, Y. Inoue\textsuperscript{2}, J. Koglin\textsuperscript{5}, G.M. Madejski\textsuperscript{3}, D.L. Meier\textsuperscript{8}, P.M. Ogle\textsuperscript{1}, M. Perri\textsuperscript{6}, S. Puccetti\textsuperscript{7}, A.C.S. Readhead\textsuperscript{1}, D. Stern\textsuperscript{5}, G. Tagliaferri\textsuperscript{9}, C.M. Urry\textsuperscript{10}, A.E. Wehrle\textsuperscript{11}, W. Zhang\textsuperscript{12}, T. Nelson\textsuperscript{13}, D. Paneque\textsuperscript{14}
\textsuperscript{1}California Institute of Technology, \textsuperscript{2}Stanford University, \textsuperscript{3}University of California, \textsuperscript{4}Technical University of Denmark, Denmark, \textsuperscript{5}University of California, \textsuperscript{6}ASI Science Data Center, Italy, \textsuperscript{7}Columbia University, \textsuperscript{8}Jet Propulsion Laboratory, \textsuperscript{9}National Institute for Astrophysics, Italy, \textsuperscript{10}Yale University, \textsuperscript{11}Space Science Institute, \textsuperscript{12}Goddard Space Flight Center, \textsuperscript{13}University of Minnesota, \textsuperscript{14}Max Planck Institute for Physics, Germany.

108.18 Probing AGN Shutdown on the Shortest Timescales
W. P. Maksym\textsuperscript{1}, W.C. Keel\textsuperscript{1}, V. Bennert\textsuperscript{2}, K. Schawinski\textsuperscript{3}, D. Chojnowski\textsuperscript{3}, C. Lintott\textsuperscript{3}, Galaxy Zoo
\textsuperscript{1}University of Alabama, \textsuperscript{2}California Polytechnic State University, \textsuperscript{3}ETH Zürich, Switzerland, \textsuperscript{4}University of Virginia, \textsuperscript{5}Oxford University, United Kingdom.
108.19 An XMM View of 3C 411
Allison Bostrom¹, C.S. Reynolds¹, F. Tombesi¹
¹University of Maryland.

109 AGN Surveys and Catalogs Poster Session
De Anza Ballroom I

109.01 Photoionized X-ray Emission
Timothy R. Kallman¹
¹NASA's GSFC.

109.02 The Average 0.5-200 keV Spectrum of AGNs at z~0
David R. Ballantyne¹
¹Georgia Institute of Technology.

109.03 Full Spectral Survey of Active Galactic Nuclei in the Rossi X-ray Timing Explorer Archive
Elizabeth Rivers¹, A. Markowitz¹, R.E. Rothschild¹
¹UCSD.

109.05 Stripe 82 X: X-ray Survey of SDSS Stripe 82
Stephanie M. LaMassa¹, C.M. Urry¹, E. Glikman¹, N. Cappelluti², A. Comastri², H. Boehringer³, G.T. Richards³, S.S. Murray⁴,⁵
¹Yale University, ²INAF, Italy, ³MPE, Germany, ⁴Drexel University, ⁵Johns Hopkins University, ⁶Harvard-Smithsonian Center for Astrophysics.

109.06 The Northern Galactic Cap AGN from the 58-month BAT Catalogue: A Comprehensive X-ray Spectral Study
Ranjan Vasudevan¹, W.N. Brandt², R. Mushotzky¹, L.M. Winter³, W.H. Baumgartner³, T. Shimizu¹, J.A. Nousek², D.P. Schneider², P. Gandhi³
¹University of Maryland, ²Penn State University, ³JAXA, Japan, ⁴AER, ⁵NASA/Goddard Space Flight Center.

109.07 New Techniques to Study Faint Ultra Hard X-ray Emission From SWIFT BAT Applied to the GOALS LIRG Sample
Michael Koss¹, R. Mushotzky², W.H. Baumgartner³, S. Veilleux², J. Tueller³, C. Markwardt³, C. Casey¹, N. Gehrels³, Swift BAT Team
¹University of Hawaii, ²University of Maryland, ³NASA Goddard.

109.08 The Combined Swift - INTEGRAL X-ray (SIX) Survey
Eugenio Bottacini¹, M. Ajello², J. Greiner³
¹Stanford University, ²Space Science Laboratory, ³Max-Plank-Institut für Extraterrestrische Physik, Germany.

109.09 The NuSTAR View of the Extragalactic Sky
Francesca Civano¹, NuStar Extragalactic Team
¹Dartmouth College

110 AGN/Galaxy Connections Poster Session
De Anza Ballroom I

110.01 The Dichotomous Evolution of AGN Host-galaxies
\textbf{110.02 A Correlation Between Star Formation Rate and Average Black Hole Accretion Rate in Star-forming Galaxies}
Chien-Ting J. Chen\textsuperscript{1}, R.C. Hickox\textsuperscript{1}, S. Alberts\textsuperscript{2}, A. Pope\textsuperscript{2}, BoötesSurvey Collaboration
\textsuperscript{1}Dartmouth College, \textsuperscript{2}University of Massachusetts.

\textbf{110.03 Observational Constraints on the Local Black Hole Occupation Fraction from X-ray Observations of Nearby (Formally) Inactive Galactic Nuclei}
Elena Gallo\textsuperscript{1}, B.P. Miller\textsuperscript{1}
\textsuperscript{1}University of Michigan.

\textbf{111 AGN/QSO Jets Poster Session}
De Anza Ballroom I

\textbf{111.01 Unifying Black Hole Jets Across the Mass Scale with Fermi and Swift}
Rodrigo Nemmen\textsuperscript{1}, M. Georganopoulos\textsuperscript{2}, E.T. Meyer\textsuperscript{3}, S. Guiriec\textsuperscript{1}, N. Gehrels\textsuperscript{1}, R.M. Sambruna\textsuperscript{4}
\textsuperscript{1}NASA GSFC, \textsuperscript{2}University of Maryland Baltimore County, \textsuperscript{3}Space Telescope Science Institute, \textsuperscript{4}George Mason University.

\textbf{111.02 The Large Scale Jets of Powerful Quasars: Not as Fast, Not as Powerful, but Efficient Particle Accelerators}
Markos Georganopoulos\textsuperscript{1,2}, E.T. Meyer\textsuperscript{3}
\textsuperscript{1}UMBC, \textsuperscript{2}NASA/GSFC, \textsuperscript{3}STSCI.

\textbf{111.03 Tracing the Origins of the Relativistic Jet Dichotomy - Accretion Mode, Spin, or Something More?}
Eileen T. Meyer\textsuperscript{1}, M. Georganopoulos\textsuperscript{2}, G. Fossati\textsuperscript{3}, M.L. Lister\textsuperscript{4}
\textsuperscript{1}Space Telescope Science Institute, \textsuperscript{2}University of Maryland, Baltimore County, \textsuperscript{3}Rice University, \textsuperscript{4}Purdue University.

\textbf{111.04 What Did We Learn From Chandra, Xmm-Newton And Fermi-Lat About The High Energy Emission In Young Radio Sources?}
Aneta Siemiginowska\textsuperscript{1}, M. Guainazzi\textsuperscript{2}, M. Hardcastle\textsuperscript{3}, B.C. Kelly\textsuperscript{4}, M. Kunert-Bajraszewska\textsuperscript{3}, G. Migliori\textsuperscript{1}, M. Sobolewska\textsuperscript{1}, L. Stawarz\textsuperscript{5}
\textsuperscript{1}Harvard-Smithsonian, CfA, \textsuperscript{2}ESA/XMM-Newton, Spain, \textsuperscript{3}University of Hertfordshire, United Kingdom, \textsuperscript{4}UCSB, \textsuperscript{5}Torun University, Poland, \textsuperscript{6}JAXA, Japan.

\textbf{112 Astroparticles Poster Session}
De Anza Ballroom I

\textbf{112.01 Energy Exchange Through Cross-Shock Potentials in Relativistic Plasma Shocks}
Joseph Barchas\textsuperscript{1}, M.G. Baring\textsuperscript{1}
112.02 Recent Evidence for Gamma-ray Line Emission from Fermi-LAT: WIMP or Artifact?
Meng Su\textsuperscript{1, 2}, D.P. Finkbeiner\textsuperscript{2}
\textsuperscript{1}MIT, \textsuperscript{2}Harvard University.

112.03 Cosmic Ray Electrons, Positrons and the Synchrotron emission of the Galaxy: consistent analysis and implications
Giuseppe Di Bernardo\textsuperscript{1-8}, C. Evoli\textsuperscript{4}, D. Gaggero\textsuperscript{3}, D. Grasso\textsuperscript{2-7}, L. Maccione\textsuperscript{5, 8}
\textsuperscript{1}University of Gothenburg, Sweden, \textsuperscript{2}INFN, Italy, \textsuperscript{3}SISSA, Italy, \textsuperscript{4}University of Hamburg, Germany, \textsuperscript{5}Max-Planck-Institut fur Physik, Germany, \textsuperscript{6}Department of Astronomy and Theoretical Astrophysics Center, University of California Berkeley, \textsuperscript{7}Dipartimento di Fisica, University of Siena, Italy, \textsuperscript{8}Ludwig-Maximilians-Universitat, Arnold Sommerfeld Center, Germany.

113 Black Holes in Globular Clusters Poster Session
De Anza Ballroom I

113.01 A Deep X-ray Search for the Putative IMBH in Omega Centauri
Daryl Haggard\textsuperscript{1}, A. Cool\textsuperscript{2}, C.O. Heinke\textsuperscript{3}, H.N. Cohn\textsuperscript{4}, P.M. Lugger\textsuperscript{4}, R.P. Van Der Marel\textsuperscript{5}, J. Anderson\textsuperscript{1}
\textsuperscript{1}Northwestern University/CIERA, \textsuperscript{2}San Francisco State University, \textsuperscript{3}University of Alberta, Canada, \textsuperscript{4}Indiana University, \textsuperscript{5}Space Telescope Science Institute.

113.02 Striking Variability from the Globular Cluster Black Hole XMMU 122939.7+075333
Tana Joseph\textsuperscript{1, 3}, T.J. Maccarone\textsuperscript{2}, R.P. Kraft\textsuperscript{3}, G.R. Sivakoff\textsuperscript{4}, Chandra LP Team
\textsuperscript{1}University of Southampton, United Kingdom, \textsuperscript{2}Texas Tech University, \textsuperscript{3}Harvard-Smithsonian Center of Astrophysics, \textsuperscript{4}University of Alberta, Canada.

113.03 Spatially Resolved Spectroscopy of the Globular Cluster RZ2109 and the Nature of its Black Hole
Mark Peacock\textsuperscript{1}, S.E. Zept\textsuperscript{6}, A. Kundu\textsuperscript{7}, T.J. Maccarone\textsuperscript{3}, K.L. Rhode\textsuperscript{5}, J.J. Salzer\textsuperscript{5}, C.Z. Waters\textsuperscript{5}, R. Ciardullo\textsuperscript{6}, C. Gronwall\textsuperscript{6}, D. Stern\textsuperscript{7}
\textsuperscript{1}Michigan State University, \textsuperscript{2}Eureka Scientific, Inc., \textsuperscript{3}University of Southhampton, United Kingdom, \textsuperscript{4}Indiana University, \textsuperscript{5}University of Hawaii at Manoa, \textsuperscript{6}The Pennsylvania State University, \textsuperscript{7}JPL, Caltech.

113.04 Radio Continuum Observations of Black Holes and Neutron Stars in Galactic Globular Clusters
Jay Strader\textsuperscript{1}, L. Chomiuk\textsuperscript{1-4}, T.J. Maccarone\textsuperscript{3}, J. Miler-Jones\textsuperscript{5}, A. Seth\textsuperscript{2}, S.M. Ransom\textsuperscript{4}, E. Noyola\textsuperscript{6}
\textsuperscript{1}Michigan State University, \textsuperscript{2}University of Utah, \textsuperscript{3}Texas Tech University, \textsuperscript{4}NRAO, \textsuperscript{5}Curtin University of Technology, Australia, \textsuperscript{6}UNAM, Mexico.

114 Blazars and BL Lacs Poster Session
De Anza Ballroom I

114.01 Compton Dominance and the Blazar Sequence
Justin Finke\textsuperscript{1}
\textsuperscript{1}US Naval Research Laboratory.

114.02 Insight into the Blazar Emission Environment from X-ray
Absorption
Amy Furniss1, M. Fumagalli2, A. Falcone3, D.A. Williams1
1Department of Physics, University of California Santa Cruz, 2Department of Astrophysics, Princeton University, 3Department of Astronomy and Astrophysics, Penn State University.

114.03 Highlights of the VERITAS Blazar Observation Program
Thomas Nelson1, VERITAS Collaboration
1University of Minnesota.

114.04 Swift Monitoring of 3C 454.3 During a Prolonged Low Gamma-ray State
Stefano Vercellone1, P. Romano1
1INAF-IASF Palermo, Italy.

114.05 A Systematic Study of Spectral Breaks in Gamma-Ray Flares of Blazars
Susanna Kohler1, K. Nalewajko1
1JILA, University of Colorado and NIST.

114.06 Localizing the Brightest Blazar Gamma-ray Flare Ever
Amanda Dotson1, M. Georganopoulos1, 2
1UMBC, 2NASA Goddard Space Flight Center.

114.07 Two Swift Public Monitoring Programs on Fermi Blazars and Fermi Unassociated Sources
Abraham Falcone1
1Penn State University.

114.08 High-Energy Polarization Signatures of Leptonic and Hadronic Models for Blazars
Haocheng Zhang1, M. Boettcher2,1
1Ohio University, 2North-West University, South Africa.

114.10 Multiwavelength Probes of Relativistic Shock Environ in Blazar Jets
Matthew G. Baring1, M. Boettcher2, E.J. Summerlin3
1Rice University, 2North-West University, South Africa, 3NASA’s Goddard Space Flight Center.

114.11 Time Dependent Leptonic Modeling of Blazar Jets
Chris Diltz1, M. Boettcher1

115 Charge Exchange Poster Session
De Anza Ballroom I

The Search for the X-ray Bow-shock in the Chandra ACIS-S Sample of Comets
Damian J. Christian1, I. Ewing1, D. Bodewits2, K. Dennerl3, C.M. Lisse4, S.J. Wolk5
1California State University, 2UMD, 3Max-Planck-Institut fur extraterrestrische Physik, Germany, 4JHU/APL, 5Harvard-Smithsonian CfA.

X-rays via Charge Exchange from the Solar System and Beyond
Randall K. Smith1, A. Foster1, N.S. Brickhouse1
1Smithsonian Astrophysical Observatory.
Characterization of Solar Wind Charge Exchange with Suzaku
Eugenio Ursino\textsuperscript{1}, M. Galeazzi\textsuperscript{2}, T. Cravens\textsuperscript{2}, D. Koutroupa\textsuperscript{3}, K.D. Kuntz\textsuperscript{4}, K. Mitsuda\textsuperscript{5}, I. Robertson\textsuperscript{2}, S. Snowden\textsuperscript{6}, N.Y. Yamasaki\textsuperscript{5}
\textsuperscript{1}Physics Department University of Miami, \textsuperscript{2}Dept. of Physics and Astronomy, University of Kansas, \textsuperscript{3}Université Versailles St-Quentin, CNRS/INSU, LATMOS-IPSL, France, \textsuperscript{4}Johns Hopkins University, \textsuperscript{5}Institute of Space and Astronautical Science, JAXA, Japan, \textsuperscript{6}NASA/Goddard Space Flight Center.

116 Clusters & Surveys Poster Session
De Anza Ballroom I

116.01 XMM-Newton Observation of the IGR J17448-3232 Field
Nicolas Barriere\textsuperscript{1}, J. Tomsick\textsuperscript{1}
\textsuperscript{1}UC Berkeley - SSL.

116.02 A Supercluster at Redshift 1.71 in the Lockman Hole
J. P. Henry\textsuperscript{1}, K. Aoki\textsuperscript{2}, A. Finoguenov\textsuperscript{3}, S. Fotopoulou\textsuperscript{4}, G. Hasinger\textsuperscript{1}, M. Salvato\textsuperscript{3}, M. Tanaka\textsuperscript{3}, H. Suh\textsuperscript{1}
\textsuperscript{1}University of Hawaii, \textsuperscript{2}Subaru Telescope, \textsuperscript{3}MPE, Germany, \textsuperscript{4}IPP, Germany, \textsuperscript{5}IPMU, Japan.

116.03 Probing the Outskirts of Galaxy Clusters: Progress and Pitfalls
Eric D. Miller\textsuperscript{1}, M.W. Bautz\textsuperscript{1}, J.V. George\textsuperscript{2}, R. Mushotzky\textsuperscript{2}, D.S. Davis\textsuperscript{3,4}, J.P. Henry\textsuperscript{5}
\textsuperscript{1}MIT, \textsuperscript{2}U. Maryland, \textsuperscript{3}GSFC, \textsuperscript{4}U. Maryland, Baltimore County, \textsuperscript{5}U. Hawaii.

116.04 The Outskirts of Galaxy Clusters: To r200 and Beyond with Suzaku, XMM-Newton and Chandra
Jithin V. George\textsuperscript{1}, R. Mushotzky\textsuperscript{1}, E.D. Miller\textsuperscript{2}, M.W. Bautz\textsuperscript{2}, D.S. Davis\textsuperscript{3,4}, J.P. Henry\textsuperscript{5}
\textsuperscript{1}University of Maryland, \textsuperscript{2}MIT, \textsuperscript{3}GSFC, \textsuperscript{4}University of Maryland, Baltimore County, \textsuperscript{5}University of Hawaii.

116.05 Investigating the Properties of a WHIM Filament in the Shapley Supercluster
Eugenio Ursino\textsuperscript{1}, M. Galeazzi\textsuperscript{1}, I. Mitsuishi\textsuperscript{2}, A. Gupta\textsuperscript{2}, N.Y. Yamasaki\textsuperscript{2}, Y. Takei\textsuperscript{2}, T. Ohashi\textsuperscript{3}, K. Sato\textsuperscript{4}, J.P. Henry\textsuperscript{5}, R.L. Kelley\textsuperscript{6}
\textsuperscript{1}Physics Department, University of Miami, \textsuperscript{2}Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (ISAS/JAXA), Japan, \textsuperscript{3}Department of Physics, Tokyo Metropolitan University, Japan, \textsuperscript{4}Department of Physics, Tokyo University of Science, Japan, \textsuperscript{5}Institute for Astronomy, University of Hawaii, \textsuperscript{6}NASA/Goddard Space Flight Center, \textsuperscript{7}Astronomy Department, Ohio State University.

116.06 CLoGS - The Complete Local-Volume Groups Survey
Jan M. Vrtilek\textsuperscript{1}, E. O’Sullivan\textsuperscript{1}, L.P. David\textsuperscript{1}, K. Kolokythas\textsuperscript{2}, S. Giacintucci\textsuperscript{1}, S. Raychaudhury\textsuperscript{2}, T.J. Ponman\textsuperscript{2}
\textsuperscript{1}Harvard-Smithsonian, CfA, \textsuperscript{2}University of Birmingham, United Kingdom, \textsuperscript{3}University of Maryland.

116.07 The Infall of the MCG+10+24-117 Into the NGC 6338 Galaxy Cluster
Renato A. Dupke\textsuperscript{1,2}, S. Martins\textsuperscript{2}
\textsuperscript{1}University of Michigan, \textsuperscript{2}Observatorio Nacional, Brazil.

116.09 Dulling Occam’s Razor: ICM Enrichment, the Elliptical Galaxy IMF, and the Diversity of Star Formation
Michael Loewenstein\textsuperscript{1}
\textsuperscript{1}NASA's GSFC/UMCP/CRESST.

116.10 Characterization of ICM Temperature Distributions of 62 Galaxy Clusters with XMM-Newton
116.11 A Deep XMM-Newton Look at the Most Powerful Radio Halo Merging Galaxy Cluster MACSJ0717.5+3745
Evan Million\textsuperscript{1}, J. Irwin\textsuperscript{1}, K. Wong\textsuperscript{1}, M. Yukita\textsuperscript{1}
\textsuperscript{1}University of Alabama.

116.12 Metallicity Distributions of the Innermost 100 kpc of Galaxy Clusters
Ka-Wah Wong\textsuperscript{1}, M. Yukita\textsuperscript{1}, E. Million\textsuperscript{1}, J. Irwin\textsuperscript{1}
\textsuperscript{1}University of Alabama - Tuscaloosa.

116.13 Cosmic Ray Dynamics Inside the Cygnus A Radio-X-ray Cavity
William G. Mathews\textsuperscript{1}, F. Guo\textsuperscript{1}
\textsuperscript{1}UC, Santa Cruz.

116.14 Role of Magnetic Field Strength and Numerical Resolution in Simulations of the Heat-flux Driven Buoyancy Instability
Mark J. Avara\textsuperscript{1}, C.S. Reynolds\textsuperscript{1,2}, T. Bogdanovic\textsuperscript{3}
\textsuperscript{1}University of Maryland, \textsuperscript{2}Joint Space Science Institute (JSI), UMD, \textsuperscript{3}Center for Relativistic Astrophysics, School of Physics, Georgia Tech.

116.15 Searching For Dark Matter Decay Annihilation in the Stacked X-ray Spectra of Galaxy Clusters
G. Esra Bulbul\textsuperscript{1,2}, M.L. Markevitch\textsuperscript{2}
\textsuperscript{1}Center for Astrophysics, \textsuperscript{2}NASA/GSFC.

116.18 First Results from the Chandra COSMOS Legacy Survey: A New Window on the High-z Universe
Francesca M. Civano\textsuperscript{1,2}, Chandra COSMOS Legacy Survey Team
\textsuperscript{1}Dartmouth College, \textsuperscript{2}SAO.

117 Data Analysis and Modeling Techniques Poster Session
De Anza Ballroom I

117.01 X-ray Reflected Spectra from Accretion Disk Models: A Complete Grid of Ionized Reflection Calculations
Javier Garcia\textsuperscript{1,2}, T. Dauser\textsuperscript{1}, C.S. Reynolds\textsuperscript{2}, T.R. Kallman\textsuperscript{4}, J.E. McClintock\textsuperscript{1}, R. Narayan\textsuperscript{1}, J. Wilms\textsuperscript{1}, W. Eikmann\textsuperscript{1}
\textsuperscript{1}Harvard-Smithsonian Center for Astrophysics, \textsuperscript{2}University of Maryland, \textsuperscript{3}Karl Remeis-Observatory and Erlangen Centre for Astroparticle Physics, Germany, \textsuperscript{4}NASA Goddard Space Flight Center.

117.02 Two-temperature and Model-Independent Differential Emission Measure Distributions: The Emperor’s New Clothes?
Kenneth G. Gayley\textsuperscript{1}
\textsuperscript{1}University of Iowa.

117.03 Modeling the Background in the HETGS Observations of the Galactic Center
John E. Davis\textsuperscript{1}
\textsuperscript{1}MIT.
117.04 Statistical Methods in XSPEC
Keith A. Arnaud
\(^1\)CRESST/UMd/GSFC.

117.05 The HEASARC in 2013 and Beyond: NuSTAR, Astro-H, NICER...
Stephen A. Drake\(^{1,2}\), A.P. Smale\(^1\), T.A. McGlynn\(^1\), K.A. Arnaud\(^{1,3}\)
\(^1\)NASA/GSFC, \(^2\)USRA, \(^3\)U. Maryland.

117.06 Application of an Improved Event Reconstruction and Imaging Approach for Compton Telescopes to Crab Measurements by NCT and COMPTEL Using MEGAlib
Andreas Zoglauer\(^1\), S.E. Boggs\(^1\)
\(^1\)UC Berkeley.

117.07 Artificial Neural Networks as a Tool to Classify the 2FGL Unassociated Sources
David Salvetti\(^1\), Fermi-LAT Collaboration
\(^1\)INAF/IASF Milan, Italy.

117.08 Earth Occultation Imaging of the Low Energy Gamma-ray Sky with GBM
James Rodi\(^1\), M.L. Cherry\(^1\), G.L. Case\(^{1,2}\), M.H. Finger\(^4\), P. Jenke\(^5\), C. Wilson\(^3\), A. Camero-Arranz\(^2\), V. Chaplin\(^5\)
\(^1\)Louisiana State University, \(^2\)La Sierra University, \(^3\)Marshall Space Flight Center, \(^4\)NSSTC, \(^5\)University of Alabama in Huntsville.

117.09 Bayesian Methods in Sherpa
Aneta Siemiginowska\(^1\), T.L. Aldcroft\(^1\), V. Kashyap\(^1\), Chandra X-ray Center CIAO Team
\(^1\)Harvard-Smithsonian, CfA.

118 Extragalactic Background Poster Session
De Anza Ballroom I

118.01 The Contribution of BL Lacertae Objects to the Isotropic Gamma-ray Background
Marco Ajello\(^1\), D. Gasparrini\(^3\), M. Shaw\(^2\), R.W. Romani\(^2\), Fermi-LAT Collaboration
\(^1\)Berkeley, \(^2\)Stanford, \(^3\)Agenzia Spaziale Italiana (ASI) Science Data Center, Italy.

118.02 The Impact of Gamma-ray Halos on the Angular Anisotropy of the Extragalactic Gamma-ray Background
Tonia M. Venters\(^1\), V. Pavlidou\(^2\)
\(^1\)Goddard Space Flight Center, \(^2\)University of Crete, Greece.

118.03 Using Gamma Rays as Intergalactic Magnetometers
Justin Finke\(^1\), L.C. Reyes\(^2\), M. Georganopoulos\(^3\), Fermi-LAT Collaboration
\(^1\)US Naval Research Laboratory, \(^2\)University of Maryland - Baltimore County, \(^3\)California Polytechnic State University.

119 Future Prospects in X-ray Astronomy Poster Session
De Anza Ballroom I
The Advanced X-ray Spectroscopic Imaging Observatory (AXSIO): Mission and Technology Overview

Jay A. Bookbinder¹, R.K. Smith¹, A. Ptak², R. Petre², N.E. White², J.N. Bregman³

¹Smithsonian Astrophysical Obs., ²NASA’s Goddard Space Flight Center, ³University of Michigan.

AXSIO: The Science Return of a High-Resolution Spectroscopic X-ray Observatory

Randall K. Smith¹, J.A. Bookbinder¹, A. Ptak³, R. Petre³, N.E. White³, J.N. Bregman²

¹Smithsonian Astrophysical Observatory, ²University of Michigan, ³NASA’s Goddard Space Flight Center.

Focal Plane Array Concept and Technologies for the X-Ray Microcalorimeter Spectrometer on the Advanced X-ray Spectroscopic Imaging Observatory (AXSIO)

Simon Bandler³,², J.D. Adams³,², S.E. Busch³, J.A. Chervenak³, M.E. Eckart³,², F.M. Finkbeiner³, C. Kilbourne², S. Lee², F.S. Porter³, J. Porst³,², J.E. Sadler², S.J. Smith³,², W.B. Dorise¹, J.W. Fowler¹, G.C. Hilton¹, K. Irwin¹, C.D. Reintsema¹, J.N. Ullom¹

¹National Institute of Standards and Technology, ²NASA/GSFC, ³University of Maryland.

Developments in Off-Plane X-ray Reflection Grating Spectrometers

Randall L. McEntaffer¹, Off-Plane X-ray Grating Spectrometer (OP-XGS) Team

¹University of Iowa.

Critical-angle Transmission Grating Development for AXSIO

Mark W. Bautz¹, R.K. Heilmann¹, M. Schattenburg¹, H.L. Marshall¹, D. Huenemoerder¹, D. Dewey¹, N.S. Schulz¹, J.E. Davis¹

¹MIT.

Laboratory Progress Toward a Soft X-ray Polarimeter

Herman L. Marshall¹, N.S. Schulz¹, R.K. Heilmann¹

¹MIT.

X-Ray Polarimetry of Neutron Stars from a CubeSat

Philip Kaaret¹

¹University of Iowa.

Supergiant Fast X-ray Transients: A Case Study for LOFT

Patrizia Romano¹, V. Mangano¹, E. Bozzo², P. Esposito³, C. Ferrigno²

¹INAF-IASF Palermo, Italy, ²ISDC, Switzerland, ³INAF-IASF Milano, Italy.

Galaxies, ISM Poster Session

De Anza Ballroom I

In Search of Bok Globules in the X-Ray

Michael L. McCollough¹

¹Harvard-Smithsonian, CfA.

Revisiting the Interstellar Abundances Toward X Per

Lynne A. Valencic¹,², R.K. Smith³

¹Johns Hopkins University, ²NASA-GSFC, ³SAO-CfA.

Dynamics of Astrophysical Bubbles and Bubble-Driven Shocks: Basic Theory, Analytical Solutions and Observational Signatures
Mikhail Medvedev$^{1,2}$, A. Loeb$^1$
$^1$Harvard University, $^2$University of Kansas.

120.05 The Low Metallicity ISM
Ke-Jung Chen$^1$
$^1$University of Minnesota, Twin Cities.

120.07 Probing the Anisotropy of Warm-Hot Gaseous Halo of the Milky Way
Anjali Gupta$^1$, S. Mathur$^1$
$^1$Ohio State University.

120.08 Missing Baryons in Galaxies
Joel N. Bregman$^1$, M.E. Anderson$^1$, M.J. Miller$^1$, X. Dai$^2$
$^1$University of Michigan, $^2$University of Oklahoma.

120.10 The Mass Profiles of Early-type Galaxies from X-ray and Optical Constraints
Aaron J. Romanowsky$^{1,2}$, J.P. Brodie$^2$, K. Woodley$^2$, J. Arnold$^2$, D. Forbes$^3$, Z. Jennings$^2$, SAGES Team
$^1$San Jose State University, $^2$University of California Observatories, $^3$Swinburne University, Australia.

120.11 Hot Gas and Nuclear X-ray Emission from Early Type Galaxies
Christine Jones$^1$, E. Churazov$^{2,3}$, W.R. Forman$^1$
$^1$Harvard-Smithsonian, Cfa, $^2$MPA, Germany, $^3$IKI, Russian Federation.

120.12 X-ray Scaling Relation of Early Type Galaxies
Dong-Woo Kim$^1$
$^1$Harvard-Smithsonian, Cfa.

120.13 Hard X-ray Emission from the Arches Cluster Region Observed with NuSTAR
Roman Krivonos$^1$, J. Tomsick$^1$, S.E. Boggs$^1$, C.J. Hailey$^2$, F. Harrison$^1$, NuSTAR Team
$^1$UC Berkeley, $^2$Columbia University, $^3$Caltech.

120.15 Getting a Good, Hard X-ray Look at Starburst Galaxies with NuSTAR
Andrew Ptak$^1$, M. Argo$^5$, K. Bechtol$^5$, S.E. Boggs$^5$, F. Christensen$^5$, W.W. Craig$^6$, C.J. Hailey$^6$, F. Harrison$^1$, A.E. Hornschemeier$^1$, B. Lehmer$^{1,12}$, J. Leyder$^{1,12}$, T.J. Macarone$^6$, D. Stern$^{10}$, T.M. Venters$^1$, D.R. Wik$^1$, A. Zezas$^{11}$, W. Zhang$^1$, NuSTAR Team
$^1$NASA/GSFC, $^2$ASTRON, Netherlands, $^3$University of Chicago, $^4$UC Berkeley, $^5$DTU Space, Denmark, $^6$Columbia University, $^7$CalTech, $^8$Johns Hopkins University, $^9$Texas Tech University, Greece, $^{10}$NASA/JPL, $^{11}$University of Crete, Greece, $^{12}$USRA.

120.16 Spatial Analysis of the Hot Gas Distribution in a Complete Chandra Survey of Early-Type Galaxies
W. P. Maksym$^1$, J. Irwin$^1$, K. Wong$^1$, M. Yukita$^1$, Y. Su$^1$, D. Lin$^1$, E. Million$^1$
$^1$University of Alabama.

121 Gravitational Waves Poster Session
De Anza Ballroom I

121.01 Electromagnetic Counterparts to Supermassive Black Hole
Mergers
John G. Baker1, B. Giacomazzo2, J. Kanner1, B.J. Kelly1,3, J. Schnittman1
1NASA/GSFC, 2University of Colorado/JILA, 3University of Maryland - Baltimore County.

121.02 Prospects for GW Transients in Early Advanced LIGO and Virgo Science Runs
Larry Price1, David Reitze1, LIGO Scientific Collaboration, Virgo Collaboration
1Caltech.

121.03 Proposed Atom Interferometry Gravitational Wave Measurements Over a Single Baseline
Peter L. Bender1
1JILA, University of Colorado and NIST.

121.04 A Possible U.S. Contribution to eLISA, a Gravitational-Wave Mission Concept for ESA’s L2 Opportunity
Robin T. Stebbins1
1NASA GSFC.

122 Lab Astro Poster Session
De Anza Ballroom I

122.01 Atomic Data for Astrophysics: Measurements of Electron Impact Ionization Using an Ion Storage Ring
Daniel W. Savin1, M. Hahn1, A. Becker2,3, D. Bernhardt2, M. Grieser1, C. Krantz3, M. Lestinsky4, A. Mueller2, O. Novotny1, R. Repnow3, S. Schippers2, K. Spruck2, A. Wolf3
1Columbia Astrophysics Lab., 2Justus-Liebig-Universitaet, Germany, 3Max-Planck-Institut fuer Kernphysik, Germany, 4GSI Helmholtzzentrum fuer Schwerionenforschung, Germany.

122.02 Laboratory Measurements of the Relative Oscillator Strengths of the Fe XVII Lines 3C and 3D Using an X-ray Laser and an Electron Beam Ion Trap
Gregory V. Brown1, Hi-Light Collaboration
1LLNL.

122.03 Low Charge States of Si and S: from Cygnus X-1 to the Lab and Back
Natalie Hell1,2, I. Miškovičová1, M. Hanke1, G.V. Brown2, J. Wilms1, J. Clementson2,3, P. Beiersdorfer2, D.A. Liedahl1, K. Pottschesmidt1,4, F. Porter4, C. Kilbourne4, R.L. Kelley4, M. Nowak5, N.S. Schulz6
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122.04 Extreme Ultraviolet Emission Lines of Iron Fe XI-XIII
Jaan Lepson1, P. Beiersdorfer2, G.V. Brown2, D.A. Liedahl1, N.S. Brickhouse1, A.K. Dupree3
1University of California, 2Lawrence Livermore National Laboratory, 3Center for Astrophysics.

122.05 Magnetized Collisionless Shock Studies Using High Velocity Plasmoids
Thomas Weber1, T. Intrator1
1LANL.

122.06 Magnetic Micro-turbulence: Relation of Electron Diffusion to Their Emitted Radiation Spectra
122.07 Laboratory Observation of Magnetic Field Growth Driven by Shear Flow
Thomas Intrator¹, L. Dorf¹, X. Sun¹, J. Sears¹, T. Weber¹, Y. Feng¹
¹Los Alamos National Laboratory.

122.08 Radiative Cooling of Non-equilibrium Ionization Plasmas Based on AtomDB
Li Ji¹, X. Zhou¹, S. Zhang¹, A. Foster², R.K. Smith², N.S. Brickhouse²
¹Purple Mountain Observatory, CAS, China, ²Harvard-Smithsonian Center for Astrophysics.

123 Missions and Instruments Poster Session
De Anza Ballroom I

123.01 TeV Signatures of Fermi and IACT Sources Observed by Milagro
Anushka U. Abeysekara¹, Milagro Collaboration
¹Michigan State University.

123.02 Monitoring the Hard X-ray/Soft Gamma-Ray Sky with Fermi/GBM - The First Four Years
Gary L. Case¹, E. Beklen⁷, A. Camero-Arranz⁶, V. Chaplin⁴, M.L. Cherry², M.H. Finger⁵, P. Jenke¹, J. Rodi², J. Taylor², C. Wilson¹
¹La Sierra University, ²Louisiana State University, ³Marshall Space Flight Center, ⁴University of Alabama, Huntsville, ⁵Universities Space Research Association, ⁶Instituto de Ciencias del Espacio, Spain, ⁷Suleyman Demiel University, Turkey.

123.04 Twelve Years of Education and Public Outreach with the Fermi Gamma-ray Space Telescope
Lynn R. Cominsky¹, K.M. McLin¹, A. Simonnet¹, Fermi E/PO Team
¹Sonoma State University

123.05 The NuSTAR Education and Public Outreach Program
Lynn R. Cominsky¹, K.M. McLin¹, S.E. Boggs², F. Christensen³, C.J. Hailey⁴, F. Harrison⁵, D. Stern⁶, W. Zhang¹, NuSTAR Team
¹Sonoma State University, ²UC Berkeley, ³Technical University of Denmark, Denmark, ⁴Columbia, ⁵Caltech, ⁶JPL, ⁷NASA Goddard Space Flight Center.

123.06 Performance, Goals, and Status of the Upcoming Nuclear Compton Telescope Balloon Campaigns
Alexander Lowell¹, N. Barriere¹, S.E. Boggs¹, J. Tomsick¹, P. von Doetinchem¹, A. Zoglauer¹, M. Amman², P. Luke², P. Jean¹, P. von Ballmoos², H. Chang³, J. Chiu², C. Yang², J. Shang¹, C.H. Lin³, Y. Chou¹, Y.H. Chang
¹Space Sciences Laboratory, UC Berkeley, ²Lawrence Berkeley National Laboratory, ³Research Institute in Astrophysics and Planetology, France, ⁴Institute of Astronomy, National Tsing Hua University, Taiwan, ⁵Institute of Physics, Academia Sinica, Taiwan, ⁶Institute of Astronomy, National Central University, Taiwan, ⁷Department of Physics, National Central University, Taiwan.

123.07 The Black Hole Evolution and Space Time (BEST) Observatory
Henrik Krawczynski¹, J. Tueller¹, S.D. Barthelmy², J. Schnittman², W. Zhang², J.H. Krolik³, M.G. Baring⁴, E. Treister⁵, R. Mushotzky⁶, M. Beilicke¹, F. Kislat¹, A. Zajczyk¹, J.H. Buckley¹, R. Cowishk¹, M.H. Israel¹
123.08 Critical Developments Toward Building Laue Lenses for Gamma-Ray Astronomy
Nicolas Barriere¹, J. Tomskic¹, S.E. Boggs¹, A. Lowell¹, C. Wade², M. Jentschel³, P. von Ballmoos⁴
¹Space Sciences Laboratory, UC Berkeley, ²University College of Dublin, Ireland, ³Institut Laue Langevin, France, ⁴IRAP, University of Toulouse, France.

123.09 A Combined Compton and Coded Mask Telescope for Gamma-Ray Astrophysics
Michelle Galloway¹, A. Zoglauer¹, S.E. Boggs¹, M. Amman²
¹Space Sciences Laboratory, University of California at Berkeley, ²Lawrence Berkeley National Laboratory.

123.10 The First Science Flight of the Gamma-RAY Polarimeter Experiment (GRAPE)
Peter F. Bloser¹, M.L. McConnell¹, T. Connor¹, C. Ertley¹, J.S. Legere¹, J.M. Ryan¹
¹University of New Hampshire.

123.11 PETS - A GRB Polarimetry Mission on the International Space Station
Mark L. McConnell¹, M.G. Baring², P.F. Bloser¹, J. Greiner³, A.K. Harding⁴, D. Hartmann⁵, J.E. Hill⁴, P. Kaaret⁶, R.M. Kippen³, M. Pearce⁷, N. Produit⁸, P. Roming⁹, J.M. Ryan¹, F. Ryde¹, T. Sakamoto¹¹, K. Tomu¹², B. Zhang¹³
¹University of New Hampshire, ²Rice University, ³Max Planck Institute (MPE), Germany, ⁴NASA Goddard Space Flight Center, ⁵Clemson University, ⁶University of Iowa, ⁷Los Alamos National Laboratory, ⁸KTH Royal Institute of Technology, Sweden, ⁹ISDC Data Center for Astrophysics, Switzerland, ¹⁰Southwest Research Institute, ¹¹Aoyama-Gakuin University, Japan, ¹²Osaka University, Japan, ¹³University of Nevada - Las Vegas.

123.12 Solar Particle Acceleration and The Gamma Ray Imager/Polarimeter for Solar Flares (GRIPS) Instrument
Nicole Duncan¹,², A.Y. Shih³, G.J. Hurford², P. Saint-Hilaire², H. Bain², A. Zoglauer², R.P. Lin¹,², S.E. Boggs¹,²
¹Univ of California, Berkeley, ²Space Sciences Laboratory, ³NASA Goddard SFC.

123.13 Pushing the Boundaries of X-ray Grating Spectroscopy in a Suborbital Rocket
Randall L. McEntaffer¹, Off-Plane Grating Rocket Experiment (OGRE) Team
¹University of Iowa.

123.14 The Focusing Optics X-ray Solar Imager (FOXSI): Instrument and First Flight
Lindsay Glesener¹, S. Christe², S. Ishikawa³, B. Ramsey⁴, T. Takahashi⁵,⁶, S. Saito⁵,⁶, R.P. Lin¹,⁷, S. Krucker¹,², FOXSI Team
¹University of California - Berkeley, ²Goddard Space Flight Center, ³National Astronomical Observatory of Japan, Japan, ⁴Marshall Space Flight Center, ⁵Institute of Space and Astronautical Science, Japan, ⁶University of Tokyo, Japan, ⁷Kyung Hee University, Republic of Korea, ⁸University of Applied Sciences Northwestern Switzerland, Switzerland.

123.15 Latest Advancements in Microchannel Plate Detectors
John Vallerga¹, O. Siegmund¹, J.B. McPhate¹, A. Tremsin¹, B. Welsh¹, H. Frisch², R.G. Wagner¹, J. Elam¹, A. Mane¹, G. Varner²
¹University of California, Berkeley, ²University of Chicago, ³Argonne National Laboratory, ⁴University of Hawaii.
123.16 The Science Payload of the LOFT Mission
Marco Feroci1, J. den Herder2, M. van der Klis3, P.S. Ray11, T. Takahashi10, J. Wilms9, D. Barret8, E. Bozzo5, S. Zane13, L. Stella12, S. Brandt6, M. Pohl6, M. Hernandez2, A. Santangelo7, A. Watts5, LOFT Team
1INAF Rome, Italy, 2SRON, Netherlands, 3University Amsterdam, Netherlands, 4DTU, Denmark, 5IEEC-CSIC, Spain, 6University Geneva, Switzerland, 7IAAT, Germany, 8INAF, France, 9University Erlangen, Germany, 10JAXA, Japan, 11NRL, 12INAF OAR, Italy, 13MSSL, United Kingdom.

123.17 The Hard X-ray Polarimeter X-Calibur - Astrophysical Motivation and Performance
Matthias Beilicke1, M.G. Baring3, J. Tueller2, H. Krawczynski1, S.D. Barthelmy2, W. Binns1, J.H. Buckley1, R. Cowssik1, Q. Guo1, M.H. Israel1, F. Kislat1, H. Matsumoto4, T. Okajima2, J. Schnittman2
1Washington University of ST.LOUIS, 2Goddard Space Flight Center, 3Rice University, 4Nagoya University, Japan.

123.18 Characterization of Si Hybrid CMOS Detectors for use in the Soft X-ray Band
Zachary Prieskorn1, C. Griffith1, S. Bongiorno1, A. Falcone1, D.N. Burrows1
1Penn State University.

123.19 Using ACIS on the Chandra X-ray Observatory as a Particle Radiation Monitor
Catherine E. Grant1, P.G. Ford1, M.W. Bautz1, S.L. O'Dell2
1MIT, 2NASA Marshall Space Flight Center.

123.20 CCD Performance Evolution on Chandra and Suzaku
Beverly LaMarr1, C.E. Grant1, E.D. Miller1, M.W. Bautz1
1Massachusetts Institute of Technology.

123.21 Cross-calibration of the Instruments Onboard the Chandra, Suzaku, Swift, and XMM-Newton Observatories Using 1E 0102.2-7219: An IACHEC Study
1Harvard-Smithsonian CfA, 2Department of Physics and Astronomy, University of Leicester, United Kingdom, 3MIT Kavli Institute for Astrophysics and Space Research, 4Max-Planck-Institut fuer Extraterrestrische Physik, Germany, 5European Space Agency, European Space Astronomy Centre, Spain.

123.22 The TEST Pilot Sounding Rocket Payload
Benjamin R. Zeiger1, W.C. Cash3, D. Swetz3, Randall McEntaffer4
1NASA-GSFC, 2University of Colorado, 3National Institute of Standards and Technology, 4Iowa State University.

123.24 Performance of the ASTRO-H Soft X-ray Telescope (SXT-1)
Takashi Okajima1, P.J. Serlemitsos1, Y. Soong1
1NASA's GSFC.

123.25 Current Research Developments at NASA Goddard Space Flight Center on the Neutron Star Interior Composition ExploreR (NICER) X-ray Concentrators
Erin Balsamo1, T. Okajima2, K. Gendreau2, Z. Arzoumanian2, L. Jalota3, Y. Soong1, P.J. Serlemitsos2
1University of Maryland Baltimore County, 2NASA Goddard Space Flight Center, 3Center for Research and Exploration in Space Science & Technology.
123.26 A Future Generation High Angular Resolution X-ray Telescope Based Upon Physical Optics
Paul Gorenstein$^{1,2}$
$^1$Center for Astrophysics, $^2$SAO.

123.27 Next Generation X-ray Optics: High Angular Resolution, Light Weight, and Low Production Cost
William Zhang$^1$
$^1$NASA's GSFC.

123.28 The Development of Adjustable X-ray Optics: Status and Plans
Paul B. Reid$^1$, T.L. Aldcroft$^1$, V. Cotroneo$^1$, W. Davis$^1$, R.L. Johnson-Wilke$^2$, S. McMuldroch$^1$, B. Ramsey$^1$, D.A. Schwartz$^1$, S. Trolier-McKinstrey$^1$, A. Vikhlinin$^1$, R. Wilke$^3$
$^1$Harvard-Smithsonian Center for Astrophysics, $^2$The Pennsylvania State University, $^3$NASA Marshall Space Flight Center.

123.29 SMART-X: Square Meter, Arcsecond Resolution Telescope for X-rays
Alexey Vikhlinin$^1$, SMART-X Collaboration
$^1$Harvard-Smithsonian, CfA.

123.30 Comparing Wolter I and Wolter-Schwarzschild I Sensitivity for the SMART-X Telescope
Daniel A. Schwartz$^1$, T. Aldcroft$^1$, J.A. Bookbinder$^1$, V. Cotroneo$^1$, B. Forman$^1$, T. Gaetz$^1$, D.H. Jerius$^1$, S. McMuldroch$^1$, P.B. Reid$^1$, H. Tananbaum$^1$, A. Vikhlinin$^1$
$^1$Smithsonian Astrophysical Observatory.

123.31 The ASTRI Project: An Innovative Prototype for a Cherenkov Dual-mirror Small-telescope
Stefano Vercellone$^1$, O. Catalano$^1$, M. Maccarone$^1$, R. Canestrari$^2$, G. Pareschi$^2$, F. Di Pierro$^3$, P. Vallania$^2$, P. Caraveo$^5$, G. Tosti$^5$, ASTRI Collaboration
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123.32 The ASTRI Mini-Array Science Case
Stefano Vercellone$^1$, O. Catalano$^1$, M. Maccarone$^1$, A. Stamerra$^2$, F. Di Pierro$^2$, P. Vallania$^2$, R. Canestrari$^1$, G. Bonnoli$^3$, G. Pareschi$^3$, G. Tosti$^3$, P. Caraveo$^5$, ASTRI Collaboration
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123.33 Results and Highlights from the Pierre Auger Observatory
Michael Sutherland$^1$, Pierre Auger Collaboration
$^1$Louisiana State University.

124 SMBH, GRB Poster Session
De Anza Ballroom I

124.01 Some Implications of Correlated GRB Pulse Properties
Jon E. Hakkila$^1$, R.D. Preece$^2$
$^1$College of Charleston, $^2$University of Alabama in Huntsville.

124.02 Radiation from Accelerated Particles in Relativistic Jets with Shocks, Shear-flow, and Reconnection
124.03 GRB Flares: A New Detection Algorithm, Previously Undetected Flares, and Implications on GRB Physics
Craig A. Swenson¹, P. Roming²,¹
¹The Pennsylvania State University, ²Southwest Research Institute.

124.05 Could High-energy Gamma-ray Photon Emission be Associated to External Shocks?
Nissim I. Fraija¹, M. Gonzalez¹, R. Sacahuí¹, J.L. Ramirez², W.H. Lee¹
¹IA-UNAM, Mexico, ²IF-UNAM, Mexico.

124.06 High-Energy Neutrino Oscillation in Hidden Jets from GRBs
Nissim I. Fraija¹
¹IA-UNAM, Mexico.

124.07 Propogation and Neutrino Oscillations in the Base of a Highly Magnetized Gamma-ray Burst Fireball Flow
Nissim I. Fraija¹
¹IA-UNAM, Mexico.

125 Solar and Stellar Poster Session
De Anza Ballroom I

125.01 Constraints on Porosity and Mass Loss in O-star Winds from Modeling of X-ray Emission Line Profile Shapes
Maurice A. Leutenegger¹, D.H. Cohen², J. Sundqvist³,⁴, S.P. Owocki³
¹NASA/GSFC, ²Swarthmore College, ³University of Delaware, ⁴Universitaetssternwarte Muenchen, Germany.

125.02 New Line Identifications in the Spectrum of Procyon Observed with the Chandra X-ray Observatory
Peter Beiersdorfer¹, J. Lepson², P. Desai², F. Diaz³, Y. Ishikawa³
¹LLNL, ²Space Sciences Laboratory, ³University of Puerto Rico.

126 Stellar Compact Poster Session
De Anza Ballroom I

126.01 Mass Ejection in Novae as Traced by the Karl G. Jansky Very Large Array
Laura Chomiuk¹,², T. Nelson¹, K. Mukai⁴,⁵, J.L. Sokoloski⁶, M.P. Rupen², J. Weston⁶, Y. Zheng⁶, A.J. Mioduszewski², N. Roy², M.I. Krauss²
¹Michigan State University, ²National Radio Astronomy Observatory, ³University of Minnesota, ⁴University of Maryland Baltimore County, ⁵NASA/GSFC, ⁶Columbia University.

126.02 The E-Nova Project: Insights from X-ray Observations
Koji Mukai¹, T. Nelson², L. Chomiuk³, J.L. Sokoloski⁴, A.J. Mioduszewski², M.P. Rupen², J. Weston⁶, Y. Zheng⁷
¹UMBC and NASA/GSFC/CRESST, ²University of Minnesota, ³Michigan State University, ⁴Columbia University, ⁷NRAO.
126.03 The Effect of Micro-lensing in Eclipsing Binary-star Systems
Kelsey L. Hoffman\textsuperscript{1}, J. Rowe\textsuperscript{2}, B. Hansen\textsuperscript{3}
\textsuperscript{1}CITA, Canada, \textsuperscript{2}NASA-Ames / SETI Institute, \textsuperscript{3}University of Toronto, Canada.

126.04 Characterization of New Hard X-ray Cataclysmic Variables
Federico Bernardini\textsuperscript{1}, Observatory of Naples, CEA Saclay, Dipartimento di Fisica, Università Roma III, INAF, CRESST, Laboratory of APC
\textsuperscript{1}wayne state university.

126.05 On the X-ray Variability and Disk Truncation in Dwarf Novae
Solen Balman\textsuperscript{1}, M. Revnivtsev\textsuperscript{2}
\textsuperscript{1}METU, Turkey, \textsuperscript{2}The Russian Space Research Institute, Russian Federation.

126.07 Exploring Radio and Gamma-ray Emission Models Using Millisecond Pulsars in the Second LAT Pulsar Catalog
Tyrel J. Johnson\textsuperscript{1}, C. Venter\textsuperscript{2}, A.K. Harding\textsuperscript{3}, J.E. Grove\textsuperscript{4}
\textsuperscript{1}NRC Fellow at NRL, \textsuperscript{2}North-West University, South Africa, \textsuperscript{3}NASA GSFC, \textsuperscript{4}Naval Research Laboratory.

126.08 Pulsar Astrophysics at Very High Energies in the Fermi-HAWC Era
Pablo Saz Parkinson\textsuperscript{1,2}, A. Belfiore\textsuperscript{1,2}, HAWC Collaboration, Fermi LAT Collaboration
\textsuperscript{1}UC, Santa Cruz, \textsuperscript{2}Santa Cruz Institute for Particle Physics.

126.09 Hard X-ray Emission by Resonant Compton Upscattering in Magnetars
Zorawar Wadiasingh\textsuperscript{1}, M.G. Baring\textsuperscript{1}, P.L. Gonthier\textsuperscript{2}
\textsuperscript{1}Rice University, \textsuperscript{2}Hope College.

126.10 On the X-ray Variability of Magnetar 1RXS J170849.0-400910
Paul Scholz\textsuperscript{1}, V.M. Kaspi\textsuperscript{1}, C. Ng\textsuperscript{2}, Robert F. Archibald\textsuperscript{3}
\textsuperscript{1}McGill University, Department of Physics, Canada, \textsuperscript{2}The University of Hong Kong, China.

126.12 The Correlation Between Dispersion Measure and X-ray Column Density from Radio Pulsars
Chi-Yung Ng\textsuperscript{2,1}, C. He\textsuperscript{2}, V.M. Kaspi\textsuperscript{2}
\textsuperscript{1}The University of Hong Kong, Hong Kong, \textsuperscript{2}McGill University, Canada.

126.13 Magnetic Pair Creation Transparency in Pulsars
Sarah Story\textsuperscript{1}, M.G. Baring\textsuperscript{1}
\textsuperscript{1}Rice University.

126.14 Compton Scattering Cross Sections in Strong Magnetic Fields: Advances for Neutron Star Applications
Matthew Elles\textsuperscript{1}, P.L. Gonthier\textsuperscript{1}, M.G. Baring\textsuperscript{2}, Z. Wadiasingh\textsuperscript{2}
\textsuperscript{1}Hope College, \textsuperscript{2}Rice University.

126.15 A Complete Set of Timing Solutions for all Three Anti-Magnetars
Eric V. Gotthelf\textsuperscript{1}, J.P. Halpern\textsuperscript{1}
\textsuperscript{1}Columbia Astrophysics Lab.

Caleb Billman\textsuperscript{1}, P.L. Gonthier\textsuperscript{1}, A.K. Harding\textsuperscript{2}
\textsuperscript{1}Hope College, \textsuperscript{2}NASA Goddard Space Flight Center.
Peter L. Gonthier1, C. Billman1, A.K. Harding2
1Hope College, 2NASA Goddard Space Flight Center.

126.18 A Multi-wavelength Campaign to Study Crab Giant Pulses
Walid A. Majid1
1JPL/Caltech.

126.19 Suzaku Observations of Orbital Phase-Dependent Dipping and Obscuration in Cyg X-1
Michael Nowak1, J. Wilms2, K. Pottschmidt3, N.S. Schulz4
1MIT Kavli Institute, 2Dr. Karl Remeis-Sternwarte and Erlangen Centre for Astroparticle Physics, Germany, 3CRESST, UMBC, and NASA GSFC.

126.20 Influence of Non-geodesic Effects on Black Hole Spin Estimations Obtained from QPO Models
Jiri Kovar1, E. Sramkova1, G. Torok1, P. Bakala1, Z. Stuchlik1
1Silesian University in Opava, Czech Republic.

126.21 Diskoseismology and QPOs Confront Black Hole Spin
Robert V. Wagoner1, M. Ortega-Rodriguez2
1Stanford University / KIPAC, 2Universidad de Costa Rica, Costa Rica.

126.22 Discovering Nearby Compact Objects with Gravitational Lensing
Rosanne Di Stefano1, F. Primini1
1Harvard-Smithsonian CfA.

126.23 A Swift Survey of Accretion onto Stellar-Mass Black Holes
Mark Reynolds1, J.M. Miller1
1University of Michigan.

126.24 The Quiescent X-ray Spectrum: Constraints from Stellar Mass Black Holes
Mark Reynolds1, R.C. Reis1, J.M. Miller1, E. Cackett2, N. Degenaar1
1University of Michigan, 2Wayne State University.

126.25 Constraints on Deviations from the Kerr Metric by XTE J1550-564
Tim Johannsen1, 2, D. Psaltis3, J.F. Steiner4
1University of Waterloo, Canada, 2Perimeter Institute for Theoretical Physics, Canada, 3University of Arizona, 4Harvard-Smithsonian Center for Astrophysics.

Wenfei Yu1, W. Zhang1
1Shanghai Astronomical Observatory, China.

126.27 Using CCI to Unravel the States of GRS 1915+105
Charith Peris1, 2, S. Buchan1, 3, S.D. Vrtilek1
1Harvard-Smithsonian Center for Astrophysics, 2Northeastern University, 3University of Southampton, United Kingdom.

126.28 Results, Constraints, and Remaining Challenges in Testing Time-dependent Accretion Theory Against Observations of
Viscous-timescale Variability in LMC X-3
Hal J. Cambier¹, D.M. Smith¹
¹UCSC.

126.29 Properties and Distribution of Current Sheets in Accretion Disk Coronae
Greg Salvesen¹, ², M.C. Begelman², J.B. Simon³, K. Beckwith³, ⁴
¹University of Colorado at Boulder, ²JILA, ³Tech-X Corporation.

126.30 Testing the Stability of Three-Dimensional Hoyle-Lyttleton Accretion with Large Upstream Gradients
Eric Raymer¹, J.M. Blondin³
¹North Carolina State University.

126.31 A Hybrid Model for the Spectra of Neutron Star Accretion Columns Including Comptonization and Cyclotron Lines
Fritz-Walter Schwarm¹, ², G. Schönherr³, P.A. Becker⁴, M.T. Wolff⁵, J. Wilms¹, ², C. Ferrigno⁶, B. West⁷
¹Dr. Remais-Sternwarte Bamberg, Germany, ²Erlangen Centre for Astroparticle Physics (ECAP), Germany, ³Leibniz-Institut für Astrophysik, Germany, ⁴Center for Earth Observing and Space Research, George Mason University, ⁵Space Science Division, Naval Research Laboratory, ⁶INTEGRAL Science Data Centre, Switzerland.

126.32 Accretion Regime of A0535+26 During its 2011 Giant Outburst
Isabel Caballero¹, M. Kühnel¹, K. Pottschmidt¹, J. Zurita Heras⁶, D. Marcu², S. Müller¹, P. Laurent¹, ², D. Klochkov⁴, P. Kretschmar⁵, C. Ferrigno⁶, I. Kreykenbohm³, J. Wilms³, R.E. Rothschild¹, A. Santangelo⁶, R. Staubert⁶, S. Suchy⁶
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126.33 High-Mass X-ray Binaries in our Backyard: Studying Their Formation and Evolution in the Magellanic Clouds
Vallia Antoniou¹
¹Iowa State University.

126.34 Exposing the Symbiosis of 3A 1954+319
Katja Pottschmidt¹, ², D.M. Marcu¹, ², N. Helt³, ⁴, F. Fuerst⁵, I. Miškoviča³, S. Müller³, V. Grinberg¹, R.H.D. Corbet¹, ², J. Wilms³
¹University of Maryland - Baltimore County, ²CRESST/NASA-GSFC, ³Dr. Karl Remeis-Sternwarte and Erlangen Centre for Astroparticle Physics, Germany, ⁴Lawrence Livermore National Laboratory, ⁵Space Radiation Laboratory Caltech.

126.35 Cyclotron Line Measurements and a Torque Reversal in 4U 1538-522 as Seen by INTEGRAL
Paul B. Hemphill¹, R.E. Rothschild¹, K. Pottschmidt¹, ², I. Caballero², M. Kühnel¹, ², F. Fuerst⁵, J. Wilms⁴, ⁷
¹CASS/UCSD, ²CEA Saclay, France, ³CRESST/NASA GSFC, ⁴Dr. Karl Remeis-Observatory, Germany, ⁵Caltech, ⁶UMB/C, ⁷ECAP, Germany.

126.36 The Accreting Pulsar XTE J1946+274: Further Indication for a Cyclotron Line from Suzaku?
Diana Marcu¹, ², K. Pottschmidt¹, ², S. Müller³, M. Kühnel³, I. Caballero⁴, F. Fuerst⁵, A. Mahmoud⁶, I. Kreykenbohn⁶, D. Klochkov⁶, R.E. Rothschild⁷, Y. Terada⁸, T. Enoto⁹, W. Iwakiri⁹, M. Nakajima⁹, J. Wilms³
¹UMBC, ²CRESST/GSFC, ³Dr. Karl Remais-Sternwarte and ECAP, Germany, ⁴CNRS/CEA/Université P. Diderot, France, ⁵California Institute of Technology, ⁶IAAT, Germany, ⁷CASS UCSD, ⁸Saitama University, ⁹Saitama University.
126.37 Toward a New Spectral Modeling Capability for Accreting X-Ray Pulsars
Michael T. Wolff1, P.A. Becker4, D. Marcu2, K. Pottschild2, J. Wilms3, K.S. Wood1
1NRL, 2UMBC, 3Universitat Erlangen-Nuernberg, Germany, 4GMU.

126.38 A New Method to Search for Quiescent Low-Mass X-ray Binary
Ping Zhao1, J.E. Grindlay1, J. Hong1, M. Servillat2, M. Van Den Berg3
1Harvard-Smithsonian, CfA, 2CEA Saclay, France, 3University of Amsterdam, Netherlands.

126.39 A Multiwavelength Study of the Field Low Mass X-Ray Binaries in the Bulge of M31
Arunav Kundu1,2, D. Maitra3, T.J. Maccarone4, S.E. Zepf6, M. Peacock5
1Eureka Scientific, 2IFR, India, 3University of Michigan, 4Texas Tech University, 5Michigan State University.

126.40 Monitoring the Spectral and Flux Evolution of MAXI Discovered Galactic Black Hole Candidates with Swift
1Penn State University, 2Istituto di Astrofisica Spaziale e Fisica Cosmica, Italy, 3NASA/GSFC & CREST, 4ISAS/JAXA, Japan, 5Nihon University, Japan, 6University of Leicester, United Kingdom.

126.42 Probing the Accretion-flow Dynamics using an Energy Dependent Timing Analysis in Black Hole X-ray Binaries
Maithili Kalamkar1, M. van der Klis1, P. Uttley1, D. Altamirano1, R. Wijnands1
1University of Amsterdam, Netherlands.

126.43 The Nature of the mHz X-ray QPOs from the Ultraluminous X-ray Source M82 X-1: Timing-Spectral (anti)-correlation?
Dheeraj Ranga Reddy Pasham1,2, T.E. Strohmayer2
1University of Maryland College Park, 2NASA/GSFC.

126.44 Tests of General Relativity in the Strong Gravity Regime Based on X-Ray Observations of Black Holes in X-Ray Binaries
Henric Krawczynski1
1Washington Univ, St. Louis.

126.45 Constraints on R-mode Amplitudes in LMXB Neutron Stars: Probing the Phases of Ultra-dense Matter
Simin Mahmoodifar1, T.E. Strohmayer2
1University of Maryland, 2NASA's GSFC.

126.46 Collisionally Heated Disk Dynamics and Torque Reversals in the Ultracompact Binary 4U 1626-67
Norbert S. Schulz1, H.L. Marshall1, D. Chakrabarty1
1MIT.

126.47 The Spectral Evolution along the Z Track of the Bright Neutron Star X-Ray Binary GX 17+2
Dacheng Lin1, R.A. Remillard2, J. Homan2, D. Barret1
1IRAP, France, 2MIT.

126.48 Preliminary Results of the NuSTAR Galactic Center Mini-survey
126.49 Distribution of High Mass X-ray Binaries in the Milky Way
Alexis Coleiro¹, S. Chaty², ³
¹CEA Saclay, France, ²University Paris Diderot, France.

126.50 X-ray Binaries and Their Makers
Stefano Mineo¹, G. Fabbiano², S.A. Rappaport³, M. Gilfanov⁴
¹Harvard-Smithsonian Center for Astrophysics, ²Harvard-Smithsonian Center for Astrophysics, ³M.I.T. Department of Physics and Kavli Institute for Astrophysics and Space Research, ⁴Max Planck Institute for Astrophysics, Germany.

126.51 The Puzzling Globular Cluster System of ESO 243-49 Hosting the Intermediate Mass Black Hole HLX-1
Mathieu Servillat¹, ²
¹CEA Saclay, France, ²Harvard-Smithsonian Center for Astrophysics.

126.52 Discovery of a Highly Variable ULX Within NGC 4736
Dacheng Lin¹, ², N. Webb², D. Barret², J. Irwin³
¹University of Alabama, ²IRAP, France.

126.53 The 62 Day X-ray Period of the Ultra-luminous X-ray Source M82 X-1 is Likely Super-orbital
Dheeraj Ranga Reddy Pasham¹, ², T.E. Strohmayer²
¹University of Maryland College Park, ²NASA/GSFC.

126.54 GRS 1758-258: Long Term Evolution of a Rare Persistent Hard State Black Hole
Maria Obst¹, K. Pottschmidt², ³, A.M. Lohfink⁴, J. Wilms¹, D.M. Smith⁵, J. Tomsick⁶, I. Kreykenbohm¹, B.H. Rodrigues⁷, ⁸
¹Dr. Karl Remeis Observatory & ECAP, Germany, ²CRESST/NASA-GSFC, ³UMBC, ⁴UMCP, ⁵SCIPP/UCSC, ⁶SLL/UCB, ⁷INPE, Brazil, ⁸CfA.

126.55 A Comprehensive Study of GBM Bursts of SGR J1550-5418
Andrew C. Collazzi¹, GRB Magnetar Team
¹NASA/ORAU.

126.56 Multi-wavelength Observations of Cyg X-3 During a Hard X-ray Flare
Jeremy S. Perkins², N.K. Matthews¹, VERITAS Collaboration
¹UMCP, ²UMBC/CRESST/GSFC.

126.57 Simultaneous Chandra/Swift Observations of the RT Cru Symbiotic System
Vinay Kashyap¹, J.A. Kennea², M. Karovska¹, Chandra Calibration
¹Smithsonian Astrophysical Observatory, ²Penn State.

127 Supernova Remnants and Gamma-ray Bursters Poster Session
De Anza Ballroom I
127.01 Characterization of the Optical and X-ray Properties of the Northwestern Wisps in the Crab Nebula
Martin C. Weisskopf1, T. Schweitzer2, N. Bucciantini3, 4, W. Idec2, 7, K. Nilsson4, A. Tennant1, R. Zanin3
1NASA/MSFC, 2Max-Planck-Institute for Physics, Germany, 3INAF-Observatorio Astrofisico di Arcetri, Italy, 4Finnish Centre for Astronomy with ESO, University of Turku, Finland, 5Universitat de Barcelona, Spain, 6INFN-Sezione di Firenze, Italy, 7Department of Astrophysics, University of Lodz, Poland.

127.02 Hard X-ray Variations in the Crab Nebula
1NASA’s MSFC, 2LSU, 3La Sierra University, 4NASA’s GSFC, 5UAH, 6USRA, 7LANL, 8MPE/SDU, Germany, 9IEEC-CSIC, Spain, 10MPE, Germany, 11ISOC/ESA/ESAC, Spain, 12Danish National Space Center, Denmark, 13INAF/IAPS, Italy.

127.03 Modeling Gamma-ray Flares in the Crab Nebula
Yajie Yuan1, R.D. Blandford1, P. Simeon1
1W. W. Hansen Experimental Physics Laboratory, Kavli Institute for Particle Astrophysics and Cosmology, Department of Physics and SLAC National Accelerator Laboratory, Stanford University.

127.04 Mapping the X-ray Structure of Vela X
Patrick O. Slane1
1Harvard-Smithsonian, CfA.

127.05 Spatially-resolved Spectroscopy of the IC443 Pulsar Wind Nebula and Environs
Douglas A. Swartz1, M.C. Weisskopf8, V. Zavlin1, N. Bucciantini3, T.E. Clarke4, M. Karovska5, G.G. Pavlov6, A. van der Horst1, M. Yukita8
1USRA/MSFC, 2NASA/MSFC, 3INAF, Italy, 4NRL, 5SAO, 6PSU, 7UVA, Netherlands, 8UA.

127.06 Heavy-Element Ejecta in G1.9+0.3
Kazimierz J. Borkowski1, S.P. Reynolds1, D. Green3, U. Hwang2, R. Petre2, K. Krishnamurthy4, R. Willett8
1North Carolina State University, 2NASA/Goddard Space Flight Center, 3Cambridge University, United Kingdom, 4Duke University.

127.07 A Decade-Baseline Study of the X-ray Knots of Cas A: The Paradox of Non-Evolution
John Rutherford1, E. Figueroa-Feliciano1, D. Dewey1, S.N. Trowbridge1
1MIT.

127.08 First Results from an XMM-Newton LP on SN1006
Jiang-Tao Li1, A. Decourchelle1
1CEA Saclay, France.

127.09 SN 1006 From Chandra: High-resolution Radial Profiles of the Ejecta
Brian J. Williams1, P.F. Winkler2, S. Katsuda4, K.S. Long5, R. Petre2, S.P. Reynolds3
1NASA Goddard, 2Middlebury College, 3North Carolina State University, 4RIKEN, Japan, 5STScI.

127.10 Particle Acceleration and Magnetic Fields: Looking at the Northwestern Rim of RCW 86 with Chandra
Daniel Castro1
1MIT.
127.11 X-ray Emission from the Galactic Supernova Remnant G272.2-3.2
Randall L. McEntaffer¹, N. Grieves¹, T. Brantseg¹
¹University of Iowa.

127.12 Unraveling the Origin of Overionized Plasma in the Galactic Supernova Remnant W49B
Sarah Pearson¹, L.A. Lopez²,⁵, E. Ramirez-Ruiz³, D. Castro³, H. Yamaguchi⁴, P.O. Slane⁴, R.K. Smith³
¹DARK Cosmology Centre, Denmark, ²MIT-Kavli Institute, ³UCSC, ⁴Harvard-Smithsonian Center for Astrophysics, ⁵Pappalardo Fellow in Physics.

127.13 G306.3-0.9: A Newly Discovered Young Galactic Supernova Remnant
Mark Reynolds¹, S.T. Loi², T. Murphy²,³, J.M. Miller¹, D. Maitra¹, K. Gultekin¹, N. Gehrels⁴, J.A. Kennea³, M.H. Siegel³, J. Gelbord², P. Kuin⁶, V. Moss², S. Reeves², W.J. Robbins², B.M. Gaensler², R.C. Reis¹, R. Petre³
¹University of Michigan, ²Sydney Institute for Astronomy (SIfA), Australia, ³The University of Sydney, Australia, ⁴NASA/Goddard, ⁵Pennsylvania State University, ⁶MSSL/UCL, United Kingdom.

127.14 The Complex Region Containing the Gamma-cygni Supernova Remnant
Denis A. Leahy¹, K. Green¹
¹University of Calgary, Canada.

127.15 Particle Acceleration and Magnetic Field Amplification at Non-relativistic Collisionless Shocks
Damiano Caprioli¹, A. Spitkovsky¹
¹Princeton University.

127.16 The Gamma-Ray Spectra of Supernova Remnants Arising from SNe of Various Types
Vikram Dwarkadas¹, I. Telezhinsky², M. Pohl³,²
¹University of Chicago, ²DESY, Germany, ³University of Potsdam, Germany.

127.17 Energetic Supernovae from the Cosmic Dawn
Ke-Jung Chen¹
¹University of Minnesota, Twin Cities.

127.18 VERITAS Studies of the TeV Emission from MGRO J1908+06/HESS J1908+063
Daniel D. Gall¹, VERITAS Collaboration
¹University of Iowa.

127.19 Core Compactness of Progenitors
Tuguldur Sukhbold¹, S.E. Woosley¹, B. Paxton², A. Heger³
¹University of California, Santa Cruz, ²University of California, Santa Barbara, ³Monash University, Australia.

127.21 On Poynting-Flux-Driven Bubbles and Shocks Around Merging NS/Magnetar Binaries and Implications for SGRBs
Mikhail Medvedev¹,², A. Loeb¹
¹Harvard University, ²University of Kansas.

127.22 Are Short Bursts with Extended Duration Emission Powered by Magnetars?
127.23 Gamma-Ray Bursts: Pulses and Populations
Thomas J. Loredo¹, J.E. Hakkila², M. Broadbent², I.M. Wasserman¹, R.L. Wolpert³
¹Cornell University, ²College of Charleston, ³Duke University.

127.24 GCN/TAN -- Current and Future Functionality
Scott D. Barthelmy¹
¹NASA's GSFC.

127.25 A Correlation Between Intrinsic Luminosity and Average Decay Rate in GRB Afterglows
Judith L. Racusin¹, S.R. Oates²
¹NASA/GSFC, ²MSSL-UCL, United Kingdom.

127.26 Pulsars in the High Energy and Early Universe
John Middleditch¹, A.C. Schmidt¹,², J. Singleton¹,³, H. Ardavan⁴, A. Ardavan⁵
¹LANL, ²University of New Mexico, ³National High Magnetic Field Laboratory, ⁴University of Cambridge, United Kingdom, ⁵University of Oxford, United Kingdom.

127.27 A Four-Year Fermi LAT Survey of Terrestrial Gamma-ray Flashes
J. E. Grove¹, A. Chekhtman², Fermi LAT Collaboration
¹NRL, ²George Mason University.

127.28 Gamma-ray and X-ray Observations Towards the Gamma-Cygni Supernova Remnant
Vikram Dwarkadas¹, A. Weinstein², M. Theiling², VERITAS Collaboration
¹University of Chicago, ²Iowa State University, ³Purdue University.

127.29 Exploring the X-ray Morphology of the Supernova Remnant Kes 27 using Numerical Simulations
Vikram Dwarkadas¹, D. Dewey²
¹University of Chicago, ²MIT.
128 Tidal Disruptions Poster Session
De Anza Ballroom I

128.01 Jetted Tidal Disruption Gone MAD: Case of Dynamically Important Magnetic Field Near the Black Hole in Sw J1644+57
Alexander Tchekhovskoy¹, B. Metzger², D. Giannios³, L.Z. Kelley⁴
¹Princeton University, ²Columbia University, ³Purdue University, ⁴Harvard University.

128.02 The Rise and Fall of Swift J164449.3+573451
David N. Burrows¹, Swift XRT Team
¹Penn State University

128.03 Simulating Tidal Disruptions of Stars on Bound Orbits Around Supermassive Black Holes
Lixin J. Dai¹,², P.S. Coppi¹, A. Escala²
¹Yale University, ²Universidad de Chile, Chile.

129 X-ray Binaries Poster Session
De Anza Ballroom I

129.01 NuSTAR Observations of the Be/X-ray Binary GRO J1008-57 in Outburst
Eric Bellm¹, F. Fuerst¹, K. Pottschmidt²,³, J. Wilms⁴, S.E. Boggs⁵, F. Christensen⁶, W.W. Craig⁷, C.J. Hailey⁸, F. Harrison¹, D. Stern⁹, J. Tomsick¹, W. Zhang², NuSTAR Science Team
¹Caltech, ²NASA-GSFC, ³CSST, UMB, ⁴Remeis-Observatory & ECAP, Germany, ⁵UC Berkeley, ⁶DTU, Denmark, ⁷LLNL, ⁸Columbia, ⁹JPL.

129.02 Angular Momentum Transport in Accreting White Dwarfs: Uniform or Differential Rotation?
Pranab Ghosh¹, J.C. Wheeler²
¹TIFR, India, ²University of Texas at Austin.

129.03 Observational Evidence for Intermediate Mass Black Holes: The State Transitions of ESO 243-41 HLX-1
Mathieu Servillat¹,²
¹CEA Saclay, France, ²Harvard-Smithsonian Center for Astrophysics.

130 Public Outreach Poster Session
De Anza Ballroom I

130.01 "Here, There, and Everywhere": Connecting Science Across The Universe
Megan Watzke¹, P.O. Slane², K.K. Arcand², K. Lestition², P. Edmonds², W.H. Tucker²
¹Chandra X-Ray Center, ²Harvard-Smithsonian Center for Astrophysics.

130.02 Astrobites: The Astro-ph Reader's Digest For Undergraduates
Susanna Kohler¹, Astrobites Team
¹University of Colorado at Boulder.
TUESDAY SESSIONS AND EVENTS
Employment Breakfast with EXCOM
Tuesday, 7:30 AM - 8:30 AM, Portola Room
Advanced Registration Required

200 Missions and Miscellaneous
Tuesday, 8:30 AM - 10:00 AM, De Anza Ballroom II-III

Chair
Henric Krawczynski
Washington Univ, St. Louis.

200.01 Probing Temperatures in the Extreme Colliding-Wind Binary Eta Carinae using Iron-Line Diagnostics
Jean-Christophe Leyder, Eta Carinae Team
NASA Goddard Space Flight Center, Universities Space Research Association.

200.02 The Fermi Large Area Telescope as a Cosmic-Ray Detector
Maria Elena Monzani, Fermi-LAT Collaboration
SLAC National Accelerator Laboratory.

200.03 High-Energy Astrophysics with the High Altitude Water Cherenkov (HAWC) Observatory
John Pretz, HAWC Collaboration
Los Alamos National Lab.

200.04 CTA - A New Observatory for Very High Energy Gamma-Ray Observations
David A. Williams, Cherenkov Telescope Array
UC, Santa Cruz.

200.05 The ASTRO-H X-ray Observatory
Tadayuki Takahashi, K. Mitsuda, R.L. Kelley, ASTRO-H Team
ISAS/JAXA, Japan, NASA/GSFC.

200.06 The Large Observatory For X-ray Timing (LOFT): The ESA Mission and Proposed US Contributions
NRL, IAPS-INAF, Italy, SRON, Netherlands, ISDC, Switzerland, MIT, NASA/MSFC.

200.07 This Is Not Your Advisor's CIAO
Jonathan C. McDowell, D.J. Burke, A. Fruscione, A. Siemiginowska, Chandra X-ray Center CIAO Team
Harvard-Smithsonian CfA.

200.08 Modeling Non-Equilibrium Collisional Plasmas with AtomDB
Adam Foster, H. Yamaguchi, R.K. Smith, N.S. Brickhouse, L. Ji, T. Kallman, J. Wilms
Harvard Smithsonian, CfA, Purple Mountain Observatory, China, NASA Goddard Space Flight Center, Universität Erlangen-Nürnberg, Germany.

200.09 The High Resolution Microcalorimeter Soft X-ray Spectrometer for the Astro-H Mission
201 NuSTAR
Tuesday, 10:30 AM - 12:05 PM, De Anza Ballroom II-III

Special Session 12

Chair
Fiona Harrison
Caltech.

201.01 The Nuclear Spectroscopic Telescope Array Mission Overview and First Results
Fiona Harrison, NuSTAR Team
Caltech.

201.02 The NuSTAR Galactic Binary Program
John Tomsick, NuSTAR Team
UC Berkeley/SSL.

201.03 The NuSTAR ULX Program
Dominic Walton, NuSTAR Team
Caltech.

201.04 A Hard X-ray View of Star Formation: NGC 253 in Focus
NASA GSFC, Johns Hopkins, ASTRON, Netherlands, KICP, University of Chicago, UC Berkeley, DTU Space, Denmark, Columbia University, Caltech, Texas Tech University, NASA JPL, Smithsonian Astrophysical Observatory.

202 PCOS Town Hall
Tuesday, 12:30 PM - 1:30 PM, De Anza Ballroom II-III

Chair
Ann E. Hornschemeier
NASA GSFC.

Chair
John A. Nousek
Penn State University

203 The Fermi Bubbles
Tuesday, 1:30 PM - 2:15 PM, De Anza Ballroom II-III

203.01 Fermi Bubbles: Formation Scenarios and Substructure
Douglas P. Finkbeiner
Harvard University
204 Stellar Compact II: Stellar Mass Black Holes and X-ray Binary Surveys
Tuesday, 2:15 PM - 3:45 PM, De Anza Ballroom II-III

Chair
Paolo S. Coppi1
1Yale University

204.01 NuSTAR Spectroscopy of the Microquasar GRS 1915+105
Jon M. Miller1, J. Tomskick2, F. Harrison3, NuSTAR Team
1University of Michigan, 2University of California at Berkeley, 3Caltech.

204.02 Accretion Variability in Black-Hole X-ray Binaries: The Optical and X-ray Connection
James F. Steiner1
1Harvard-Smithsonian Center for Astrophysics.

204.03 A Statistical Approach to Identifying Compact Objects in X-ray Binaries
Saeqa D. Vrtilek1
1Harvard-Smithsonian, CfA.

204.04 XMM-Newton Observations of IC 10 X-1, the Most Massive Known Stellar Black Hole: Eclipse Mapping and 7 mHz QPOs
Tod E. Strohmayer1, D.R. Pasham2
1NASA's GSFC, 2University of Maryland.

204.05 On the Role of the X-ray Corona in Black Hole State Transitions
Ruben C. Reis1, J.M. Miller1, M. Reynolds1, A.C. Fabian2, D. Walton3, E. Cackett4, J.F. Steiner2
1University of Michigan, 2Institute of Astronomy, United Kingdom, 3Caltech, 4Wayne State University.

204.06 What's on Tap? The Role of Spin in Compact Objects and Relativistic Jets
Ashley L. King1, J.M. Miller1, A.C. Fabian4, C.S. Reynolds2, D. Walton3, K. Gultekin1
1University of Michigan, 2University of Maryland, 3California Institute of Technology, 4Cambridge University, United Kingdom.

204.07 Gemini-GMOS Spectroscopy of X-ray Sources in the Galactic Bulge Survey
Jianfeng Wu1, P.G. Jonker2, M. Torres2, J.E. McClintock1
1Harvard-Smithsonian Center for Astrophysics, 2SRON Netherlands Institute for Space Research, Netherlands.

204.08 X-ray Populations in the Norma and Scutum-Crux Spiral Arms
Francesca Fornasini1, J. Tomskick2, F. Rahou5, A. Bodaghee6,7, A. Bodaghee2, R.A. Krivonos8, H. An4, E.V. Gotthelf6, V.M. Kaspi1, F.E. Bauer8, D. Stern6, S.E. Boggs6
1University of California-Berkeley, 2Space Sciences Laboratory, University of California-Berkeley, 3Columbia University, 4McGill University, Canada, 5Jet Propulsion Laboratory, California Institute of Technology, 6ESO Garching, Germany, 7Harvard University, 8Pontificia Universidad Catolica de Chile, Chile.

204.09 Evolution of X-ray Binaries Across Cosmic Time and Energy Feedback at High Redshift
Tassos Fragos1
1Harvard-Smithsonian Center for Astrophysics.
205 Accretion, Spin, and Feedback: How are AGN Jets Produced?
Tuesday, 4:15 PM - 5:45 PM, Portola Room

Chair
Daniel A. Evans¹
¹NSF.

205.01 Relativistic Jets from Accreting Black Holes
Ramesh Narayan¹
¹Harvard-Smithsonian, CfA.

205.02 Disks, Winds, and Jets in AGN: The X-ray View
Christopher S. Reynolds¹
¹University of Maryland.

205.03 Powering Extragalactic Radio Jets in Galaxy Clusters
Brian R. McNamara¹
¹University of Waterloo, Canada.

205.04 The Role and Power of Jets Across the Black Hole Mass Scale
Sera Markoff¹
¹University of Amsterdam, Netherlands.

206 Black Holes in Globular Clusters
Tuesday, 4:15 PM - 5:45 PM, De Anza Ballroom II-III

Chair
Stephen E. Zepf¹
¹Michigan State University

206.01 Black Holes in Globular Clusters: An Overview
Thomas J. Maccarone¹
¹Texas Tech University.

206.02 Modeling Black Holes in Globular Clusters
Natalia Ivanova¹
¹University of Alberta, Canada.

206.03 Searching for Black Holes in Milky Way Globular Clusters
Laura Chomiuk¹, ², J. Strader¹, T.J. Maccarone¹, ², J. Miler-Jones³, A. Seth⁴
¹Michigan State University, ²National Radio Astronomy Observatory, ³University of Southampton, United Kingdom, ⁴Texas Tech University, ⁵International Centre for Radio Astronomy Research, Curtin University, Australia, ⁶University of Utah.

206.04 Emission Lines From Tidally Disrupted White Dwarfs and Other Evolved Stars
Drew R. Clausen¹, S. Sigurdsson¹, M. Eracleous¹, J. Irwin²
¹The Pennsylvania State University, ²University of Alabama.

206.05 Observations of Black Holes in Extragalactic Globular Clusters
Arunav Kundu¹, ²
¹TIFR, India, ²Eureka Scientific.

206.06 Black Holes in Globular Clusters: A Summary

Happy Hour: Poster Session III
Tuesday, 5:45 PM - 6:45 PM, De Anza Ballroom I
207 Science of Future X-ray Missions
Tuesday, 7:30 PM - 9:00 PM, De Anza Ballroom II-III

A number of new X-ray missions are under discussion either for a start this decade (e.g. AXSIO, LOFT) or the next decade (e.g. Smart-X, Athena+). These missions all feature large areas and often new detector technology which will enable entirely new science. This session, part of the X-ray Science Analysis Group, will feature short presentations about both near and longer-term science objectives of the US mission concepts as well as an open discussion about other possibilities.

Chair
Randall K. Smith

1Smithsonian Astrophysical Observatory.

1. Alexey Vikhlinin, SAO: X-ray Astronomy in the Next Decade with a True Successor to Chandra
2. Tim Kallman, NASA/GSFC: X-ray Polarimetry Science
4. Randall Smith, SAO: Moderator for Open Discussion on Expanding and Enhancing the Science Case for X-ray Missions
WEDNESDAY SESSIONS AND EVENTS

300 AGN II: Winds/jets/accretion (theory) and AGN/Galaxy Connections

Wednesday, 8:30 AM - 10:00 AM, De Anza Ballroom II-III

Chair
Jan M. Vrtilek

1Harvard-Smithsonian, CfA.

300.01 Observing Relativistic Jet Simulations
Roger D. Blandford1, 2, J. McKinney1, 2, N.L. Zakamska3, 2
1Stanford University, 2KIPAC, 3University Maryland, 4Johns Hopkins University.

300.02 The Fermi Bubbles: Possible Nearby Laboratory for AGN Jet Activity
Hsiang-Yi Karen Yang1, M. Ruszkowski1, E.G. Zweibel2, P.M. Ricker3
1University of Michigan, 2University of Wisconsin-Madison, 3University of Illinois.

300.03 Fermi Bubbles and Periodic Past Activity of the Central Galactic Black Hole
Dmitry Chernyshov1, K. Cheng2, V. Dogiel1, C. Ko3
1Lebedev's Institute of Physics, Russian Federation, 2University of Hong Kong, Hong Kong, 3Institute of Astronomy, National Central University, Taiwan.

300.04 The NuSTAR Extragalactic Survey: A First Look at the Distant High-Energy X-ray Background Population
1Georgia Institute of Technology, 2Caltech, 3National Tsing Hua University, Taiwan, 4KIPAC/SLAC, 5Durham University, United Kingdom, 6Pontificia Universidad Católica de Chile, Chile, 7UC Berkeley, 8DTU Space, Denmark, 9Columbia University, 10JPL/Caltech, 11NASA/GSFC, 12University of Florida.

300.05 A Chandra Investigation of Empirical Links Between XRB and AGN Accretion
Paul J. Green1, M. Trichas1, A. Constantin2, T.L. Aldcroft1, D. Kim1, A. Hyde3, D. Haggard4, B.C. Kelly6, M. Sobolewska1, H. Zhoue5
1Harvard-Smithsonian CfA, 2James Madison University, 3Imperial College, United Kingdom, 4CIERA, 5USTC, China, 6University of California.

300.06 Catching Actively Growing Galaxies and SMBHs in a High Redshift (z = 2.23) Protocluster Environment with Herschel and Chandra
Bret Lehmer1, 2, A.B. Lucy3, D.M. Alexander4, P. Best4, J. Geach6, C. Harrison4, A.E. Hornschemeier1, 2, Y. Matsuda7, J. Mullaney4, I. Smail4, D. Sobral6, M. Swinbank4
1Johns Hopkins University, 2NASA GSFC, 3University of Oklahoma, 4University of Tennessee, United Kingdom, 5Institute for Astronomy, United Kingdom, 6McGill University, Canada, 7National Astronomical Observatory, Japan, 8Leiden University, Netherlands.

300.07 Cosmological Evolution of the FSRQ Gamma-ray Luminosity Function and Spectra and the Contribution to the Background Based on Fermi-LAT Observations
Jack Singal1, V. Petrosian1, A. Ko1
1KIPAC.
Herschel Observations of Blazars PKS 1510-089 and AO 0235+164
Krzysztof Nalewajko1, M. Sikora2, G.M. Madejski3, K. Exter4, A. Szostek3, 5, R. Szczerba6, M.R. Kidger7, R. Lorente8
1University of Colorado, 2Nicolaus Copernicus Astronomical Center, Poland, 3KIPAC, 4KU Leuven, Belgium, 5Jagiellonian University, Poland, 6Nicolaus Copernicus Astronomical Center, Poland, 7Herschel Science Center, Spain.

301 Galaxies & ISM
Wednesday, 10:30 AM - 12:00 PM, De Anza Ballroom II-III

Chair
Randall K. Smith1
1Smithsonian Astrophysical Observatory.

The Structure of the Milky Way's Hot Gas Halo
Matthew J. Miller1, J.N. Bregman1
1University of Michigan.

Spatially-resolved Spectral Analysis of the Hot Gaseous Emission in the M31 Bulge
Mihoko Yukita1, J. Irwin1, K. Wong1, E. Million1
1University of Alabama - Tuscaloosa.

Unresolved Soft X-Ray Emission from the Galactic Disk
Ikuyuki Mitsuishi1, T. Sato1, 2, S. Kimura2, K. Mitsuda2, N.Y. Yamasaki2, Y. Takei2, T. Ohashi1, D. McCammon3
1Tokyo Metropolitan University, Japan, 2ISAS/JAXA, Japan, 3University of Wisconsin.

Exploring the Influence of Metallicity on X-ray Binary Formation in Nearby and Distant UV-selected Galaxies
Antara Basu-Zych1, B. Lehmer2, 1, A.E. Hornschemeier1, A. Ptak1
1Goddard Space Flight Center, 2Johns Hopkins University.

Explore the Origin of Galactic Coronae with a Chandra Survey of Nearby Highly-Inclined Disc Galaxies
Jiang-Tao Li1, 2, Q.D. Wang1
1Astronomy Department of University of Massachusetts, 2CEA Saclay, France.

X-ray and Ultraviolet Halos Around the Nearby Edge-on Spiral NGC 891
Edmund J. Hodges-Kluck1, J.N. Bregman1
1University of Michigan.

Charge-Exchange in X-ray Spectrum of M82
Shuinai Zhang1, Q.D. Wang2, L. Ji1, R.K. Smith3, A. Foster5
1Purple Mountain Observatory, China, 2Astronomy department, UMASS, 3Center for Astrophysics.

The Diffuse X-rays from the Local Galaxy (DXL) Mission
1University of Miami, 2University of Wisconsin, 3NASA Goddard Space Flight Center, 4University of Michigan, 5University of Kansas, 6Johns Hopkins University.
302 Gravitational Wave Mission Plans
Wednesday, 1:30 PM - 3:00 PM, De Anza Ballroom II-III

Chair
Peter L. Bender
1JILA, University of Colorado and NIST.

302.01 The Proposed Evolved-LISA Mission
Karsten Danzmann
1AEI Hannover, Germany.

302.02 The LISA Pathfinder Mission
Stefano Vitale1, LISA Pathfinder Team
1University of Trento, Italy.

302.03 Astrophysical Information from Massive Black Hole Coalescences
Scott A. Hughes
1MIT.

303 The Charge Exchange Process in the Solar System and Beyond
Wednesday, 1:30 PM - 3:00 PM, Portola Room

Chair
Damian J. Christian
1California State University.

303.01 Solar System X-rays from Charge Exchange Processes
1Johns Hopkins University Applied Physics Laboratory, 2CSUN Department of Physics and Astronomy, 3Physics Laboratory, Vikram Sarabhai Space Centre, India, 4Max-Planck-Institut für extraterrestrische Physik, Germany, 5Chandra X-ray Center, Harvard-Smithsonian Center for Astrophysics, 6The University of Maryland Department of Astronomy, 7The University of Michigan Department of Space Sciences.

303.02 Cometary Charge Exchange Emission in Ultraviolet and Soft X-ray Wavelengths
Dennis Bodewits
1University of Maryland.

303.03 Charge-Exchange Emission and the Soft X-ray Background
K. D. Kuntz
1Johns Hopkins University

303.04 Laboratory Studies of X-ray Spectra Formed by Charge Exchange
Peter Beiersdorfer1, R. Ali2, G.V. Brown1, D. Koutroumpa3, R.L. Kelley3, C. Kilbourne3, M.A. Leutenegger1, F. Porter3
1LLNL, 2University of Jordan, Jordan, 3Goddard Space Flight Center.

304 Bridging Laboratory and High Energy Astrophysics
Wednesday, 3:30 PM - 5:00 PM, De Anza Ballroom II-III

Chair
Daniel W. Savin
304.01 Nuclear Data Needs for Astrophysics
Stan E. Woosley¹, A. Heger², R.D. Hoffman³
¹UC, Santa Cruz, ²Monash University, Australia, ³LLNL.

304.02 High-Energy-Density Laboratory Astrophysics Experiments on the Omega Laser Facility and the National Ignition Facility
Carolyn C. Kuranz¹
¹University of Michigan.

304.03 Spectral Modeling of Cosmic Atomic Plasmas
Jelle S. Kaastra¹, ²
¹SRON, Netherlands, ²Utrecht University, Netherlands.

305 Understanding Gamma-Ray Bursts Emission Mechanism in the Fermi Era
Wednesday, 3:30 PM - 5:00 PM, Portola Room
Chair
Giacomo Vianello¹
¹Stanford University.

305.01 Spectral and Temporal Properties of Pre-Fermi GRBs
Robert D. Preece¹
¹University of Alabama.

305.02 Fermi Observations of GRBs
Vlasisos Vasileiou¹, ², Fermi LAT, GBM Collaborations
¹CNRS/IN2P3/LUPM Montpellier, France, ²Universite Montpellier II, France.

305.04 Fermi Observations of the Jet Photosphere in GRBs: Interpretations and Consequences
Felix Ryde¹, ², Fermi LAT, Fermi GBM
¹KTH, Sweden, ²The Oskar Klein Centre for Cosmoparticle Physics, Sweden.

Happy Hour: Poster Session IV
Wednesday, 5:00 PM - 6:00 PM, De Anza Ballroom I

HEAD Banquet Dinner
Wednesday, 7:30 PM - 9:00 PM, Portola Hotel and Spa
400 SNR/GRB
Thursday, 8:30 AM - 10:00 AM, De Anza Ballroom II-III

Chair
Stephen P. Reynolds
North Carolina State University

400.01 Numerical Simulation-based Jet Model Fits to GRB Light Curves
Binbin Zhang, H. Van Eerten, D.N. Burrows, A. MacFadyen
The Pennsylvania State University, New York University.

400.02 A New Channel for Low-Luminosity GRBs: Tidal Disruptions of White Dwarfs by Intermediate Mass Black Holes
Roman V. Shcherbakov, A. Pe’er, C.S. Reynolds, R. Haas, T. Bode, P. Laguna
University of Maryland, University College Cork, Ireland, Harvard-Smithsonian Center for Astrophysics, California Institute of Technology, Georgia Institute of Technology.

400.03 Searches for Gravitational Waves Associated with Gamma-ray Bursts
Raymond Frey, LIGO Scientific Collaboration, Virgo Collaboration
University of Oregon.

400.04 NuSTAR Constraints on the Shock Temperature and Velocity in the Luminous Type II In Supernova 2010jl
UC Berkeley, Weizmann Institute of Science, Caltech, DTU Space, Denmark, LLNL, LANL, Columbia, North Carolina State University, JPL, GSFC.

400.05 NuSTAR First Pulsar-wind Nebulae Results
Caltech, DTU Space, Denmark, LLNL, Columbia, Goddard, Berkeley, McGill, Canada, NCSU, LANL, JPL, MIT, Riken, Japan.

400.06 SN 1006 from Chandra: Exquisite Testament to Progress in Fifty Years of X-ray Astronomy
P. F. Winkler, S. Katsuda, K.S. Long, R. Petre, S.P. Reynolds, B.J. Williams
Middlebury College, RIKEN, Japan, STScI, NASA-GSFC, NCSU.

400.07 What Would the Remnant of a Gamma-ray Burst Look Like?
Laura A. Lopez
MIT.

400.08 Determining Progenitors of Young Supernova Remnants from Their Fe K-Shell Emission
Hiroya Yamaguchi, R.K. Smith, P.O. Slane
Harvard-Smithsonian Center for Astrophysics.

401 Galaxy Clusters
Thursday, 10:30 AM - 12:00 PM, De Anza Ballroom II-III
401.01 Virial Region of Abell 133 Viewed with the 2.4 Msec Chandra Exposure
Alexey Vikhlinin
1Harvard-Smithsonian, CfA.

401.02 NuSTAR’s Hard Look at the Bullet Cluster: First Results
1NASA Goddard Space Flight Center, 2National Space Institute, Technical University of Denmark, Denmark, 3INAF-IASF, Italy, 4Caltech Division of Physics, Mathematics and Astronomy, 5U.C. Berkeley Space Sciences Laboratory, 6Lawrence Livermore National Laboratory, 7Columbia University, 8RIKEN, Japan, 9KIPAC, SLAC National Accelerator Laboratory, 10Jet Propulsion Laboratory.

401.03 The Evolution of Cool Cores in Galaxy Clusters from z=0 to z=1.2
Michael McDonald1
1MIT.

401.04 How AGN Feedback Evolves in Clusters of Galaxies
Julie Hlavacek-Larrondo1
1Stanford University.

401.05 Feedback at the Working Surface: A Joint X-ray and Low-Frequency Radio Spectral Study of the Cocoon Shock in Cygnus A
Michael W. Wise1, 2, D.A. Rafferty3, J.P. McKean1
1ASTRON (Netherlands Institute for Radio Astronomy), Netherlands, 2University of Amsterdam, Netherlands, 3Leiden University, Netherlands.

401.06 ICM Properties and Gas Mixing in the Stripped Tails of Two Nearby Early-type Cluster Galaxies
Ralph P. Kraft1, E. Roediger2-1, M.E. Machacek1, W.R. Forman1, P. Nulsen1, E. Churazov3
1Harvard-Smithsonian, CfA, 2Hamburger Sternwarte, Germany, 3Max-Planck-Institut fuer Astrophysik, Germany.

401.07 Intragroup and Galaxy-Linked Diffuse X-ray Emission in Compact Groups of Galaxies
Tyler D. Desjardins1, S. Gallagher1, P. Tzanavari2, J.S. Mulchaey3, W.N. Brandt4, 5, J.C. Charlton1, G. Garmire4, C. Gronwall4, 5, A.E. Hornschemeier2, K.E. Johnson1, I. Konstantopoulos4, A.I. Zabludoff3
1Department of Physics and Astronomy, University of Western Ontario, Canada, 2Laboratory for X-ray Astrophysics, NASA/Goddard Space Flight Center, 3Carnegie Observatories, 4Department of Astronomy and Astrophysics, The Pennsylvania State University, 5Institute for Gravitation and the Cosmos, The Pennsylvania State University, 6Department of Astronomy, University of Virginia, 7Australian Astronomical Observatory, Australia, 8Steward Observatory, University of Arizona.

401.08 Probing Non-thermal Emission from Clusters with Gamma-Ray and Radio Observations
Tesla E. Jeltema1, E. Storm1, S. Profumo1, L. Rudnick2
1University of California, Santa Cruz, 2University of Minnesota.
402 Stellar Compact III: X-ray Binaries, Transients and ULX Sources
Thursday, 1:30 PM - 3:00 PM, De Anza Ballroom II-III

Chair
Nicholas E. White
1NASA's GSFC.

402.01 NuSTAR’s First Results for Cyclotron Lines Sources
Felix Fuerst1, B. Grefenstette1, S.E. Boggs2, F. Christensen3, W.W. Craig2,4, C.J. Hailey5, F. Harrison1, K. Pottschtmiss6,7, R. Staubert8, D. Stern9, J. Tomsick2, J. Wilms10, W. Zhang6, NuSTAR Team
1SRL, Caltech, 2UC Berkeley, 3DTU-Space, Denmark, 4LLNL, 5Columbia University, 6NASA-GSFC, 7CSST, UMBC, 8IAAT, Germany, 9JPL, 10Remeis-Observatory & ECAP, Germany.

402.02 Long-term Monitoring of Supergiant Fast X-ray Transients with Swift: From Hours to Years
Patrizia Romano1, J.A. Kennea2, S. Vercellone1, D.N. Burrows2, L. Ducci3, P. Esposito4, H.A. Krimm5, V. Mangano1, N. Gehrels5
1INAF-IASF Palermo, Italy, 2Pennsylvania State University, 3Universitat Tuebingen, Germany, 4INAF-IASF Milano, Italy, 5NASA/GSFC.

402.03 Interactions of X-ray Binaries with their Surrounding Material
Mathieu Servillat1, 2, S. Chaty1, A. Coleiro1, S. Tang3, 2, J.E. Grindlay2, E. Los2
1CEA Saclay, France, 2Harvard-Smithsonian Center for Astrophysics, 3UC Santa Barbara.

402.04 The First Dynamical Mass Measurement for an Ultraluminous X-ray Source
Jifeng Liu1, J.N. Bregman2, Y. Bai3
1National Astronomical Observatory of China, China, 2University of Michigan, 3Beijing Normal University, China.

402.05 Discovery of Quasi-periodic X-ray Dips from the ULX NGC 5408 X-1: Implications for the Accretion Geometry
Dheeraj Ranga Reddy Pasham1, 2, T.E. Strohmayer2
1University of Maryland College Park, 2NASA/GSFC.

402.06 A State Transition of the Luminous X-ray Binary in the Low-Metallicity Blue Compact Dwarf Galaxy I Zw 18
Philip Kaaret1, H. Feng2
1University of Iowa, 2Tsinghua University, China.

402.07 First Models of Neutron Star X-ray Bursts with too Short Recurrence Times
Laurens Keek1, A. Heger2
1Michigan State University, 2Monash University, Australia.

402.08 Determining Neutron Star Masses and Radii using Energy-resolved Waveforms of X-ray Burst Oscillations
Frederick K. Lamb1, K. Lo1, M.C. Miller2, S. Bhattacharyya3
1University of Illinois, 2University of Maryland, 3Tata Institute of Fundamental Research, India.

402.09 Gamma-ray Observations of the Microquasars Cygnus X-1, Cygnus X-3, GRS 1915+105, and GX 339-4 with Fermi-LAT
Arash Bodaghee1, J. Tomsick1, J. Rodriguez2, K. Pottschtmiss1, J. Wilms5, G.G. Pooley5
1University of California, Berkeley, 2CEA Saclay, France, 3CREST/UMBC - NASA-GSFC, 5Sternwarte-University Erlangen, Germany, 5University of Cambridge, United Kingdom.
403 AGN III: Transients and Low Luminosity/Mass AGN

Thursday, 3:30 PM - 5:00 PM, De Anza Ballroom II-III

Chair
Joshua S. Bloom
1UC, Berkeley.

403.01 The Swift Monitoring Campaign of Sagittarius A*
Nathalie Degenaar1, J.M. Miller1, J.A. Kennea2, R. Wijnands2, N. Gehrels4
1University of Michigan, 2University of Amsterdam, Netherlands, 3Penn State University, 4NASA Goddard Space Flight Center.

403.02 NuSTAR Detection of High-energy Emission and Fast Variability from a Sagittarius A* X-ray Flare
Nicolas Barriere1, J. Tomsick1, F.K. Baganoff2, S.E. Boggs1, F. Christensen3, W.W. Craig4, 1, B. Grefenstette3, C.J. Hailey6, F. Harrison3, K. Madsen5, K. Mori2, K. Perez6, D. Stern7, S. Zhang8, W. Zhang9, A. Zoglauer1, NuSTAR Team
1Space Sciences Laboratory, UC Berkeley, 2Center for Space Research, MIT, 3National Space Institute, DTU, Denmark, 4Lawrence Livermore National Laboratory, 5Cahill Center for Astronomy and Astrophysics, Caltech, 6Columbia Astrophysics Laboratory, Columbia University, 7Jet Propulsion Laboratory, Caltech, 8NASA Goddard Space Flight Centre.

403.03 A 200-Second Quasi-Periodicity After the Tidal Disruption of a Star by a Dormant Black Hole
Ruben C. Reis1, J.M. Miller1, M. Reynolds1, K. Gultekin1, D. Maitra1, A.L. King1, T.E. Strohmayer2
1University of Michigan, 2NASA Goddard Space Flight Center.

403.04 Late-time Observations of the New Class of Relativistic Tidal Disruption Flares
Stephen B. Cenko
1University of California, Berkeley.

403.05 PS1-10jh: The Partial Disruption of a Main-Sequence Star of Near-Solar Composition
James Guillochon1, E. Ramirez-Ruiz1
1UC Santa Cruz.

403.06 The Sharpest Spatial View of a Black Hole Accretion Flow from the Chandra X-ray Visionary Project Observation of the NGC 3115 Bondi Region
Jimmy Irwin1, K. Wong1, R.V. Shcherbakov2, M. Yukita1, W.G. Mathews3
1University of Alabama - Tuscaloosa, 2University of Maryland, 3University of California, Santa Cruz.

403.07 Modeling the Accretion Flow Onset in the Low-Luminosity Active Galactic Nucleus of NGC3115
Roman V. Shcherbakov1, K. Wong2, J. Irwin2, C.S. Reynolds1
1University of Maryland, 2University of Alabama.

403.08 Probing the Origin of the Intermediate Mass Black Hole ESO 243-49 HLX-1
Sean Farrell1, M. Servillat2, 4, N. Webb3, D. Barret3, O. Godet3
1The University of Sydney, Australia, 2CEA-Saclay, France, 3IRAP, France, 4Harvard-Smithsonian Center for Astrophysics.
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<tbody>
<tr>
<td>Abeysekara, A. U.</td>
<td>123.01</td>
</tr>
<tr>
<td>Adams, J. D.</td>
<td>119.03</td>
</tr>
<tr>
<td>Ajello, M.</td>
<td>105.04, 108.17, 109.08, 118.01, 300.04</td>
</tr>
<tr>
<td>Alberts, S.</td>
<td>110.02</td>
</tr>
<tr>
<td>Aldcroft, T. L.</td>
<td>117.09, 123.28, 300.05</td>
</tr>
<tr>
<td>Aldcroft, T.</td>
<td>123.30</td>
</tr>
<tr>
<td>Alexander, D. M.</td>
<td>300.04, 300.06</td>
</tr>
<tr>
<td>Ali, R.</td>
<td>303.04</td>
</tr>
<tr>
<td>Altamirano, D.</td>
<td>126.42</td>
</tr>
<tr>
<td>Amman, M.</td>
<td>123.06, 123.09</td>
</tr>
<tr>
<td>An, H. 204.08,</td>
<td></td>
</tr>
<tr>
<td>Anderson, J.</td>
<td>101.08, 113.01</td>
</tr>
<tr>
<td>Anderson, M. E.</td>
<td>120.08</td>
</tr>
<tr>
<td>Andersson, K.</td>
<td>116.10</td>
</tr>
<tr>
<td>Antoniou, V.</td>
<td>126.33</td>
</tr>
<tr>
<td>Antonucci, R. R.</td>
<td>108.07</td>
</tr>
<tr>
<td>Aoki, K.</td>
<td>116.02</td>
</tr>
<tr>
<td>Arcand, K. K.</td>
<td>130.01</td>
</tr>
<tr>
<td>Archibald, R. F.</td>
<td>103.09, 126.10</td>
</tr>
<tr>
<td>Ardavan, A.</td>
<td>127.26</td>
</tr>
<tr>
<td>Ardavan, H.</td>
<td>127.26</td>
</tr>
<tr>
<td>Arendt, R. G.</td>
<td>116.17</td>
</tr>
<tr>
<td>Argo, M.</td>
<td>120.15, 201.04</td>
</tr>
<tr>
<td>Arnaud, K. A.</td>
<td>117.04, 117.05</td>
</tr>
<tr>
<td>Arnold, J.</td>
<td>120.10</td>
</tr>
<tr>
<td>Arzoumanian, Z.</td>
<td>123.25</td>
</tr>
<tr>
<td>Ashby, M.</td>
<td>108.07</td>
</tr>
<tr>
<td>Assef, R. J.</td>
<td>300.04</td>
</tr>
<tr>
<td>Avara, M. J.</td>
<td>116.14</td>
</tr>
<tr>
<td>Baganoff, F. K.</td>
<td>108.14, 126.48, 403.02</td>
</tr>
<tr>
<td>Bai, Y.</td>
<td>402.04</td>
</tr>
<tr>
<td>Bain, H.</td>
<td>123.12</td>
</tr>
<tr>
<td>Bakala, P.</td>
<td>126.20</td>
</tr>
<tr>
<td>Baker, J. G.</td>
<td>121.01</td>
</tr>
<tr>
<td>Ballantyne, D. R.</td>
<td>109.02, 300.04</td>
</tr>
<tr>
<td>Balko, S.</td>
<td>126.05</td>
</tr>
<tr>
<td>Balokovic, M.</td>
<td>108.17, 300.04</td>
</tr>
<tr>
<td>Balsamo, E.</td>
<td>123.25</td>
</tr>
<tr>
<td>Bandler, S.</td>
<td>104.01, 119.03</td>
</tr>
<tr>
<td>Barchas, J.</td>
<td>112.01</td>
</tr>
<tr>
<td>Baring, M. G.</td>
<td>112.01, 114.10, 123.07, 123.11, 123.17, 126.09, 126.13, 126.14</td>
</tr>
<tr>
<td>Baron, E. A.</td>
<td>108.08</td>
</tr>
<tr>
<td>Barret, D.</td>
<td>123.16, 126.47, 126.52, 403.08</td>
</tr>
<tr>
<td>Barriere, N.</td>
<td>116.01, 123.06, 123.08, 126.48, 400.04, 403.02</td>
</tr>
<tr>
<td>Barthel, P.</td>
<td>108.07</td>
</tr>
<tr>
<td>Author</td>
<td>Pages</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Barthelmy, S. D.</td>
<td>123.07, 123.17, 127.24</td>
</tr>
<tr>
<td>Basu-Zych, A.</td>
<td>301.04</td>
</tr>
<tr>
<td>Bauer, F. E.</td>
<td>126.48, 204.08, 300.04</td>
</tr>
<tr>
<td>Baumgartner, W. H.</td>
<td>109.06, 109.07, 127.02</td>
</tr>
<tr>
<td>Bautz, M. W.</td>
<td>116.03, 116.04, 119.05, 123.19, 123.20</td>
</tr>
<tr>
<td>Beardmore, A. P.</td>
<td>103.09, 123.21, 126.40</td>
</tr>
<tr>
<td>Bechtol, K.</td>
<td>120.15, 201.04</td>
</tr>
<tr>
<td>Becker, A.</td>
<td>122.01</td>
</tr>
<tr>
<td>Becker, P. A.</td>
<td>126.31, 126.37</td>
</tr>
<tr>
<td>Beckwith, K.</td>
<td>126.29</td>
</tr>
<tr>
<td>Begelman, M. C.</td>
<td>126.29</td>
</tr>
<tr>
<td>Behar, E.</td>
<td>108.15</td>
</tr>
<tr>
<td>Beiersdorfer, P.</td>
<td>122.03, 122.04, 125.02, 303.04</td>
</tr>
<tr>
<td>Bellicke, M.</td>
<td>123.07, 123.17</td>
</tr>
<tr>
<td>Beklen, E.</td>
<td>123.02, 127.02</td>
</tr>
<tr>
<td>Belfiore, A.</td>
<td>126.08</td>
</tr>
<tr>
<td>Bellm, E.</td>
<td>103.02, 129.01, 400.04</td>
</tr>
<tr>
<td>Belmont, R.</td>
<td>108.14</td>
</tr>
<tr>
<td>Bender, P. L.</td>
<td>121.03</td>
</tr>
<tr>
<td>Bennett, V.</td>
<td>108.18</td>
</tr>
<tr>
<td>Bernardini, F.</td>
<td>126.04</td>
</tr>
<tr>
<td>Bernhardt, D.</td>
<td>122.01</td>
</tr>
<tr>
<td>Best, P.</td>
<td>300.06</td>
</tr>
<tr>
<td>Bhardwaj, A.</td>
<td>303.01</td>
</tr>
<tr>
<td>Bhat, N. P.</td>
<td>127.02</td>
</tr>
<tr>
<td>Bhattacharyya, S.</td>
<td>402.08</td>
</tr>
<tr>
<td>Billman, C.</td>
<td>126.16, 126.17</td>
</tr>
<tr>
<td>Binns, W.</td>
<td>123.17</td>
</tr>
<tr>
<td>Biretta, J. A.</td>
<td>101.08</td>
</tr>
<tr>
<td>Birkinshaw, M.</td>
<td>108.07</td>
</tr>
<tr>
<td>Blackburne, J. A.</td>
<td>101.01</td>
</tr>
<tr>
<td>Blandford, R. D.</td>
<td>108.17, 127.03, 300.01</td>
</tr>
<tr>
<td>Blondin, J. M.</td>
<td>126.30</td>
</tr>
<tr>
<td>Bloser, P. F.</td>
<td>123.10, 123.11</td>
</tr>
<tr>
<td>Bodaghee, A.</td>
<td>204.08, 402.09</td>
</tr>
<tr>
<td>Bode, T.</td>
<td>400.02</td>
</tr>
<tr>
<td>Bodewits, D.</td>
<td>303.01, 303.02</td>
</tr>
<tr>
<td>Boehringer, H.</td>
<td>109.05</td>
</tr>
<tr>
<td>Boettcher, M.</td>
<td>114.08, 114.10, 114.11</td>
</tr>
<tr>
<td>Bogdanovic, T.</td>
<td>116.14</td>
</tr>
<tr>
<td>Boggs, S.</td>
<td>108.16, 201.04</td>
</tr>
<tr>
<td>Boggs, S. E.</td>
<td>108.17, 117.06, 120.13, 120.15, 123.05, 123.06, 123.08, 123.09, 123.12, 126.48, 129.01, 204.08, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02</td>
</tr>
<tr>
<td>Bongiorno, S.</td>
<td>123.18</td>
</tr>
<tr>
<td>Bonnoli, G.</td>
<td>123.32</td>
</tr>
<tr>
<td>Bookbinder, J. A.</td>
<td>119.01, 119.02, 123.30</td>
</tr>
<tr>
<td>Author Name</td>
<td>Pages</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Borkowski, K. J.</td>
<td>127.06</td>
</tr>
<tr>
<td>Bostrom, A.</td>
<td>108.19</td>
</tr>
<tr>
<td>Bottacini, E.</td>
<td>109.08</td>
</tr>
<tr>
<td>Boydstun, K.</td>
<td>108.17, 300.04</td>
</tr>
<tr>
<td>Bozzo, E.</td>
<td>119.08, 123.16, 200.06</td>
</tr>
<tr>
<td>Braito, V.</td>
<td>101.06</td>
</tr>
<tr>
<td>Brandt, S.</td>
<td>123.16</td>
</tr>
<tr>
<td>Brandt, W. N.</td>
<td>109.06, 401.07</td>
</tr>
<tr>
<td>Brantseg, T.</td>
<td>127.11</td>
</tr>
<tr>
<td>Bregman, J. N.</td>
<td>119.01, 119.02, 120.08, 301.01, 301.06, 402.04</td>
</tr>
<tr>
<td>Brenneman, L.</td>
<td>101.07, 108.16</td>
</tr>
<tr>
<td>Brickhouse, N. S.</td>
<td>122.04, 122.08, 200.08</td>
</tr>
<tr>
<td>Bridge, C.</td>
<td>300.04</td>
</tr>
<tr>
<td>Briggs, M. S.</td>
<td>127.02</td>
</tr>
<tr>
<td>Broadbent, M.</td>
<td>127.23</td>
</tr>
<tr>
<td>Brodie, J. P.</td>
<td>120.10</td>
</tr>
<tr>
<td>Brown, E. F.</td>
<td>103.08</td>
</tr>
<tr>
<td>Brown, G. V.</td>
<td>122.02, 122.03, 122.04, 303.04</td>
</tr>
<tr>
<td>Bucciantini, N.</td>
<td>127.01, 127.05</td>
</tr>
<tr>
<td>Buchan, S.</td>
<td>126.27</td>
</tr>
<tr>
<td>Buckley, J. H.</td>
<td>123.07, 123.17</td>
</tr>
<tr>
<td>Buehler, R.</td>
<td>105.04</td>
</tr>
<tr>
<td>Bulbul, G.</td>
<td>116.15</td>
</tr>
<tr>
<td>Burke, D. J.</td>
<td>200.07</td>
</tr>
<tr>
<td>Burrows, D. N.</td>
<td>123.18, 128.02, 400.01, 402.02</td>
</tr>
<tr>
<td>Busch, S. E.</td>
<td>119.03</td>
</tr>
<tr>
<td>Caballero, I.</td>
<td>126.32, 126.35, 126.36</td>
</tr>
<tr>
<td>Cackett, E.</td>
<td>101.03, 126.24, 204.05</td>
</tr>
<tr>
<td>Cambier, H. J.</td>
<td>126.28</td>
</tr>
<tr>
<td>Camero-Arranz, A.</td>
<td>117.08, 123.02, 127.02</td>
</tr>
<tr>
<td>Canestrari, R.</td>
<td>123.31, 123.32</td>
</tr>
<tr>
<td>Cappelluti, N.</td>
<td>109.05, 116.17</td>
</tr>
<tr>
<td>Cappi, M.</td>
<td>101.06</td>
</tr>
<tr>
<td>Caprioli, D.</td>
<td>127.15</td>
</tr>
<tr>
<td>Caraveo, P.</td>
<td>123.31, 123.32</td>
</tr>
<tr>
<td>Case, G. L.</td>
<td>117.08, 123.02, 127.02</td>
</tr>
<tr>
<td>Casey, C.</td>
<td>109.07</td>
</tr>
<tr>
<td>Cash, W. C.</td>
<td>123.22</td>
</tr>
<tr>
<td>Castro, D.</td>
<td>127.10, 127.12</td>
</tr>
<tr>
<td>Catalano, O.</td>
<td>123.31, 123.32</td>
</tr>
<tr>
<td>Cenko, S. B.</td>
<td>403.04</td>
</tr>
<tr>
<td>Chakrabarty, D.</td>
<td>126.46, 200.06</td>
</tr>
<tr>
<td>Chang, H.</td>
<td>123.06</td>
</tr>
<tr>
<td>Chang, Y. H.</td>
<td>123.06</td>
</tr>
<tr>
<td>Chaplin, V.</td>
<td>117.08, 123.02, 127.02</td>
</tr>
<tr>
<td>Charlton, J. C.</td>
<td>401.07</td>
</tr>
</tbody>
</table>
AUTHOR INDEX

Chartas, G.  101.01
Chaty, S.  126.49, 402.03
Chekhtman, A.  127.27
Chen, B.  101.01, 108.08
Chen, C. J.  110.02
Chen, K.  120.05, 127.17
Cheng, K.  300.03
Chernyshov, D.  300.03
Cherry, M. L.  117.08, 123.02, 127.02
Chervenak, J. A.  119.03
Cheung, C. C.  101.04
Chini, R.  108.07
Chiu, J.  123.06
Chojnowski, D.  108.18
Chomiuk, L.  103.03, 113.04, 126.01, 126.02, 206.03
Chou, Y.  123.06
Christe, S.  123.14
Christensen, F.  108.16, 108.17, 120.15, 123.05, 126.48, 129.01,
              201.04, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02
Christian, D. J.  303.01
Churazov, E.  108.06, 120.11, 401.06
Ciardullo, R.  113.03
Civano, F. M.  116.18, 109.09
Clarke, T. E.  127.05
Clausen, D. R.  206.04
Clementson, J.  122.03
Cohen, D. H.  125.01
Cohn, H. N.  113.01
Coleiro, A.  126.49, 402.03
Collazzi, A. C.  126.55
Collier, M.  301.08
Comastri, A.  109.05
Combi, M. R.  303.01
Cominsky, L. R.  123.04, 123.05
Connahughton, V.  127.02
Connor, T.  123.10
Constantin, A.  300.05
Contopoulos, J.  108.15
Cool, Á.  113.01
Coppi, P. S.  128.03
Corbet, R. H.  101.04, 126.34
Cotroneo, V.  123.28, 123.30
Cowsik, R.  123.07, 123.17
Craig, W. W.  108.16, 108.17, 120.15, 126.48, 129.01, 201.04,
              300.04, 400.04, 400.05, 401.02, 402.01, 403.02
Cravens, T.  301.08
Dai, L. J.  128.03
AUTHOR INDEX

Dai, X. 101.01, 108.08, 120.08
Danforth, C. 101.09
Danzmann, K. 302.01
Dauser, T. 117.01
David, L. P. 116.06
Davis, D. S. 116.03, 116.04
Davis, J. E. 117.03, 119.05
Davis, W. 123.28
Decourchelle, A. 127.08
Degenaar, N. 126.24, 403.01
Deibel, A. T. 103.08
Del Moro, A. 300.04
den Herder, J. 123.16, 200.06
Dennerl, K. 303.01
DePasquale, J. M. 123.21
Desai, P. 125.02
Desjardins, T. D. 401.07
Dewey, D. 119.05, 123.21, 127.07, 127.29
Di Bernardo, G. 112.03
Di Pierro, F. 123.31, 123.32
Di Stefano, R. 126.22
Diaz, F. 125.02
Dibi, S. 108.14
Diehl, R. 127.02
Diltz, C. 114.11
Dogiel, V. 300.03
Dominguez, A. 105.02
Dorf, L. 122.07
Doriese, W. B. 119.03
Dotson, A. 114.06
Drake, S. A. 117.05
Ducci, L. 402.02
Dufour, F. 126.48
Duncan, N. 123.12
Dupke, R. A. 116.07
Dupree, A. K. 122.04
Dwarkadas, V. 127.16, 127.28, 127.29
Eckart, M. E. 119.03
Edmonds, P. 130.01
Eikmann, W. 117.01
Eiles, M. 126.14
Eisenhardt, P. R. 300.04
Elam, J. 123.15
Elvis, M. 108.16
Ely, J. 101.05
Enoto, T. 126.36
Eracleous, M.  206.04
Ertley, C.  123.10
Escala, A.  128.03
Esposito, P.  119.08, 402.02
Evans, P.  126.40
Evoli, C.  112.03
Exter, K.  300.08
Fabbiano, G.  126.50
Fabian, A. C.  101.03, 116.10, 204.05, 204.06
Falcone, A.  114.02, 114.07, 123.18
Farrell, S.  403.08
Favata, F.  106.04
Fazio, G. G.  108.07
Feng, H.  402.06
Feng, Y.  122.07
Feroci, M.  123.16, 200.06
Ferrara, E. C.  103.04
Ferreira, D.  401.02
Ferrigno, C.  119.08, 126.31, 126.32
Figueroa-Feliciano, E.  127.07
Finger, M. H.  117.08, 123.02, 127.02
Finkbeiner, D. P.  112.02, 203.01
Finkbeiner, F. M.  119.03
Finke, J.  105.02, 114.01, 118.03
Finoguenov, A.  116.02
Forbes, D.  120.10
Ford, P. G.  123.19
Forman, B.  123.30
Forman, W. R.  108.06, 110.01, 120.11, 401.06
Fornasini, F.  204.08
Fossati, G.  108.12, 111.03
Foster, A.  122.08, 123.21, 200.08, 301.07
Fotopoulos, S.  116.02
Fowler, J. W.  119.03
Fragos, T.  204.09
Fraija, N. I.  124.05, 124.06, 124.07
Frank, K. A.  116.10
Frey, R.  400.03
Frisch, H.  123.15
Froning, C. S.  108.02
Fruscione, A.  200.07
Fryer, C.  400.04, 400.05
Fuerst, F.  108.16, 126.34, 126.35, 126.36, 129.01, 402.01
Fukumura, K.  108.15
Fumagalli, M.  101.09, 114.02
Furniss, A.  101.09, 108.17, 114.02
Gaensler, B. M.  127.13
<table>
<thead>
<tr>
<th>Author</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaetz, T.</td>
<td>123.30</td>
</tr>
<tr>
<td>Gaggero, D.</td>
<td>112.03</td>
</tr>
<tr>
<td>Galeazzi, M.</td>
<td>116.05, 301.08</td>
</tr>
<tr>
<td>Gall, D. D.</td>
<td>127.18</td>
</tr>
<tr>
<td>Gallagher, S.</td>
<td>401.07</td>
</tr>
<tr>
<td>Gallo, E.</td>
<td>110.03</td>
</tr>
<tr>
<td>Gallo, L. C.</td>
<td>101.05</td>
</tr>
<tr>
<td>Galloway, M.</td>
<td>123.09</td>
</tr>
<tr>
<td>Gandhi, P.</td>
<td>109.06</td>
</tr>
<tr>
<td>Garcia, J.</td>
<td>117.01</td>
</tr>
<tr>
<td>Garmire, G.</td>
<td>401.07</td>
</tr>
<tr>
<td>Gaspari, M.</td>
<td>101.06</td>
</tr>
<tr>
<td>Gasparrini, D.</td>
<td>118.01</td>
</tr>
<tr>
<td>Gayley, K. G.</td>
<td>117.02</td>
</tr>
<tr>
<td>Geach, J.</td>
<td>300.06</td>
</tr>
<tr>
<td>Gehrels, N.</td>
<td>103.09, 109.07, 111.01, 127.02, 127.13, 402.02, 403.01</td>
</tr>
<tr>
<td>Gelbord, J.</td>
<td>127.13</td>
</tr>
<tr>
<td>Gendreau, K.</td>
<td>123.25</td>
</tr>
<tr>
<td>Georganopoulos, M.</td>
<td>111.01, 111.02, 111.03, 114.06, 118.03</td>
</tr>
<tr>
<td>George, J. V.</td>
<td>116.03, 116.04</td>
</tr>
<tr>
<td>Ghosh, P.</td>
<td>129.02</td>
</tr>
<tr>
<td>Giacintucci, S.</td>
<td>116.06</td>
</tr>
<tr>
<td>Giacomazzo, B.</td>
<td>121.01</td>
</tr>
<tr>
<td>Giannios, D.</td>
<td>128.01</td>
</tr>
<tr>
<td>Gilfanov, M.</td>
<td>126.50</td>
</tr>
<tr>
<td>Giommi, P.</td>
<td>108.17</td>
</tr>
<tr>
<td>Glesener, L.</td>
<td>123.14</td>
</tr>
<tr>
<td>Glikman, E.</td>
<td>109.05</td>
</tr>
<tr>
<td>Godet, O.</td>
<td>403.08</td>
</tr>
<tr>
<td>Gompertz, B.</td>
<td>127.22</td>
</tr>
<tr>
<td>Gonthier, P. L.</td>
<td>126.09, 126.14, 126.16, 126.17</td>
</tr>
<tr>
<td>Gonzalez, A. H.</td>
<td>300.04</td>
</tr>
<tr>
<td>Gonzalez, M.</td>
<td>124.05</td>
</tr>
<tr>
<td>Gorenstein, P.</td>
<td>123.26</td>
</tr>
<tr>
<td>Gotthelf, E. V.</td>
<td>126.15, 126.48, 204.08</td>
</tr>
<tr>
<td>Goulding, A. D.</td>
<td>110.01</td>
</tr>
<tr>
<td>Gourgouliatos, K. N.</td>
<td>103.09</td>
</tr>
<tr>
<td>Grant, C. E.</td>
<td>123.19, 123.20</td>
</tr>
<tr>
<td>Grasso, D.</td>
<td>112.03</td>
</tr>
<tr>
<td>Green, D.</td>
<td>127.06</td>
</tr>
<tr>
<td>Green, K.</td>
<td>127.14</td>
</tr>
<tr>
<td>Green, P. J.</td>
<td>300.05</td>
</tr>
<tr>
<td>Grefenstette, B.</td>
<td>400.05, 402.01, 403.02</td>
</tr>
<tr>
<td>Greiner, J.</td>
<td>109.08, 123.11, 127.02</td>
</tr>
<tr>
<td>Grieser, M.</td>
<td>122.01</td>
</tr>
</tbody>
</table>
AUTHOR INDEX

Grieves, N. 127.11
Griffith, C. 123.18
Grinberg, V. 126.34
Grindlay, J. E. 126.38, 126.48, 402.03
Gronwall, C. 113.03, 401.07
Grove, J. E. 126.07, 127.27
Grupe, D. 101.05
Gu, Q. 108.02
Guainazzi, M. 111.04
Guillochon, J. 403.05
Guiriec, S. 111.01
Gultekin, K. 127.13, 204.06, 403.03
Guo, F. 116.13
Guo, Q. 123.17
Gupta, A. 116.05, 120.07
Haas, M. 108.07
Haas, R. 400.02
Haberl, F. 123.21
Haggard, D. 113.01, 300.05
Hahn, M. 122.01
Hailey, C. J. 108.17, 120.13, 120.15, 123.05, 126.48, 129.01, 201.04, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02
Hakkila, J. E. 124.01, 127.23
Halpern, J. P. 126.15
Hanke, M. 122.03
Hansen, B. 126.03
Hardcastle, M. 111.04
Harding, A. K. 123.11, 126.07, 126.16, 126.17
Harrison, C. 300.06
Harrison, F. 108.16, 120.13, 120.15, 123.05, 126.48, 129.01, 201.01, 201.04, 204.01, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02
Hartmann, D. 123.11
Hasinger, G. 116.02
Hayashida, M. 108.17
He, C. 126.12
Heger, A. 127.19, 304.01, 402.07
Heilmann, R. K. 119.05, 119.06
Heinke, C. O. 113.01
Helfand, D. J. 126.48
Hell, N. 122.03, 126.34
Hemphill, P. B. 126.35
Henry, J. P. 116.02, 116.03, 116.04, 116.05
Hernanz, M. 123.16
Hertz, P. L. 106.03
Hickox, R. C. 110.01, 110.02
<table>
<thead>
<tr>
<th>Author Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higginbottom, N.</td>
<td>108.03</td>
</tr>
<tr>
<td>Hill, J. E.</td>
<td>123.11</td>
</tr>
<tr>
<td>Hilton, G. C.</td>
<td>119.03</td>
</tr>
<tr>
<td>Hlavacek-Larrondo, J.</td>
<td>401.04</td>
</tr>
<tr>
<td>Hodges-Kluck, E. J.</td>
<td>301.06</td>
</tr>
<tr>
<td>Hoffman, K. L.</td>
<td>126.03</td>
</tr>
<tr>
<td>Hoffman, R. D.</td>
<td>304.01</td>
</tr>
<tr>
<td>Homan, J.</td>
<td>126.47</td>
</tr>
<tr>
<td>Hong, J.</td>
<td>126.38, 126.48</td>
</tr>
<tr>
<td>Hornschemeier, A. E.</td>
<td>120.15, 201.04, 300.06, 301.04, 401.07</td>
</tr>
<tr>
<td>Hornstrup, A.</td>
<td>126.48, 401.02</td>
</tr>
<tr>
<td>Huenemoerder, D.</td>
<td>119.05</td>
</tr>
<tr>
<td>Hughes, S. A.</td>
<td>302.03</td>
</tr>
<tr>
<td>Humensky, B.</td>
<td>108.17, 400.05</td>
</tr>
<tr>
<td>Hurford, G. J.</td>
<td>123.12</td>
</tr>
<tr>
<td>Hwang, U.</td>
<td>127.06</td>
</tr>
<tr>
<td>Hyde, A.</td>
<td>300.05</td>
</tr>
<tr>
<td>Idec, W.</td>
<td>127.01</td>
</tr>
<tr>
<td>Inoue, S.</td>
<td>105.05</td>
</tr>
<tr>
<td>Inoue, Y.</td>
<td>105.05, 108.17</td>
</tr>
<tr>
<td>Intrator, T.</td>
<td>122.05, 122.07</td>
</tr>
<tr>
<td>Irwin, J.</td>
<td>116.11, 116.12, 120.16, 126.52, 206.04, 301.02, 403.06, 403.07</td>
</tr>
<tr>
<td>Irwin, K.</td>
<td>119.03</td>
</tr>
<tr>
<td>Ishikawa, S.</td>
<td>123.14</td>
</tr>
<tr>
<td>Ishikawa, Y.</td>
<td>125.02</td>
</tr>
<tr>
<td>Israel, M. H.</td>
<td>123.07, 123.17</td>
</tr>
<tr>
<td>Ivanova, N.</td>
<td>206.02</td>
</tr>
<tr>
<td>Iwakiri, W.</td>
<td>126.36</td>
</tr>
<tr>
<td>Jacobsen, S.</td>
<td>126.48</td>
</tr>
<tr>
<td>Jahoda, K.</td>
<td>127.02</td>
</tr>
<tr>
<td>Jalota, L.</td>
<td>123.25</td>
</tr>
<tr>
<td>Jean, P.</td>
<td>123.06</td>
</tr>
<tr>
<td>Jeltema, T. E.</td>
<td>401.08</td>
</tr>
<tr>
<td>Jenke, P.</td>
<td>117.08, 123.02, 127.02</td>
</tr>
<tr>
<td>Jennings, Z.</td>
<td>120.10</td>
</tr>
<tr>
<td>Jentschel, M.</td>
<td>123.08</td>
</tr>
<tr>
<td>Jerius, D. H.</td>
<td>123.30</td>
</tr>
<tr>
<td>Ji, L.</td>
<td>108.02, 122.08, 200.08, 301.07</td>
</tr>
<tr>
<td>Johannsen, T.</td>
<td>126.25</td>
</tr>
<tr>
<td>Johnson, K. E.</td>
<td>401.07</td>
</tr>
<tr>
<td>Johnson, T. J.</td>
<td>126.07</td>
</tr>
<tr>
<td>Johnson-Wilke, R. L.</td>
<td>123.28</td>
</tr>
<tr>
<td>Jones, C.</td>
<td>108.06, 110.01, 120.11</td>
</tr>
<tr>
<td>Jonker, P. G.</td>
<td>204.07</td>
</tr>
<tr>
<td>Joseph, T.</td>
<td>113.02</td>
</tr>
</tbody>
</table>
Kaaret, P. 119.07, 123.11, 402.06
Kaastra, J. S. 304.03
Kalamkar, M. 126.42
Kallman, T. 108.02, 200.08
Kallman, T. R. 109.01, 117.01
Kanner, J. 121.01
Kantowski, R. 108.08
Kara, E. 101.02
Karas, V. 108.09
Karovska, M. 126.57, 127.05
Kashlinsky, A. 116.17
Kashyap, V. 117.09, 126.57
Kaspi, V. M. 103.09, 126.10, 126.12, 126.48, 204.08, 400.05
Kastner, J. H. 103.01
Katsuda, S. 127.09, 400.06
Kazanas, D. 108.15
Keek, L. 402.07
Keel, W. C. 108.18
Keenan, B. 122.06
Kelley, L. Z. 128.01
Kelley, R. L. 116.05, 122.03, 200.05, 200.09, 1 NASA/GSFC, 303.04
Kelly, B. J. 121.01
Kelly, B. C. 111.04, 300.05
Kennea, J. A. 103.09, 126.40, 126.57, 127.13, 402.02, 403.01
Kidger, M. R. 300.08
Kilbourne, C. 104.01, 119.03, 122.03, 303.04
Kim, D. 120.12, 300.05
Kimura, S. 301.03
King, A. L. 204.06, 403.03
Kippen, R. M. 123.11, 127.02
Kislat, F. 123.07, 123.17
Kitaguchi, T. 400.05, 401.02
Kitaura, F. S. 105.02
Klochkov, D. 126.32, 126.36
Knigge, C. 108.03
Ko, A. 300.07
Ko, C. 300.03
Kobayashi, M. A. 105.05
Kochanek, C. S. 101.01
Koglin, J. 105.01
Kohler, S. 114.05, 130.02
Kolokythas, K. 116.06
Komossa, S. 101.05
Konstantopoulos, I. 401.07
Koss, M. 109.07
Koutroumpa, D. 301.08, 303.04
Kouveliotou, C. 103.07, 127.02
<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>PAGE NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kovar, J.</td>
<td>108.09, 126.20</td>
</tr>
<tr>
<td>Kraft, R. P.</td>
<td>113.02, 401.06</td>
</tr>
<tr>
<td>Krantz, C.</td>
<td>122.01</td>
</tr>
<tr>
<td>Krauss, M. I.</td>
<td>126.01</td>
</tr>
<tr>
<td>Krawczynski, H.</td>
<td>123.07, 123.17, 126.44</td>
</tr>
<tr>
<td>Kretschmar, P.</td>
<td>126.32</td>
</tr>
<tr>
<td>Kreykenbohm, I.</td>
<td>126.32, 126.36, 126.54</td>
</tr>
<tr>
<td>Krimm, H. A.</td>
<td>126.40, 127.02, 402.02</td>
</tr>
<tr>
<td>Krishnamurthy, K.</td>
<td>127.06</td>
</tr>
<tr>
<td>Kriss, G. A.</td>
<td>101.05</td>
</tr>
<tr>
<td>Krivonos, R.</td>
<td>120.13, 126.48</td>
</tr>
<tr>
<td>Krivonos, R. A.</td>
<td>204.08</td>
</tr>
<tr>
<td>Krolik, J. H.</td>
<td>123.07</td>
</tr>
<tr>
<td>Krongold, Y.</td>
<td>101.05</td>
</tr>
<tr>
<td>Krucker, S.</td>
<td>123.14</td>
</tr>
<tr>
<td>Krumpe, M.</td>
<td>108.10</td>
</tr>
<tr>
<td>Kuin, P.</td>
<td>127.13</td>
</tr>
<tr>
<td>Kundu, A.</td>
<td>113.03, 126.39, 206.05</td>
</tr>
<tr>
<td>Kunert-Bajraszewska, M.</td>
<td>111.04</td>
</tr>
<tr>
<td>Kuntz, K. D.</td>
<td>301.08, 303.03</td>
</tr>
<tr>
<td>Kuranz, C. C.</td>
<td>304.02</td>
</tr>
<tr>
<td>Kuraszkiewicz, J.</td>
<td>108.07</td>
</tr>
<tr>
<td>Kusenko, A.</td>
<td>105.03</td>
</tr>
<tr>
<td>Kuulkers, E.</td>
<td>127.02</td>
</tr>
<tr>
<td>Kühlner, M.</td>
<td>126.32, 126.35, 126.36</td>
</tr>
<tr>
<td>Laguna, P.</td>
<td>400.02</td>
</tr>
<tr>
<td>LaMarr, B.</td>
<td>123.20</td>
</tr>
<tr>
<td>LaMassa, S. M.</td>
<td>109.05</td>
</tr>
<tr>
<td>Lamb, F. K.</td>
<td>402.08</td>
</tr>
<tr>
<td>Laurent, P.</td>
<td>126.32</td>
</tr>
<tr>
<td>Lawrence, C. R.</td>
<td>108.07</td>
</tr>
<tr>
<td>Leahy, D. A.</td>
<td>127.14</td>
</tr>
<tr>
<td>Lee, S.</td>
<td>119.03</td>
</tr>
<tr>
<td>Lee, W. H.</td>
<td>124.05</td>
</tr>
<tr>
<td>Legere, J. S.</td>
<td>123.10</td>
</tr>
<tr>
<td>Lehmer, B.</td>
<td>120.15, 201.04, 300.06, 301.04</td>
</tr>
<tr>
<td>Leipski, C.</td>
<td>108.07</td>
</tr>
<tr>
<td>Lepri, S. T.</td>
<td>301.08, 303.01</td>
</tr>
<tr>
<td>Lepson, J.</td>
<td>122.04, 125.02</td>
</tr>
<tr>
<td>Lestinksy, M.</td>
<td>122.01</td>
</tr>
<tr>
<td>Lestition, K.</td>
<td>130.01</td>
</tr>
<tr>
<td>Leutenegger, M. A.</td>
<td>125.01, 303.04</td>
</tr>
<tr>
<td>Levitan, D. B.</td>
<td>103.02</td>
</tr>
<tr>
<td>Leyder, J.</td>
<td>120.15, 200.01, 201.04</td>
</tr>
<tr>
<td>Li, J. G.</td>
<td>103.06</td>
</tr>
<tr>
<td>Li, J.</td>
<td>127.08, 301.05</td>
</tr>
<tr>
<td>Author</td>
<td>Pages</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Liedahl, D. A.</td>
<td>122.03, 122.04</td>
</tr>
<tr>
<td>Lin, C. H.</td>
<td>123.06</td>
</tr>
<tr>
<td>Lin, D.</td>
<td>120.16, 126.47, 126.52</td>
</tr>
<tr>
<td>Lin, R. P.</td>
<td>123.12, 123.14</td>
</tr>
<tr>
<td>Lintott, C.</td>
<td>108.18</td>
</tr>
<tr>
<td>Lisse, C. M.</td>
<td>303.01</td>
</tr>
<tr>
<td>Lister, M. L.</td>
<td>111.03</td>
</tr>
<tr>
<td>Liu, J.</td>
<td>402.04</td>
</tr>
<tr>
<td>Lo, K.</td>
<td>402.08</td>
</tr>
<tr>
<td>Loeb, A.</td>
<td>120.04, 127.21</td>
</tr>
<tr>
<td>Loewenstein, M.</td>
<td>116.09</td>
</tr>
<tr>
<td>Lohfink, A. M.</td>
<td>101.07, 108.11, 126.54</td>
</tr>
<tr>
<td>Loi, S. T.</td>
<td>127.13</td>
</tr>
<tr>
<td>Long, K. S.</td>
<td>108.03, 127.09, 400.06</td>
</tr>
<tr>
<td>Longinotti, A.</td>
<td>101.05</td>
</tr>
<tr>
<td>Lopez, L. A.</td>
<td>127.12, 400.05, 400.07</td>
</tr>
<tr>
<td>Loredo, T. J.</td>
<td>127.23</td>
</tr>
<tr>
<td>Lorente, R.</td>
<td>300.08</td>
</tr>
<tr>
<td>Los, E.</td>
<td>402.03</td>
</tr>
<tr>
<td>Lowell, A.</td>
<td>123.06, 123.08</td>
</tr>
<tr>
<td>Lu, T.</td>
<td>300.04</td>
</tr>
<tr>
<td>Lucy, A. B.</td>
<td>300.06</td>
</tr>
<tr>
<td>Lugger, P. M.</td>
<td>113.01</td>
</tr>
<tr>
<td>Luke, P.</td>
<td>123.06</td>
</tr>
<tr>
<td>Lund, N.</td>
<td>127.02</td>
</tr>
<tr>
<td>Maccarone, M.</td>
<td>123.31, 123.32</td>
</tr>
<tr>
<td>Maccarone, T. J.</td>
<td>113.02, 113.03, 113.04, 120.15, 126.39, 201.04, 206.01, 206.03</td>
</tr>
<tr>
<td>Maccione, L.</td>
<td>112.03</td>
</tr>
<tr>
<td>MacFadyen, A.</td>
<td>400.01</td>
</tr>
<tr>
<td>Machacek, M. E.</td>
<td>401.06</td>
</tr>
<tr>
<td>Madejski, G. M.</td>
<td>108.17, 300.08, 108.16, 401.02</td>
</tr>
<tr>
<td>Madsen, K.</td>
<td>126.48, 400.05, 403.02</td>
</tr>
<tr>
<td>Mahmoodifar, S.</td>
<td>126.45</td>
</tr>
<tr>
<td>Mahmoud, A.</td>
<td>126.36</td>
</tr>
<tr>
<td>Maitra, D.</td>
<td>126.39, 127.13, 403.03</td>
</tr>
<tr>
<td>Majid, W. A.</td>
<td>126.18</td>
</tr>
<tr>
<td>Makiya, R.</td>
<td>105.05</td>
</tr>
<tr>
<td>Maksym, W. P.</td>
<td>108.18, 120.16</td>
</tr>
<tr>
<td>Malzac, J.</td>
<td>108.14</td>
</tr>
<tr>
<td>Mane, A.</td>
<td>123.15</td>
</tr>
<tr>
<td>Mangano, V.</td>
<td>119.08, 126.40, 402.02</td>
</tr>
<tr>
<td>Marcu, D.</td>
<td>126.32, 126.36, 126.37</td>
</tr>
<tr>
<td>Marcu, D. M.</td>
<td>126.34</td>
</tr>
<tr>
<td>Margon, B. H.</td>
<td>103.02</td>
</tr>
<tr>
<td>Marinucci, A.</td>
<td>108.16</td>
</tr>
<tr>
<td>Markevitch, M. L.</td>
<td>116.15</td>
</tr>
</tbody>
</table>
AUTHOR INDEX

Markoff, S. 108.14, 205.04
Markowitz, A. 108.10, 109.03
Markwardt, C. 109.07
Marshall, H. L. 119.05, 119.06, 126.46
Martins, S. 116.07
Mather, J. C. 116.17
Mathews, W. G. 116.13, 403.06
Mathur, S. 101.05, 120.07
Matsuda, Y. 300.06
Matsumoto, H. 123.17
Matt, G. 108.16
Matthews, N. K. 126.56
McCammon, D. 301.03, 301.08
McClintock, J. E. 117.01, 204.07
McCough, M. L. 120.02
McConnell, M. L. 123.10, 123.11
McDonald, M. 401.03
McDowell, J. C. 200.07
McEntaffer, R. L. 119.04, 123.13, 127.11, 123.22
McGlynn, T. A. 117.05
McKean, J. P. 401.05
McKinney, J. 300.01
McLin, K. M. 123.04, 123.05
McMuldroch, S. 123.28, 123.30
McNamara, B. R. 205.03
McPhate, J. B. 123.15
Medvedev, M. 120.04, 122.06, 127.21
Meegan, C. A. 127.02
Meier, D. L. 108.17
Metzger, B. 128.01
Meyer, E. T. 101.08, 111.01, 111.02, 111.03
Middleditch, J. 127.26
Migliori, G. 111.04
Miller-Jones, J. 113.04, 206.03
Miller, B. P. 110.03
Miller, E. D. 101.07, 116.03, 116.04, 123.20, 123.21
Miller, J. M. 126.23, 126.24, 127.13, 204.01, 204.05, 204.06, 403.01, 403.03
Miller, L. 108.01
Miller, M. C. 402.08
Miller, M. J. 120.08, 301.01
Million, E. 116.11, 116.12, 120.16, 301.02
Mineo, S. 126.50
Mioduszewski, A. J. 103.03, 126.01, 126.02
Mitsuda, K. 200.05, 200.09, 301.03
Mitsushii, I. 116.05, 301.03
<table>
<thead>
<tr>
<th>Author</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miyasaka, H.</td>
<td>400.05</td>
</tr>
<tr>
<td>Miškoviča, I.</td>
<td>126.34</td>
</tr>
<tr>
<td>Miškovičova, I.</td>
<td>122.03</td>
</tr>
<tr>
<td>Molendi, S.</td>
<td>401.02</td>
</tr>
<tr>
<td>Montez, R.</td>
<td>103.01</td>
</tr>
<tr>
<td>Monzani, M.</td>
<td>200.02</td>
</tr>
<tr>
<td>Morgan, C. W.</td>
<td>101.01</td>
</tr>
<tr>
<td>Morgan, K.</td>
<td>301.08</td>
</tr>
<tr>
<td>Mori, K.</td>
<td>126.48, 400.05, 403.02</td>
</tr>
<tr>
<td>Moseley, S. H.</td>
<td>116.17</td>
</tr>
<tr>
<td>Mosquera, A. M.</td>
<td>101.01</td>
</tr>
<tr>
<td>Moss, V.</td>
<td>127.13</td>
</tr>
<tr>
<td>Mueller, A.</td>
<td>122.01</td>
</tr>
<tr>
<td>Mukai, K.</td>
<td>103.03, 126.01, 126.02</td>
</tr>
<tr>
<td>Mulchaey, J. S.</td>
<td>401.07</td>
</tr>
<tr>
<td>Mullaney, J.</td>
<td>300.06</td>
</tr>
<tr>
<td>Murphy, T.</td>
<td>127.13</td>
</tr>
<tr>
<td>Murray, S. S.</td>
<td>109.05, 110.01</td>
</tr>
<tr>
<td>Mushotzky, R.</td>
<td>101.07, 108.11, 109.06, 109.07, 116.03, 116.04, 123.07</td>
</tr>
<tr>
<td>Müller, S.</td>
<td>126.32, 126.34, 126.36</td>
</tr>
<tr>
<td>Nakajima, M.</td>
<td>126.36</td>
</tr>
<tr>
<td>Nakamura, M.</td>
<td>101.08</td>
</tr>
<tr>
<td>Nalewajko, K.</td>
<td>114.05, 300.08</td>
</tr>
<tr>
<td>Narayan, R.</td>
<td>117.01, 205.01</td>
</tr>
<tr>
<td>Natalucci, L.</td>
<td>126.48, 127.02</td>
</tr>
<tr>
<td>Negoro, H.</td>
<td>126.40</td>
</tr>
<tr>
<td>Neilsen, J.</td>
<td>102.01, 108.14</td>
</tr>
<tr>
<td>Nelson, T.</td>
<td>103.03, 108.17, 114.03, 126.01, 126.02</td>
</tr>
<tr>
<td>Nemmen, R.</td>
<td>101.06, 111.01</td>
</tr>
<tr>
<td>Ng, C.</td>
<td>103.09, 126.10, 126.12</td>
</tr>
<tr>
<td>Niino, Y.</td>
<td>105.05</td>
</tr>
<tr>
<td>Nikutta, R.</td>
<td>108.10</td>
</tr>
<tr>
<td>Nilsson, K.</td>
<td>127.01</td>
</tr>
<tr>
<td>Nishikawa, K.</td>
<td>124.02</td>
</tr>
<tr>
<td>Norman, C. A.</td>
<td>101.08</td>
</tr>
<tr>
<td>Nousek, J. A.</td>
<td>109.06</td>
</tr>
<tr>
<td>Novotny, O.</td>
<td>122.01</td>
</tr>
<tr>
<td>Nowak, M.</td>
<td>108.11, 108.14, 122.03, 126.19</td>
</tr>
<tr>
<td>Noyola, E.</td>
<td>113.04</td>
</tr>
<tr>
<td>Nulsen, P.</td>
<td>401.06</td>
</tr>
<tr>
<td>Nynka, M.</td>
<td>400.05</td>
</tr>
<tr>
<td>O'Brien, P. T.</td>
<td>127.22</td>
</tr>
<tr>
<td>O'Dell, S. L.</td>
<td>123.19</td>
</tr>
<tr>
<td>O'Sullivan, E.</td>
<td>116.06</td>
</tr>
<tr>
<td>Oates, S. R.</td>
<td>127.25</td>
</tr>
<tr>
<td>Obst, M.</td>
<td>126.54</td>
</tr>
<tr>
<td>Ofek, E.</td>
<td>400.04</td>
</tr>
<tr>
<td>Author</td>
<td>Pages</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Ogle, P. M.</td>
<td>108.07, 108.17</td>
</tr>
<tr>
<td>Ohashi, T.</td>
<td>116.05, 301.03</td>
</tr>
<tr>
<td>Okajima, T.</td>
<td>123.17, 123.24, 123.25</td>
</tr>
<tr>
<td>Orr, M.</td>
<td>105.01</td>
</tr>
<tr>
<td>Ortega-Rodriguez, M.</td>
<td>126.21</td>
</tr>
<tr>
<td>Owocki, S. P.</td>
<td>125.01</td>
</tr>
<tr>
<td>Paciesas, W. S.</td>
<td>127.02</td>
</tr>
<tr>
<td>Paneque, D.</td>
<td>105.02, 108.17</td>
</tr>
<tr>
<td>Pareschi, G.</td>
<td>123.31, 123.32</td>
</tr>
<tr>
<td>Pasham, D. R.</td>
<td>204.04</td>
</tr>
<tr>
<td>Pasham, D.</td>
<td>126.43, 126.53, 402.05</td>
</tr>
<tr>
<td>Pavlidou, V.</td>
<td>118.02</td>
</tr>
<tr>
<td>Pavlov, G. G.</td>
<td>127.05</td>
</tr>
<tr>
<td>Paxton, B.</td>
<td>127.19</td>
</tr>
<tr>
<td>Pe'er, A.</td>
<td>400.02</td>
</tr>
<tr>
<td>Peacock, M.</td>
<td>113.03, 126.39</td>
</tr>
<tr>
<td>Pearce, M.</td>
<td>123.11</td>
</tr>
<tr>
<td>Pearson, S.</td>
<td>127.12</td>
</tr>
<tr>
<td>Pedersen, K.</td>
<td>401.02</td>
</tr>
<tr>
<td>Perez, K.</td>
<td>126.48, 403.02</td>
</tr>
<tr>
<td>Peris, C.</td>
<td>126.27</td>
</tr>
<tr>
<td>Perkins, J. S.</td>
<td>126.56</td>
</tr>
<tr>
<td>Perri, M.</td>
<td>108.17</td>
</tr>
<tr>
<td>Peterson, J. R.</td>
<td>116.10</td>
</tr>
<tr>
<td>Petre, R.</td>
<td>119.01, 119.02, 127.06, 127.09, 127.13, 400.06</td>
</tr>
<tr>
<td>Petrosian, V.</td>
<td>300.07</td>
</tr>
<tr>
<td>Phinney, E. S.</td>
<td>103.02</td>
</tr>
<tr>
<td>Pivovaroff, M.</td>
<td>400.05</td>
</tr>
<tr>
<td>Plucinsky, P. P.</td>
<td>123.21</td>
</tr>
<tr>
<td>Pohl, M.</td>
<td>123.16, 127.16</td>
</tr>
<tr>
<td>Pollock, A.</td>
<td>123.21</td>
</tr>
<tr>
<td>Ponman, T. J.</td>
<td>116.06</td>
</tr>
<tr>
<td>Pooley, G. G.</td>
<td>402.09</td>
</tr>
<tr>
<td>Pope, A.</td>
<td>110.02</td>
</tr>
<tr>
<td>Porst, J.</td>
<td>119.03</td>
</tr>
<tr>
<td>Porter, F. S.</td>
<td>119.03, 301.08</td>
</tr>
<tr>
<td>Porter, F.</td>
<td>122.03, 303.04</td>
</tr>
<tr>
<td>Posson-Brown, J.</td>
<td>123.21</td>
</tr>
<tr>
<td>Pottschmidt, K.</td>
<td>122.03, 126.19, 126.32, 126.34, 126.35, 126.36, 126.37, 126.54, 129.01, 402.01, 402.09</td>
</tr>
<tr>
<td>Prada, F.</td>
<td>105.02</td>
</tr>
<tr>
<td>Pradhan, A. K.</td>
<td>101.05</td>
</tr>
<tr>
<td>Prasai, K.</td>
<td>301.08</td>
</tr>
<tr>
<td>Preece, R. D.</td>
<td>124.01, 127.02, 305.01</td>
</tr>
<tr>
<td>Pretz, J.</td>
<td>200.03</td>
</tr>
<tr>
<td>Price, L.</td>
<td>121.02</td>
</tr>
</tbody>
</table>
AUTHOR INDEX

Prieskorn, Z. 123.18
Primack, J. R. 101.09, 105.02
Primini, F. 126.22
Prince, T. A. 103.02
Produit, N. 123.11
Profumo, S. 401.08
Psaltis, D. 126.25
Ptak, A. 119.01, 119.02, 120.15, 201.04, 301.04
Puccetti, S. 108.17
Racusin, J. L. 127.25
Rafferty, D. A. 401.05
Rahoui, F. 204.08
Ramirez, J. L. 124.05
Ramirez-Ruiz, E. 127.12, 403.05
Ramsey, B. 123.14, 123.28
Ransom, S. M. 113.04
Rappaport, S. A. 126.50
Ray, P. S. 123.16, 200.06
Raychaudhury, S. 116.06
Raymer, E. 126.30
Readhead, A. C. 108.17
Reeves, J. 101.06, 108.01
Reeves, S. 127.13
Reid, P. B. 104.02, 123.28, 123.30
Reimer, A. 105.04
Reintsema, C. D. 119.03
Reis, R. C. 126.24, 127.13, 204.05, 403.03
Reitz, D. 121.02
Remillard, R. A. 126.47
Repnow, R. 122.01
Revnivtsev, M. 126.05
Reyes, L. C. 118.03
Reynolds, C. S. 101.03, 101.06, 101.07, 108.11, 108.19, 116.14, 117.01, 204.06, 205.02, 400.02, 403.07
Reynolds, M. 126.23, 126.24, 127.13, 204.05, 403.03
Reynolds, S. P. 127.06, 127.09, 400.04, 400.05, 400.06
Rhode, K. L. 113.03
Richards, G. T. 109.05
Ricker, P. M. 300.02
Risaliti, G. 108.16
Rivers, E. 109.03
Robbins, W. J. 127.13
Robertson, I. 301.08
Rodin, J. 117.08, 123.02, 127.02
Rodrigues, B. H. 126.54
Rodriguez, J. 402.09
Roediger, E. 401.06
AUTHOR INDEX

Romani, R. W. 118.01
Romano, P. 114.04, 119.08, 126.40, 402.02
Romanowsky, A. J. 120.10
Roming, P. 123.11, 124.03
Rothschild, R. E. 109.03, 126.32, 126.35, 126.36
Rowe, J. 126.03
Roy, N. 126.01
Rudnick, L. 401.08
Rupen, M. P. 103.03, 126.01, 126.02
Rupke, D. 108.05
Ruszkowski, M. 300.02
Rutherford, J. 127.07
Ryan, J. M. 123.10, 123.11
Ryde, F. 123.11, 305.04
Sacahui, R. 124.05
Sadleir, J. E. 119.03
Saint-Hilaire, P. 123.12
Saito, S. 123.14
Sakamoto, T. 123.11
Salvato, M. 116.02
Salvesen, G. 126.29
Salvetti, D. 117.07
Salzer, J. J. 113.03
Sambruna, R. M. 111.01
Sanders, J. 116.10
Santangelo, A. 123.16, 126.32
Sartori, A. 103.05
Sato, K. 116.05
Sato, T. 301.03
Savin, D. W. 122.01
Saz Parkinson, P. 126.08
Scargle, J. D. 101.04
Schattenburg, M. 119.05
Schawinski, K. 108.18
Schippers, S. 122.01
Schmidt, A. C. 127.26
Schneider, D. P. 109.06
Schnittman, J. 121.01, 123.07, 123.17
Scholz, P. 103.09, 126.10
Schulz, B. 108.07
Schulz, N. S. 119.05, 119.06, 122.03, 126.19, 126.46
Schwarm, F. 126.31
Schwartz, D. A. 123.28, 123.30
Schweitzer, T. 127.01
Schoenherr, G. 126.31
Sears, J. 122.07
<table>
<thead>
<tr>
<th>Author Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sembay, S.</td>
<td>123.21</td>
</tr>
<tr>
<td>Serlemitsos, P. J.</td>
<td>123.24, 123.25</td>
</tr>
<tr>
<td>Servillat, M.</td>
<td>126.38, 126.51, 129.03, 402.03, 403.08</td>
</tr>
<tr>
<td>Seth, A.</td>
<td>113.04, 206.03</td>
</tr>
<tr>
<td>Shang, J.</td>
<td>123.06</td>
</tr>
<tr>
<td>Shaposhnikov, N.</td>
<td>127.02</td>
</tr>
<tr>
<td>Shaw, M.</td>
<td>118.01</td>
</tr>
<tr>
<td>Shcherbakov, R. V.</td>
<td>400.02, 403.06, 403.07</td>
</tr>
<tr>
<td>Shih, A. Y.</td>
<td>123.12</td>
</tr>
<tr>
<td>Shimizu, T.</td>
<td>109.06</td>
</tr>
<tr>
<td>Shrader, C. R.</td>
<td>108.15</td>
</tr>
<tr>
<td>Siana, B. D.</td>
<td>105.02</td>
</tr>
<tr>
<td>Siegel, M. H.</td>
<td>127.13</td>
</tr>
<tr>
<td>Siegmund, O.</td>
<td>123.15</td>
</tr>
<tr>
<td>Siemiginowska, A.</td>
<td>111.04, 117.09, 200.07</td>
</tr>
<tr>
<td>Sigurdsson, S.</td>
<td>206.04, 206.06</td>
</tr>
<tr>
<td>Sikora, M.</td>
<td>300.08</td>
</tr>
<tr>
<td>Sim, S.</td>
<td>108.03</td>
</tr>
<tr>
<td>Simeon, P.</td>
<td>127.03</td>
</tr>
<tr>
<td>Simon, J. B.</td>
<td>126.29</td>
</tr>
<tr>
<td>Simonnet, A.</td>
<td>123.04</td>
</tr>
<tr>
<td>Singal, J.</td>
<td>300.07</td>
</tr>
<tr>
<td>Singleton, J.</td>
<td>127.26</td>
</tr>
<tr>
<td>Sivakoff, G. R.</td>
<td>113.02</td>
</tr>
<tr>
<td>Skinner, G. K.</td>
<td>127.02</td>
</tr>
<tr>
<td>Slane, P. O.</td>
<td>127.04, 127.12, 130.01, 400.08</td>
</tr>
<tr>
<td>Slany, P.</td>
<td>108.09</td>
</tr>
<tr>
<td>Smail, I.</td>
<td>300.06</td>
</tr>
<tr>
<td>Smale, A. P.</td>
<td>117.05</td>
</tr>
<tr>
<td>Smith, D. M.</td>
<td>126.28, 126.48, 126.54</td>
</tr>
<tr>
<td>Smith, R. K.</td>
<td>119.01, 119.02, 120.03, 122.08, 123.21, 127.12, 200.08, 301.07, 400.08</td>
</tr>
<tr>
<td>Smith, S. J.</td>
<td>119.03</td>
</tr>
<tr>
<td>Snowden, S.</td>
<td>301.08</td>
</tr>
<tr>
<td>Sobolewska, M.</td>
<td>111.04, 300.05</td>
</tr>
<tr>
<td>Sobral, D.</td>
<td>300.06</td>
</tr>
<tr>
<td>Sohn, S.</td>
<td>101.08</td>
</tr>
<tr>
<td>Sokoloski, J. L.</td>
<td>103.03, 126.01, 126.02</td>
</tr>
<tr>
<td>Soong, Y.</td>
<td>123.24, 123.25</td>
</tr>
<tr>
<td>Sparks, W. B.</td>
<td>101.08</td>
</tr>
<tr>
<td>Spitkovsky, A.</td>
<td>103.06, 127.15</td>
</tr>
<tr>
<td>Spruck, K.</td>
<td>122.01</td>
</tr>
<tr>
<td>Šramkova, E.</td>
<td>126.20</td>
</tr>
<tr>
<td>Stamerra, A.</td>
<td>123.32</td>
</tr>
<tr>
<td>Staubert, R.</td>
<td>126.32, 402.01</td>
</tr>
<tr>
<td>Stawarz, L.</td>
<td>111.04</td>
</tr>
<tr>
<td>Stebbins, R. T.</td>
<td>121.04</td>
</tr>
</tbody>
</table>
AUTHOR INDEX

Steiner, A. W.  
Steiner, J. F.  126.25, 204.02, 204.05  
Stella, L.  123.16  
Stern, D.  108.16, 108.17, 113.03, 120.15, 123.05, 126.48, 129.01, 201.04, 204.08, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02  
Stocke, J. T.  101.09  
Storm, E.  401.08  
Story, S.  126.13  
Strader, J.  113.04, 206.03  
Strohmayer, T. E.  126.43, 126.45, 126.53, 204.04, 402.05, 403.03  
Stuchlik, Z.  108.09, 126.20  
Su, M.  112.02  
Su, Y.  120.16  
Suchy, S.  126.32  
Suh, H.  116.02  
Sukhbold, T.  127.19  
Summerlin, E. J.  114.10  
Sun, X.  122.07  
Sundqvist, J.  125.01  
Sutherland, M.  123.33  
Swartz, D. A.  127.02, 127.05  
Swenson, C. A.  124.03  
Swetz, D.  123.22  
Swinbank, M.  300.06  
Szczerska, R.  300.08  
Szostek, A.  300.08  
Tagliaferri, G.  108.17  
Takahashi, T.  106.05, 123.14, 123.16, 200.05  
Takei, Y.  116.05, 301.03  
Tanaka, M.  116.02  
Tanaka, Y.  105.05  
Tananbaum, H.  106.02, 123.30  
Tang, S.  402.03  
Tatum, M.  108.01  
Taylor, J.  123.02  
Tchekhovskoy, A.  103.06, 128.01  
Telezhinsky, I.  127.16  
Teng, S. H.  108.05  
Tennant, A.  127.01  
Terada, Y.  126.36  
Theiling, M.  127.28  
Thomas, N. E.  301.08  
Toma, K.  123.11  
Tombesi, F.  101.06, 108.15, 108.19
AUTHOR INDEX

Tomsick, J. 116.01, 120.13, 123.06, 123.08, 126.48, 126.54, 129.01, 201.02, 204.01, 204.08, 402.01, 402.09, 403.02

Torok, G. 126.20

Torres, M. 204.07

Tosti, G. 123.31, 123.32

Totani, T. 105.05

Treister, E. 123.07

Tremsin, A. 123.15

Trichas, M. 300.05

Trolle-McKinstry, S. 123.28

Trowbridge, S. N. 127.07

Tsang, D. 103.09

Tucker, W. H. 130.01

Tueller, J. 109.07, 123.07, 123.17

Turner, T. 108.01

Tzanavaris, P. 401.07

Ullom, J. N. 119.03

Uprety, Y. 301.08

Urry, C. M. 101.09, 108.17, 109.05

Ursino, E. 116.05

Uttley, P. 126.42

Valencic, L. A. 120.03

Vallania, P. 123.31, 123.32

Vallerga, J. 123.15

Van Den Berg, M. 126.38

van der Horst, A. 103.07, 127.05

van der Klis, M. 123.16, 126.42

Van Der Marel, R. P. 101.08, 113.01

Van Eerten, H. 400.01

Vanden Bout, P. A. 106.01

Varner, G. 123.15

Vasileiou, V. 305.02

Vasudevan, R. 109.06

Veilleux, S. 108.05, 109.07

Venter, C. 126.07

Venters, T. M. 118.02, 120.15, 201.04

Vercellone, S. 114.04, 123.31, 123.32, 402.02

Vikhlinin, A. 123.28, 123.29, 123.30, 401.01

Vitale, S. 302.02

von Ballmoos, P. 123.06, 123.08

von Doetinchem, P. 123.06

von Kienlin, A. 127.02

Vrtilek, J. M. 116.06

Vrtilek, S. D. 126.27, 204.03

Wade, C. 123.08

Wadiasingh, Z. 126.09, 126.14
Wagner, R. G. 123.15
Wagoner, R. V. 126.21
Walton, D. 108.16, 201.03, 204.05, 204.06
Wang, Q. D. 301.05, 301.07
Wasserman, I. M. 127.23
Waters, C. Z. 113.03
Watts, A. 123.16
Watzke, M. 130.01
Webb, N. 126.52, 403.08
Weber, T. 122.05, 122.07
Wehrle, A. E. 108.17
Weinstein, A. 127.28
Weisskopf, M. C. 127.01, 127.05
Welsh, B. 123.15
West, B. 126.31
Westergaard, N. J. 400.05, 401.02
Weston, J. 103.03, 126.01, 126.02
Wheeler, J. C. 129.02
White, N. E. 119.01, 119.02
Wijnands, R. 126.42, 403.01
Wik, D. R. 120.15, 201.04, 400.05, 401.02
Wilke, R. 123.28
Wilkes, B. J. 108.07
Wilkins, D. 108.13
Willett, R. 127.06
Williams, B. J. 127.09, 400.06
Williams, D. A. 101.09, 114.02, 200.04
Willner, S. P. 108.07
Wilms, J. 117.01, 122.03, 123.16, 126.19, 126.31, 126.32, 126.34, 126.35, 126.36, 126.37, 126.54, 129.01, 200.08, 402.01, 402.09
Wilson, C. 117.08, 123.02, 127.02, 200.06
Winkler, P. F. 127.09, 400.06
Winter, L. M. 109.06
Wise, M. W. 401.05
Wolf, A. 122.01
Wolff, M. T. 126.31, 126.37
Wolk, S. J. 303.01
Wolpert, R. L. 127.23
Wong, K. 116.11, 116.12, 120.16, 301.02, 403.06, 403.07
Wood, K. S. 126.37
Woodley, K. 120.10
Woosley, S. E. 127.19, 304.01
Worrall, D. 108.07
Wu, J. 204.07
Yamaguchi, H. 127.12, 200.08, 400.08
Yamaoka, K. 126.40
Yamasaki, N. Y. 116.05, 301.03
Yang, C. 123.06
Yang, H. 300.02
Yao, Y. 108.02
Younes, G. A. 103.07
Yu, W. 126.26
Yuan, Y. 127.03
Yukita, M. 116.11, 116.12, 120.16, 127.05, 301.02, 403.06
Zabludoff, A. I. 401.07
Zajczyk, A. 123.07
Zakamska, N. L. 300.01
Zane, S. 123.16
Zanin, R. 127.01
Zavlin, V. 127.05
Zeiger, B. R. 123.22
Zepf, S. E. 113.03, 126.39
Zezas, A. 120.15, 201.04
Zhang, B. 400.01, 123.11
Zhang, H. 114.08
Zhang, S. 108.02, 122.08, 301.07, 126.48, 403.02
Zhang, W. 126.26, 108.16, 108.17, 120.15, 123.05, 123.07, 123.27, 126.48, 129.01, 300.04, 400.04, 400.05, 401.02, 402.01, 403.02
Zhang, X. 127.02
Zhao, P. 126.38
Zheng, Y. 103.03, 126.01, 126.02
Zhou, X. 122.08
Zhoue, H. 300.05
Zoghbi, A. 101.03
Zoglauer, A. 117.06, 123.06, 123.09, 123.12, 400.04, 400.05, 401.02, 403.02
Zurbuchen, T. H. 303.01
Zurita Heras, J. 126.32
Zweibel, E. G. 300.02
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<td>Tech Development Plans - Near Term Technologies, 9:00am-9:45am, Rob Petre, NASA/Goddard Space Flight Center</td>
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<td>9:45am</td>
<td>Tech Development Plans - Future Technologies, 9:45am-10:15am Paul Reid, SAO</td>
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<td>10:15am</td>
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<td>Break, 10:45am-11:00am</td>
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<td>11:00am</td>
<td>Session: Optics</td>
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<td>11:10am</td>
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<td>Lunch, 12:45pm-1:30pm</td>
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<td>Session: Detectors</td>
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<td>Open Discussion, 4:30pm-5:30pm</td>
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Recent High Energy Astrophysics Dissertations

As a service to the high energy community, HEAD has decided to begin publishing short summaries of recent dissertations in the field. The following dissertation summaries were submitted to the Secretary for inclusion in the program, and will also be stored permanently on the HEAD website.

Dr. Andrea Belfiore (Universitá di Pavia & University of California [Santa Cruz Institute for Particle Physics])
“Search and Characterization of Radio-quiet Gamma-ray Pulsars with Fermi-LAT”

Dr. Tim Johannsen (University of Arizona)

Dr. W. Peter Maksym (Northwestern University)
“An X-ray Survey for Tidal Disruption Flares in Rich Clusters of Galaxies”

Dr. Elizabeth Rivers (University of California San Diego)
“Exploring the Geometry of Circumnuclear Material in Active Galactic Nuclei Through X-ray Spectroscopy”
Search and Characterization of Radio-quiet Gamma-ray Pulsars with Fermi-LAT

Andrea Belfiore

Università di Pavia (Dipartimento di Fisica Nucleare e Teorica)

University of California (Santa Cruz Institute for Particle Physics)

This thesis is about pulsars: pulsars from a new perspective, the gamma-ray perspective, as offered by the Fermi Large Area Telescope (LAT). This thesis is about finding new pulsars using LAT data only. And this thesis is about extending our knowledge about those pulsars. My work has been part of a much broader effort started long before I entered the field. On one side, the Fermi-LAT collaboration is providing the community with a marvelous instrument, wonderful data, and a wide base of knowledge. On the other side, at SCIPP, new techniques have been developed and from these data many new pulsars have been found, opening a new era for pulsar astronomy. As the LAT keeps collecting data, new difficulties arise and new techniques must be developed to keep finding new pulsars. Since most of the pulsars found in “blind” searches of LAT data turn out to be radio-quiet, their characterization is left to X rays and gamma rays. Here I will focus especially on the second aspect, while a colleague, M. Marelli, has focused his PhD work mainly on the first aspect. Much of the material in this thesis has been presented in conferences or has contributed to published papers. Several further papers are on the way, three of which will be a revised version of the three main chapters of this thesis. For these chapters I am very much indebted to my coworkers at SCIPP; especially P. Saz Parkinson and M. Dormody.

This thesis is divided into seven chapters: the first three chapters provide an introduction, in which my original contribution has not been central; the following three chapters represent the main body of my PhD work; the final chapter collects the main results and outlines directions for future work. Chapter 1 introduces the subject and describes the structure of the thesis. Chapter 2 provides some background about pulsars, the Fermi LAT, and the characteristics of pulsars seen by the LAT. Chapter 3 describes the blind search technique, that allows us to find pulsars using only the times of arrival of the gamma-ray photons detected by the LAT, and estimates the sensitivity of this technique. Chapter 4 uses the results of the sensitivity study to trace back from the observed young gamma-ray pulsar sample the characteristics of the Galactic gamma-ray pulsar population. Chapter 5 is an application of the blind search technique and of pulsar timing with the LAT, to monitor for pulsar glitches. Chapter 6 describes the search for pulsations from a candidate radio-quiet gamma-ray millisecond pulsar in a binary system, 2FGL J2339.6+0532. Chapter 7 contains a brief summary of this thesis, and describes where we stand now with the blind search technique. It also presents some directions and plans for future work in this field.

In the last four years, gamma-ray observations with the LAT have offered new insights into pulsar astronomy, for which the past 40 years has been mainly the domain of X-ray and radio astronomy. The LAT is a pair-production telescope, sensitive in the 20MeV-300GeV band, onboard
the Fermi satellite, launched on June 11th 2008 and currently in operation. Perhaps unexpectedly, it has discovered a broad variety of gamma-ray pulsars, whose high-energy emission is giving key insights into pulsar physics (1).

Several problems hamper the search for pulsations in gamma-ray data, so that extending the techniques used in other bands is not straightforward. The broad point spread function and the presence of other sources and diffuse background, especially along the Galactic plane, produce a strong contamination. It is not possible to know exactly what gamma rays come from a target source, but we can only assign to each event a probability, given a model: this makes event selection critical and complicated. Every single gamma-ray photon carries a lot of energy: even if the spectrum is hard, gamma rays are sparse, requiring long time series to collect enough statistics. Standard Fourier techniques used in other bands become impractical due to the higher demand in computation time and memory. Besides, over such a long time span, irregularities in the timing solution might intervene, especially for the young pulsars that are the principal target of our searches, destroying the coherence of the signal. Considering the difference in the time of arrivals of the photons, instead of the times themselves, and truncating the series to a maximum value, the periodicity is conserved, with a limited loss of information. Applying an FFT to the series of time differences reveals extremely effective in terms of computing resources, and loses the coherence requirements (2). The spectral and directional information carried by the photons can be used either in selecting the events or in weighting the events by their probability of coming from the pulsar candidate.

This technique led to the discovery of 26 new pulsars: for the first time pulsars are found using gamma-ray data alone (3,4). Most of these objects are either radio-quiet or extremely radio-faint: they are at or beyond the sensitivity threshold of current radio telescopes. This means that, beyond the scientific throughput of understanding single objects, a whole new population of pulsars, so far undetectable, has emerged. Using a large scale Montecarlo simulation of gamma-ray pulsars we have estimated the sensitivity of the LAT and of our blind search technique to find new pulsars (5). Assuming a flux, a sky position, and a set of pulsar parameters, we can calculate the probability of finding the pulsar in one year of LAT data (Fig 1). Since a large fraction (about a third) of gamma-ray pulsars are radio-quiet, the consequences for the overall pulsar population are very important, so we tried to quantify them. We first applied the sensitivity study to all the gamma-ray pulsars in the second LAT pulsar catalog, extending and validating the procedure. One of the key elements in determining the probability of detection is the shape of the pulse profile, that for real pulsars often departs significantly from the assumed templates. We used the same criteria to parametrize the light curves predicted by two beaming models, the outer gap and the two-pole caustic, depending on the geometry of emission. We then assumed a birth-site distribution in the Galaxy, simulated a pulsar population with a constant birth rate, and evolved it into the Galactic gravitational potential. We parametrized the pulsar spin parameters in terms of energy loss at birth and surface magnetic field, evolved them to the present day, and applied a pulse profile according to the geometry and emission model. We finally applied the sensitivity study to estimate the pulsar sample expected to be observable, given the birth
distribution, and compared it with the observed sample. We repeated this procedure many times, scanning the space of birth spin parameters, trying to constrain the underlying overall population of pulsars (Fig 1). The results so far are still preliminary, as we are trying to better characterize the pulse profiles produced by the assumed emission models, and will be published in a paper.

The young gamma-ray pulsars detected by the LAT tend to exhibit timing irregularities: their spin frequency deviates from the simple spin-down model (6). In particular, apart for a smooth drift, the frequency can suddenly jump, by as much as a few parts in a million: this is a glitch. Since many gamma-ray pulsars are radio-quiet and the LAT can continuously observe them, we try to detect and characterize glitches directly from LAT data. We validate the procedure considering pulsars observed also in the radio band, for which an independent estimate of the glitch parameters is available. We apply the time-differencing technique to events in a sliding window, examining the time evolution of the spin frequency (Fig 2): the stronger the signal, the shorter the time window, the more sensitive and accurate the technique. We find 16 glitches in 14 gamma-ray pulsars, and generally cannot detect ‘microglitches’, about 2 order of magnitudes smaller. We refine and estimate the uncertainties on the glitch parameters using a direct likelihood analysis of the time of arrival of each single photon. We validate this technique on a large glitch in the bright Vela pulsar, observed also in radio: the epoch of the glitch is consistent within a couple of minutes, and happened while the pulsar was in the LAT field of view. We could then set strong limits on the flux and profile variability, suggested in the past both by theoretical models and previous observations. I have presented the preliminary results (7) and am currently working at turning this chapter into a paper.

The LAT has been very successful in leading radio astronomers to discover new millisecond pulsars, especially binary systems in the field of the Galaxy, outside globular clusters. The general problem of searching for millisecond pulsars in binary systems, without prior knowledge of the pulsar parameters, directly from LAT data is currently out of reach. A particular type of systems, ‘black widows’, have very compact, nearly circular orbits, exhibiting variable eclipses in radio, that hamper their detection. We considered 2FGL J2339.6+0532 as a good candidate: it is very bright, out of the Galactic plane, as most millisecond pulsars, has a stable flux, with a spectral cutoff in the GeV range, typical signatures of pulsars. Optical observations over several years identify a counterpart for the companion, whose modulation allows to resolve the binary system to a high precision, unfortunately insufficient for a blind search for pulsations. First we extended the analytical treatment of modulations in the Fourier space to the case of time-differencing and set up an optimized grid in the orbital parameters, balancing resources and sensitivity. Then we validated the technique on all the known LAT black widows, verified that we can detect them, and tuned the parameters of the original search accordingly (Fig 3). Then we created a grid for 2FGL J2339.6+0532, with a restricted range of parameters. The search over this grid, that required more than 20 CPU years, did not lead to a discovery. A new search, with an extended range of parameters, less compromising about the drop in significance, is now under way: it is going to take more than 100 CPU years to complete. While I have already presented the methods and preliminary results (8), in the coming months, as soon as the extended search is done, we will submit a paper.
References

3) Abdo et al. 2009, Science 325, 840A
7) Belfiore 2011, III Fermi Symposium, Rome
8) Belfiore 2012, XXVII IAU GA, S291, Beijing

Fig. 1.— Left. Sensitivity map, showing the flux required for a gamma-ray pulsar to be detected with 50% probability in one year of LAT data, assuming a standard set of pulsar parameters. Right. Sample of outcomes from the pulsar population study. Given the central values of the distribution in surface magnetic field and energy loss rate at birth, in logarithmic scale in the x and y axes, the plot shows on the z axis the log-likelihood of observing the actual LAT pulsar population. All the other parameters in the birth distribution are fixed. In this case, large values of the sampled birth quantities are preferred.
Fig. 2.— Left. Diagram showing the algorithm used to find pulsar glitches directly in gamma rays. Right. Output of the algorithm applied to a glitch observed in the radio-quiet gamma ray pulsar J1023-5746, highlighting some of the glitch parameters. The x axis reports the offset in frequency from the expected timing solution, while the y axis represents the time in days. Besides the sudden jump in frequency, a drift in frequency appears after the glitch, indicating a jump in the spin-down rate.

Fig. 3.— Plots obtained as part of the validation study of the blind search technique on black-widow pulsars, for the particular case of J1810+1744. We measure the drop in significance by introducing an estimator, defined as $SE = -\log_{10} (N_{\text{trials}} \times P_{\text{val}})$, where the number of trials $N_{\text{trials}}$ is fixed and the probability $P_{\text{val}}$ of detecting the signal by mere random fluctuation increases as the signal degrades. On the left we consider an offset in the assumed pulsar location, each line representing a drop of 1 in SE: the accuracy required is a fraction of an arc second. On the right we calibrate the grid in the orbital parameters, in this case the semi-major axis of the orbit $A_1$. The 2 colors represent different harmonic components of the signal.
Testing General Relativity in the Strong-Field Regime with Observations of Black Holes in the Electromagnetic Spectrum

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Abstract.
General relativity has been tested by many experiments, which, however, almost exclusively probe weak spacetime curvatures. In this thesis, I create two frameworks for testing general relativity in the strong-field regime with observations of black holes in the electromagnetic spectrum using current or near-future instruments. In the first part of this thesis, I design tests of the no-hair theorem, which uniquely characterizes the nature of black holes in general relativity in terms of their masses and spins and which states that these compact objects are described by the Kerr metric. I investigate a quasi-Kerr metric and construct a Kerr-like spacetime, both of which contain an independent parameter in addition to mass and spin. If the no-hair theorem is correct, then any deviation from the Kerr metric has to be zero. I show that already moderate changes of the deviation parameters in either metric lead to significant modifications of the observed signals. I apply this framework to the imaging of supermassive black holes using very-long baseline interferometry as well as to the quasi-periodic variability and relativistically broadened iron lines observed in both galactic and supermassive black holes. In the second part of this thesis, I devise a method to test the predicted evaporation of black holes in Randall-Sundrum-type braneworld gravity through the orbital evolution of black-hole X-ray binaries and obtain constraints on the size of the extra dimension from A0620-00 and XTE J1118+480.

1. Introduction

General relativity, Einstein’s theory of gravity, has been tested and confirmed by a variety of different experiments ranging from Eddington’s solar eclipse expedition of 1917 to modern observations of double neutron stars (Will 2006). Seldom, however, have these tests probed settings of strong spacetime curvature, and general relativity still stands practically untested in the strong-field regime to date (Psaltis 2008).

Black holes are among the most fascinating objects in the universe surrounded by matter under extreme conditions in a regime of strong spacetime curvature. The study of these objects will lead to a deeper understanding of their nature, their environment, and their implications for fundamental theories such as general relativity and string theory. At the same time, the wealth and precision of observations across the electromagnetic spectrum from both ground-based and space observatories is opening up ever increasing possibilities to test fundamental properties of black holes.

In this thesis, I create two frameworks for testing general relativity in the strong-field regime with observations of black holes in the electromagnetic spectrum using current or near-future instruments.

‡ CITA National Fellow
In the first part of this thesis, I design tests of the no-hair theorem with observations of black hole accretion flows. In the second part of this thesis, I obtain constraints on the size of extra dimensions from the orbital evolution of black-hole X-ray binaries in Randall-Sundrum type braneworld gravity (Randall & Sundrum 1999).

2. Observational Tests of the No-Hair Theorem

According to the no-hair theorem, black holes are fully characterized by their masses and spins and are described by the Kerr metric. This theorem rests on the cosmic censorship conjecture as well as on the assumption that the exterior of a black hole is free of closed timelike curves. Mass and spin are the first two multipole moments of a black hole, and all higher order moments can be expressed in terms of mass and spin (e.g., Heusler 1996). Consequently, the no-hair theorem naturally leads to the expectation that all astrophysical black holes are Kerr black holes.

On the observational side, first evidence for the existence of an actual event horizon in stellar-mass and supermassive black holes has been inferred either from the lack of observed X-ray bursts, the properties of advection dominated accretion flows, or from the black-hole mass function (c.f., Psaltis 2006). To date, however, a definite proof and a verification of the Kerr nature of black holes are still lacking, and it is important to test the black hole hypothesis.

If astrophysical black holes are not the black holes of general relativity, there are a number of alternatives. First, the compact object could be a different kind of black hole other than Kerr as suggested by various string-theory inspired scenarios. Alternatively, it could be a different kind of star, a naked singularity, or even some exotic object. To this end, I have developed a framework to test the no-hair theorem with observations in the electromagnetic spectrum (Johannsen & Psaltis 2010a, 2010b). Initially, I investigate a quasi-Kerr metric (Glampedakis & Babak 2006), which contains an independent quadrupole moment in addition to mass and spin and which is valid for small to moderate values of the spin.

If the no-hair theorem is correct, then any deviation from the Kerr metric has to be zero. If, however, a nonzero deviation is detected, there are two possibilities. Either, the compact object is not a black hole (Collins & Hughes 2004; Hughes 2006) or general relativity is only approximately valid in the strong-field regime (e.g., Yunes & Pretorius 2009). In this interpretation, if the object is otherwise known to possess an event horizon, both the no-hair theorem and strong-field general relativity are invalid.

Other parametric deviations from the Kerr metric have been developed (e.g., Manko & Novikov 1992; Collins & Hughes 2004; Yunes & Pretorius 2009; Vigeland & Hughes 2010; Vigeland et al. 2011), most of which aim to test general relativity with observations of gravitational waves from extreme mass-ratio inspirals. All of these spacetimes including the quasi-Kerr metric are not ideal for the study of electromagnetic non-Kerr signatures, because they are either valid only for small values of the black hole spin or for small deviations from the Kerr metric or because they contain singularities or closed timelike curves outside of the event horizon. For high values of the black hole spin, however, these pathologies encompass the innermost stable circular orbit hampering the description of accretion flows and the electromagnetic radiation emitted from them.

I, then, construct a Kerr-like black hole spacetime, which is free of such pathologies outside of the central object and which is valid for arbitrary values of the spin up to the maximum bound and for large deviations from the Kerr metric (Johannsen & Psaltis 2011). I analyze the properties of this metric as well as the quasi-Kerr metric and perform extensive analytical and numerical calculations in order to identify a number of observables across the electromagnetic spectrum that can be used for an unambiguous test of the no-hair theorem (Johannsen & Psaltis 2010; Johannsen & Psaltis 2011; see, also, Bambi 2011, 2012; Bambi & Barausse 2011; Krawczynski 2012). I make clear predictions
for signatures that indicate a violation of the no-hair theorem and I am in a position to confront my predictions with observation.

First, I apply this framework to the imaging of supermassive black holes using very-long baseline interferometry (VLBI; Johannsen & Psaltis 2010). I develop a ray-tracing code based on the full second-order geodesic equations and simulate images of black holes. I show that the shadow of a black hole as well as the shape of a bright and narrow ring surrounding the shadow ("photon ring") depend uniquely on its mass, spin, and inclination (see, e.g., Falcke et al. 2000) as well as on the deviation parameter. In addition, I show that the shape of the ring is circular for a Schwarzschild black hole and remains nearly circular for a Kerr black hole within the spin range $|a| < 0.9M$. For nonzero values of the deviation parameter, however, the ring shape becomes asymmetric, and the degree of asymmetry is a direct measure of the violation of the no-hair theorem (see Figure 1; Johannsen & Psaltis 2010b).

Figure 1. Left: 68% and 95% confidence contours of the mass $M$ and distance $D$ of Sgr A* obtained from the combination of dynamical measurement (Gillessen et al. 2009) and simulated data for VLBI observations of the shadow of this black hole. Compared to (solid line) the 95% confidence contour of dynamical the observations alone, the improvement of the mass and distance measurements is significant. For comparison, I also plot (dashed lines) the constant ratios $M/D$ and $M/D^2$ in order to illustrate the dependence of both individual methods on the correlation between mass and distance (Johannsen et al. 2012). Right: Asymmetry of the photon ring of a black hole versus $\epsilon \sin^3/2i$, where $\epsilon$ measures the deviation from the Kerr metric and $i$ is the disk inclination. The ring asymmetry provides a direct measure of the violation of the no-hair theorem (Johannsen & Psaltis 2010b).

Sgr A*, the supermassive black hole in the center of our galaxy, as well as the supermassive black hole in M87 are the prime targets for VLBI imaging observations with the Event Horizon Telescope (EHT; Doeleman et al. 2009), a planned global array of (sub-)millimeter telescopes. I argue that the no-hair theorem can be tested with the EHT (Johannsen 2012). I estimate the precision of future VLBI arrays consisting of five to six stations and use a Bayesian technique to simulate measurements of the diameter of the ring of Sgr A* (see Figure 1; Johannsen et al. 2012) with the goal to reduce the correlation of current measurements of the mass and distance of Sgr A* from the monitoring of stars on orbits around the galactic center (Ghez et al. 2008; Gillessen et al. 2009).

Second, I investigate the potential of quasi-periodic variability detected by X-ray observatories (e.g., XMM-Newton, Rossi X-ray Timing Explorer) in both galactic black holes (Remillard & McClintock

87
(2006) and active galactic nuclei (Gierlinski et al. 2008) to test the no-hair theorem in two different scenarios. I consider the diskoseismology model (Wagoner 2008) and a kinematic resonance model (Abramowicz et al. 2003) and derive expressions of the dynamical frequencies of the quasi-Kerr and my newly constructed spacetimes. I demonstrate the ability of both models to test the no-hair theorem (Johannsen & Psaltis 2011a, 2012).

Third, I analyze the prospects of using observations of relativistically broadened iron line profiles to test the no-hair theorem. I simulate iron line profiles over the entire range of spins and demonstrate that deviations from the Kerr metric lead to shifts of the measured flux primarily at high energies as well as in the low-energy tail of the line profiles. I show that these changes can be significant and estimate the required precision of future X-ray missions in order to be able to test the no-hair theorem with fluorescent iron lines for disks of different inclinations (see Figure 2; Psaltis & Johannsen 2012; Johannsen & Psaltis 2012).

Figure 2. Left: Profiles of relativistically broadened iron lines for several values of the deviation parameter. Increasing values of the deviation parameter lead to an extended tail at low energies and a smaller intensity ratio of the two peaks. Right: Contours of the precision required in future observations of iron lines to place constraints on deviations from the Kerr metric, for different values of the black-hole spin at an inclination of 30°. Constraints |ε| ∼ 1 can be obtained at a precision level of ∼ 5% irrespective of the value of the black hole spin (Johannsen & Psaltis 2012).

3. Constraints on the Size of Extra Dimensions

String theory is the prime candidate for a unified theory of all fundamental forces requiring the existence of extra spatial dimensions. One of its challenges is the so-called hierarchy problem expressing the fact that the unification scale of gravity (Planck scale) and the electroweak scale differ by 16 orders of magnitude. In the second part of this thesis, I obtain constraints on the size of extra dimensions from the orbital evolution of black-hole X-ray binaries in Randall-Sundrum type braneworld gravity (Randall & Sundrum 1999), a proposed solution of the hierarchy problem. In this model, black holes are unstable (Tanaka 2003) and can evaporate into the extra dimension at cosmologically relevant timescales (Emparan et al. 2003).
I derive the resulting rate of change of the orbital period of black hole X-ray binaries in conjunction with magnetic braking and the evolution of the companion star. The black hole binaries A0620-00 and XTE J1118+480 have orbital periods on the order of several hours implying that gravitational radiation plays no role in the evolution of the orbital period. Furthermore, the spectral type and mean density of the respective companion stars indicate that they do not evolve rapidly. In this case, an evolution of the orbital period can only result from a balance between magnetic braking and the predicted evaporation of black holes in the extra dimension. I use existing measurements of the orbital periods of both systems to constrain the asymptotic curvature radius of the extra dimension to be less than 161 \( \mu m \) (Johannsen et al. 2009; Johannsen 2009).

I predicted (at the time of publication) that only one additional measurement of the orbital period of XTE J1118+480 would mark the first detection of orbital evolution in a black hole binary and place the tightest constraint on the size of the extra dimension of ~35 \( \mu m \). Such a measurement was recently obtained confirming the prediction (Gonzales Hernandez et al. 2012).

Upcoming instruments, such as the EHT, Astro-H, the Large Observatory For x-ray Timing (LOFT), and an ATHENA-like mission will allow unprecedented views into the workings of black holes across the electromagnetic spectrum. Systematic tests of general relativity in the strong-field regime with electromagnetic observations are within reach.

References

DISSERTATION SUMMARY:
An X-ray Survey for Tidal Disruption Flares in Rich Clusters of Galaxies
by: W. Peter Maksym, Northwestern University; advisor: Melville Ulmer

Background: Galaxies are frequently observed to host massive black holes (MBHs) in their cores, via luminous multiwavelength emission in the form of AGNs, as well as through the kinematic signatures of stars and gas at their centers. Such black holes are thought to play a significant role in the formation and evolution of galaxies, but the interrelationship between black holes and galaxies is complicated and uncertain. There are observed relationships between MBHs and the velocity dispersion of the nuclear stellar cluster ($M_\bullet - \sigma$), as well as with the bulge luminosity ($M_\bullet - L_{\text{bulge}}$). But this relationship is difficult to measure at the low end of the $M_\bullet$ distribution, owing to the inherent faintness of dwarf galaxies and the difficulty involved in spatially resolving small or distant galactic nuclei.

This low end is particularly critical to models of hierarchical galaxy formation (e.g. Volonteri, 2010; Volonteri & Natarajan, 2009) where varying theories of black hole origin (such as via direct collapse, population III stars, or runaway stellar mergers) predict different slopes to the low-mass tail. The low-mass tail is also of interest to rates of gravitational wave events (Amaro-Seoane, et al., 2007). Ongoing research into dwarf AGNs has proven a fruitful measure of the low-mass tail (Xiao et al., 2011; Jiang et al., 2011) but it probes a particular phase of galactic evolution, whereas most MBHs in the local universe are observed to be quiescent.

A normally quiescent black hole can, however, occasionally flare up when it tidally disrupts a star. The star is shredded by the difference in gravitational force across its extent, with ≥ half of its debris scattered to escape velocities and the remainder returning to pericenter on a spread of elliptical orbits. There it shock-heats, emitting a luminous flare (to first order) approximately as a blackbody of $kT \sim 0.01 - 0.1$ keV, hence predominantly in the ultraviolet and soft X-rays, and whose bolometric luminosity should first order evolve with the accretion rate, thought to be roughly $\propto t^{-5/3}$ owing to Kepler’s laws (see, e.g., Rees, 1988, and Ulmer, 1999). There exists a practical upper limit to $M_\bullet$ for tidal disruption flares (TDFs), such that the event horizon is greater than the disruption radius and the star is ingested prior to disruption. For a $M_\star \sim 1 M_\odot$ main-sequence star and a non-spinning MBH, $M_\bullet \lesssim 10^8 M_\odot$.

The rate at which these events occur ($\gamma$) is a matter well-studied by dynamicists, and a large body of literature exists to infer the rate at which these events occur as a function of $M_\bullet$ and nuclear stellar populations, as well any possible basic deviations from the typical observational signature outlined above. These events are sufficiently rare, however, that despite their luminosity and long duration ($\sim 10^{42} - 10^{45}$ erg s$^{-1}$ for months or years), they are difficult to observe. Theory generally predicts $\gamma \sim 10^{-6} - 10^{-3}$ galaxy$^{-1}$ year$^{-1}$, and though there is still room for disagreement, the observed and theoretical rate is generally so low that there are few candidates.

For example, at the start of this thesis, ∼ 5 TDFs had been claimed in the literature. As of its submission, the total stood at ∼ 20, of which two had been found via the thesis. Estimates of the rate are compounded by difficulty in distinguishing TDF candidates from other highly variable, luminous objects such flares from obscured or weak AGN disks. Each new candidate is therefore
important to disentangling the broader understanding of $\gamma$ and TDF observational characteristics.

A major uncertainty in $\gamma$ arises from the MBH fraction in dwarf spheroidal galaxies. These galaxies are common in galaxy clusters, and their sheer numbers have the potential to dominate the TDF rate. In particular, Wang & Merritt (2004) predict $\gamma \sim 10^{-3}$ galaxy$^{-1}$ year$^{-1}$ if nucleated dwarf spheroidal galaxies typically host MBHs.

**Goals and Implementation:** The major purposes of the thesis were to identify new examples of tidal disruption flares, thereby exploring the properties of these TDFs and their host galaxies, as well as better determining $\gamma$ for a well-defined population.

X-ray surveys are a well-established method of identifying TDFs, as the X-ray band is likely to contain the bulk of the TDF bolometric luminosity and is relatively unhindered by host galaxy contamination and obscuration as compared to ultraviolet or optical surveys (e.g. Komossa et al., 2004; Esquej et al., 2008; Cappelluti et al, 2009). X-rays may also best track the characteristic $r^{-5/3}$ signature over long time periods (Lodato & Rossi, 2011). However, X-rays surveys are challenging to implement, owing to the poor sensitivity of all-sky monitors and the narrow fields of view of focusing X-ray telescopes.

Galaxy clusters are, however, popular targets for studies of diffuse emission from the intracluster medium (ICM). Hundreds of galaxy clusters have been observed by *Chandra* and *XMM-Newton* over their 13-year missions, many of them multiple times. The basic premise of the dissertation’s implementation is therefore simple: rich galaxy clusters hold as many as ~ 1000 galaxies in a *Chandra* or *XMM-Newton* field-of-view. By observing galaxy clusters multiple times and searching for highly variable ($\gtrsim 10\times$) point sources and eliminating alternate explanations (such as AGN flares, supernovae, M-dwarfs, etc.), we maximize the chance of finding a TDF within any given pointing. Galaxy clusters also typically have well-studied, uniform populations which aid in estimating the flare distance (and energetics), as well as the determination of $\gamma$. Galaxy clusters also (as per Wang & Merritt 2004) present an unusual galaxy population by which to search for environmental effects on $\gamma$.

The technical execution is, however, complicated, owing to variations in instrumental resolution and response across different instruments, different pointings, and different locations within a given pointing, as well as highly non-uniform coverage given the variety of survey designs by the original cluster observation programs. Finally, there is an inherent uncertainty to the nature of any TDF candidate. Spectroscopy is necessary to unambiguously confirm the distance to the host galaxy as well as to set limits on the presence of any hidden or weakly accreting AGN, but spectroscopy of sufficient quality to achieve these goals may not be easy to obtain.

**Significant Results:** In addition to the major goals of the survey, the dissertation contained a thorough review of the state of tidal disruption flare observations. This review was timely and is likely to be useful, as TDF studies have experienced considerable growth over the past few years. To pick a few examples from the review, several flares have been found via new observational techniques in the ultraviolet (e.g. Gezari et al., 2006; 2009), optical (van Velzen et al., 2011a; Cenko et al., 2012a), and numerous other means. Several significant new papers have produced detailed new models of multiwavelength TDF evolution dependent upon stellar structure, (e.g.
Strubbe & Quataert 2009; 2011; Lodato et al., 2009; Lodato & Rossi 2011). And the identification of jetted, relativistic (beamed) TDFs via Swift has effectively redefined the TDF paradigm (e.g. Bloom et al., 2011; Cenko et al., 2012b; Zauderer et al., 2011).

In keeping with the major scientific issues of the dissertation, it also included a direct comparison of $M_*$ as inferred from $M_\bullet-L_{\text{bulge}}$ to $M_\bullet$ as inferred from a variety of observed TDF properties in the literature. This study was laborious, given the non-uniform discovery methods and reported properties. This comparison found that reported $M_\bullet$ inferred TDFs are generally consistent with the assumption of the Eddington limit and remarkably consistent with a broad range of thermal models appropriate to reported data. Estimates of $M_\bullet$ from the timescale of light curve decay are less certain, but are consistent with the assumption that stars are maximally spun-up upon closest approach. The implications of this finding are uncertain, given this approach to TDF modeling is currently disfavored by recent modeling (Gezari, private communication; Lodato et al., 2009).

The initial results of the X-ray survey included a single likely TDF associated with SDSS J131122.15-012345.6, a moderately sized ($M_V = -17.10$) early-type galaxy $\sim 3.7$ from the cluster core (Fig. 1). Via modeling of the galaxy population from previous optical and infrared studies of A1689, by assuming a flare duration consistent with $t^{-5/3}$ decay (Fig. 2), and by taking into account the cadence and sensitivity of the $\sim 7$ years of Chandra observations, $\gamma$ was inferred to be $\sim 1.2 \times 10^{-4}$ galaxy$^{-1}$ year$^{-1}$, lower than predicted by Wang & Merritt (2004) but modestly higher than other observational studies ($\sim$ few $\times 10^{-5}$ galaxy$^{-1}$ year$^{-1}$). Subsequent analysis covered a total of 10 galaxy clusters, almost all of which contained non-detections. Considering the quality of coverage and relative galaxy populations, the adjusted $\gamma$ is $\sim 3 \times 10^{-5}$ galaxy$^{-1}$ year$^{-1}$.

The remarkable exception to this string of non-detections was Abell 1795, which contained possibly the most significant thesis result. A luminous TDF candidate was identified at a projected distance of $\sim 50$ kpc from the cluster core. The associated galaxy, WINGS J134849.88 +263557.5 (WINGS J1348), is exceptionally faint, such that in multiple serendipitous observations between 100$\mu$m and $\sim 1700\text{Å}$ it was only identified at $B, V = 23.3, 22.5$. The flare is, however, consistent with a TDF and would be one of the best-sampled TDFs to date, with $\sim 28$ Chandra and XMM-Newton pointings over $\sim 13$ years (Fig. 3; owing to the fact that A1795 is a Chandra calibration source). The flare is also exceptional due to its excellent photon statistics; high-quality X-ray data is relatively rare in TDFs, and the multiple Chandra epochs with counts sufficient for meaningful spectral modeling ($\sim 700$) is only exceeded by flares reported by Saxton et al. (2012), Lin et al. (2011) and the Swift flares. The flare is associated with a bright archival EUVE flare, making it the first reported EUV identification of a TDF and solves a mystery posed by Bowyer et al. (1999).

Finally and most intriguingly, limits from multi-band photometry and Magellan echellette spectroscopy suggest the galaxy is likely a cluster member (Fig. 4). If so, its intrinsic faintness ($M_V \sim -14.7$) would make it a dwarf galaxy an order of magnitude less massive than POX 52 (Thornton et al., 2008) or Henize 2-10 (Reines et al., 2011), and the lowest-mass galaxy known to host a MBH, to the best of our knowledge. This state of affairs is extremely difficult to explain from a galaxy formation standpoint, but its proximity to the cluster core ($\gtrsim 50$ kpc) suggests that it could have been tidally stripped during passage through the cluster core. This object is interesting from many perspectives and will likely serve as a focus for investigations for years to come.
Figure 1: Pre-flare HST WFPC2 image of SDSS J131122.15-012345.6 taken using the HST/WFPC2 F606W filter. The larger overlaid pixels are singly binned X-ray events from the flare at its peak at epoch 2004.16. The circle indicates centroid error at $r \sim 1''8$ and the cross is the middle of the centroid.

Figure 2: Light curve for SDSS J1311 with error bars. Arrows indicate upper bounds. $L_X(0.3–3)$ corrected for galactic extinction are indicated by $\times$. The dashed line is a $t^{-5/3}$ light curve which assumes pericenter passage time $t_P$ at the expected value for a solar-type star, indicated by the solid vertical line. Dotted lines indicate the error range for $t_P$.

Figure 3: Model-dependent X-ray evolution for WINGS J1348: At the distance of A1795 ($z \sim 0.062$), $10^{-14}$ erg cm$^{-2}$s$^{-1} \sim 10^{31}$ erg s$^{-1}$. Chandra (blue), XMM-Newton (black $\times$) EUVE (red/purple). The ROSAT upper limit is $1.6 \times 10^{-14}$ erg cm$^{-2}$ s$^{-1}$ at Date = 1997.57.

Figure 4: Color-magnitude diagram of A1795 galaxies, with ridge line (dashed) and WINGS J1348 (asterisk). WINGS J1348 position is consistent with the ridge line. Correlation of Magellan echellette spectra with templates supports this analysis.
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Exploring the Geometry of Circumnuclear Material in Active Galactic Nuclei Through X-ray Spectroscopy

Dissertation Summary
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1. Introduction

AGN have been studied closely for many decades, but their environments, evolution and even many of the physical processes that produce the high-energy photons in these objects are not yet fully understood. I have endeavored to understand aspects of AGN geometry and high energy emission processes through X-ray spectral investigations.

X-ray emission is seen universally in AGN and offers a wealth of information about the geometrical and physical make-up of the accreting supermassive black holes at the hearts of distant galaxies. The primary X-ray continuum is thought to arise from the hot, Comptonizing electron or electron-positron pair corona close to the black hole. In many galaxies and especially in Seyferts the continuum is reprocessed by the accretion disk or other circumnuclear material creating commonly seen reflection features: Fe K emission around 6–7 keV and the so-called Compton reflection hump peaking around 20–30 keV.

In the last two decades the 20–100 keV sky has become more accessible, a development which is especially interesting for AGN because 20–100 keV AGN fluxes do not suffer from absorption by gas along the line of sight to the nucleus. The Rossi X-ray Timing Explorer (RXTE), launched at the end of 1995, is the longest currently running X-ray mission and the public archive contains almost 16 years’ worth of data, including ~150 AGN, many of which have been monitored for at least 5–10 years. My analysis has taken advantage of the fact that the two pointed-observation instruments aboard RXTE, the Proportional Counter Array (PCA) and the High Energy X-ray Timing Experiment (HEXTE), are always operating simultaneously, removing ambiguity due to source variability inherent in splicing non-simultaneous <10 and >10 keV data sets from different missions as is commonly done to achieve broad-band coverage. For many of the objects in this sample, the spectra are time-averaged over timescales of years. Thus the long-term average spectral properties found for the hard and very hard X-ray bands can serve as baselines for future investigations and variability studies. I have supplemented this work with observations of individual objects which has allowed me to perform more intense investigations into properties of the location, geometry and nature of circumnuclear material in these objects.

2. Individual Objects

2.1 The Clumpy Absorber in Cen A

A sustained monitoring campaign by RXTE observed an occultation event in Cen A in detail from ingress to egress. A discrete clump of material, likely associated with a clumpy torus, transited the line of sight to the central illuminating source for 170 days between 2010 August and 2011 February with a maximum increase in $N_H$ of $8.4 \times 10^{22}$ cm$^{-2}$. Assuming the clump of material was roughly spherical with a linear density profile and assuming a distance from the central nucleus of 0.1–0.3 pc (from infrared measurements) we found that the clump had a linear dimension of $1.4–2.4 \times 10^{15}$ cm with a central number density of $n_H = 1.8–3.0 \times 10^7$ cm$^{-3}$, in good agreement with previous results. Two occultation events seen in ~10 years indicate that clumps of material are indeed transiting our line of sight and evidence suggests that they are part of a clumpy, Compton-thin torus, the characteristics of which are consistent with the model proposed by Nenkova et al. (2008a; 2008b).
2.2 The Circumnuclear Material in MCG–2-58-22

A long-look Suzaku observation of MCG–2-58-22 confirmed that it is extremely unabsorbed in the X-ray band (an upper limit of $2.5 \times 10^{20} \text{cm}^{-2}$ in excess of the Galactic column), despite significant reddening seen in the optical band and lack of substantial optical broad lines (MCG–2-58-22 is a Seyfert 1.5). These results led the conclusion that while no absorbers are in the line of sight to the central region of the AGN, it is possible that clumps of material may be obscuring lines of sight to the region(s) where the optical line emission is produced.

The excellent resolution of the XIS CCDs around $\sim 5$–7 keV gave a detailed picture the Fe K complex. A narrow ($\sigma_{\text{FWHM}} < 7100 \text{ km s}^{-1}$) Fe Kα emission line constrained the locating of the emitting material to much further out than has been done with previous observations. No significant broad Fe line was detected, such as would be expected from the inner portions of a radiatively efficient accretion disk. Since there is such a clean line of sight to the nucleus, this region cannot be simply obscured or out of the line of sight, implying that the inner disk may be truncated or radiatively inefficient. From the limits on the Fe line $\sigma_{\text{FWHM}}$ I have calculated a minimum inner radius of $\gtrsim 1200 R_S$. Comparing the Fe line EW to the CRH strength indicated that both components likely arise in the same Compton-thick material without any contribution from additional Compton-thin circumnuclear material. A disk/slab geometry (\textsc{pexrav}) for the Compton-thick material gave a reflection strength $R = 0.69 \pm 0.05$ with a photon index of $\Gamma = 1.80 \pm 0.02$.

I successfully applied the new \textsc{MYTorus} model for Compton reflection to MCG–2-58-22, which assumes that the reflecting material is in the form of a torus of uniform density rather than in the form of a flat disk, as has typically been done with more established models, such as \textsc{pexrav}. I attempted to apply the \textsc{MYTorus} model to our RXTE sample, but the model’s assumption that the torus has a uniform density leads to a steep change in the line-of-sight absorption at the edge of the donut-shaped torus, causing all Compton-thin sources to have inclination angles close to 60° (the opening angle assumed in the model). Most sources also required additional Fe line emission from Compton-thin material. For the majority of our sources this led to two parameters, angle and torus density, characterizing only one measurable quantity, the flux of the CRH, leading to degeneracy between these two physical quantities.

2.3 The Disappearing Soft Excess in Mkn 590

I analyzed a long-look Suzaku observation of the Seyfert 1.2 Mkn 590 with the aim of measuring the Compton reflection strength, Fe K complex properties, and soft excess emission which had been observed previously in this source. The Compton reflection strength was measured to be in the range 0.2–1.0 depending on the model used. A moderately strong Fe Kα emission line was detected with an equivalent width of $\sim 120$ eV and an Fe Kβ line was identified with an equivalent width of $\sim 30$ eV, although contribution from ionized Fe emission at this energy could not be ruled out. Surprisingly, there was no evidence for soft excess emission. Comparing these results with a 2004 observation from XMM-Newton, we found that either the soft excess has decreased by a factor of 20–30 in 7 years or else the photon index has steepened by 0.10 (with no soft excess present), while the continuum flux in the range 2–10 keV has varied only minimally (10%). This result could support recent claims that the soft excess is independent of the hard X-ray continuum.

3. The Archival Surveys

I have analyzed data for all AGN in the Rossi X-ray Timing Experiment (RXTE) archive in order to explore the geometry of circumnuclear material around SMBHs and characterize their X-ray spectra. Two surveys, one broad band survey with 23 AGN and one full spectral survey with 100 AGN, improve upon previous surveys of the hard X-ray energy band in terms...
of accuracy and sensitivity, particularly with respect to confirming and quantifying the amount of Compton-reflection in these sources. Thanks to the combination of the longevity of the RXTE mission, the sustained monitoring campaigns on many AGN, and the simultaneous operation of the PCA and HEXTE instruments in the 3–200 keV energy range, broadband X-ray spectra with long integration times, high sensitivity, and moderately good spectral resolution were obtained. Although the HEXTE instrument is sometimes overlooked due to its low sensitivity on short timescales, this work has demonstrated that HEXTE can indeed yield spectra out to at least 100 keV for 23 AGN with a sufficient combination of brightness and exposure time and out to at least 50 keV for an additional 18 sources. The fact that many of the spectra presented here are long-term averaged spectra means the ambiguity inherent in single-epoch spectral fitting caused by variability of the source is eliminated. These spectra may serve as baselines for future missions and can be combined with broadband data to create SEDs for future analysis. With information about abundances of the different types of AGN and X-ray luminosity functions, the stacked spectra could be combined to find the AGN contribution to the CXB. Average spectral parameters and distributions within different types of Seyferts could also be used to fine-tune current CXB models.

Long-term averaged values for $\Gamma$ were generally consistent with previous results for individual objects; averages by AGN classification were also consistent with previous surveys. Unsurprisingly, I found that the Fe line complex was necessary to model in all Seyfert spectra. Using a single gaussian to model this component I found typical equivalent widths around 100–200 eV, roughly consistent with previous results. There was tentative evidence for high-energy rollovers in the spectra of only three objects, Circinus, NGC 4945, and MR 2251–178, while for the remaining objects no rollover below 200 keV was indicated.

Roughly 85% of Seyferts in both samples showed significant contribution from the CRH. Comparing the strength of the CRH with the amount of Fe emission seen, allowed me to estimate the ratio of Compton-thick to Compton-thin material in AGN, with the average being around 40%, though there was large object to object variation.

There was no significant correlation between $\Gamma$ and $L$ for the Seyferts in the full sample, however a positive correlation between $\Gamma$ and $L$ for blazars was in agreement with the Fossati sequence and the luminosity dependence of the broad band SED hump peak energies. The BL Lac objects tended to have higher values of $\Gamma$ than the FSRQs (averages of 2.3 and 1.8, respectively) as expected since FSRQs tend to be brighter and have lower peak frequencies. This is consistent with inverse Compton emission processes where higher fluxes of scattered photons cool the Comptonizing electrons.

4. Conclusion

The paradigm of AGN unification has been shifting slowly over the past two decades. The models proposed by Antonucci & Miller (1985), and iconically illustrated by Urry & Padovani (1995), have been tested, modified, and refined. What remains firmly intact is the central engine of AGN emission: an accretion disk surrounding a supermassive black hole with the addition of large-scale jet emission orthogonal to the disk in the case of blazars and other radio-loud AGN.

The similar distributions of $\Gamma$ for type 1 and 2 Seyferts in the full RXTE sample supports the idea that they are intrinsically the same. However, the distribution of CRH strengths showed no difference between types 1 and 2, which we would expect under classical unification schemes with reflection off a disk and obscuration by a torus, where inclination angle is the primary difference between the two types. This does not conclusively prove that all of the reflection is arising in the torus, but is strongly indicative that not all the reflection arises in the accretion disk. The NLSy1’s in the full sample showed significantly higher photon indices than the normal Seyfert 1’s. Two of the Seyfert 2’s in the sample had very soft X-ray spectra, similar to NLSy1’s and could be in a similar accretion regime. This is also consistent with a
common central engine for all Seyferts, but with the differences between types being dependent on accretion rate and the geometry of the circumnuclear material, as well as viewing angle.

The broad range of the brightest 23 RXTE AGN was necessary to test for the presence of rollovers in the continuum, however only one source clearly required a rollover. Spectroscopy up to 100 keV was sufficient to constrain the rollover in Seyferts to $\geq 225$ keV in 20 out of 23 sources, corresponding to an electron temperature of $k_B T_e \geq 75$ keV for the corona surrounding the disk, the putative source of the high energy photons. Rollovers below 200 keV seem to be much rarer than expected from previous work (e.g., Perola et al. 2002) and true broad band SEDs stretching into the MeV range will be needed to search for rollovers at these higher energies. Once we find the rollovers in AGN we can begin to test Comptonization models for the corona as is done in GBH spectra. Results for the blazars in the full sample were consistent with the Fossati sequence and support models of blazar high energy emission as inverse Comptonization processes.

The biggest changes to the iconic picture have occurred as our knowledge of the torus structure has grown. It seems clear that the torus can be characterized as clumpy in at least some cases, supported by strong evidence from infrared observations and our own observations of clumps of distant material occulting the central illuminating source in Cen A. Additionally, we have shown that overly simplistic Compton reflection hump models such as a flat disk or uniform doughnut need to be replaced by more detailed models that portray the characteristics of matter in the environment of SMBHs in a more realistic fashion. From our RXTE samples we found that $\sim 85\%$ of Seyferts showed a significant CRH, and that an average of 40\% of the Fe Kα line flux arises in reflection off Compton-thick material. This implies that, while Compton-thick material is commonly found in the vicinity of the black hole, a significant amount of Compton-thin material is also common and must be taken into account when modeling the Fe line self-consistently with the CRH. More complex models of the CRH and sensitive hard X-ray spectrometers are needed to progress further in our understanding of the geometry of the Compton-thick circumnuclear material.

The soft excess remains something of a mystery, not yet fully integrated into our picture of AGN. It may be blurred fluorescent lines from reflection off ionized Compton-thick material in the vicinity of the black hole. Alternatively, it may come from absorption by partially ionized disk winds where the velocity of the winds causes the smearing of the lines. If it can be shown that it varies with UV emission (as seen by Mehdipour et al. 2011) in multiple cases then we must accept that it may be the high energy tail of optical-UV disk emission. Simultaneous monitoring with UV and X-ray instruments for several sources could confirm or reject this hypothesis.

Overall, my results are consistent with the picture of all AGN sharing a common engine. The differences in observed properties between the classes of AGN are likely based on mass, accretion rate, the presence and beaming angle of jets, and the geometry of the circumnuclear material. I conclude that the unified picture of AGN remains intact, but a more complex reflecting geometry such as a combined disk and (possibly clumpy) torus is likely a more accurate picture of the Compton-thick material and we should work toward using more realistic models.

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