13th Meeting of the

High Energy Astrophysics Division

Program Book 2013

Monterey CA 7-11 April

13th Meeting of the American Astronomical Society's High Energy Astrophysics Division (HEAD)

7-11 April 2013
Monterey, California

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

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Rosanne DiStefano	2011-2014
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Jan Vrtilek	2011-2014
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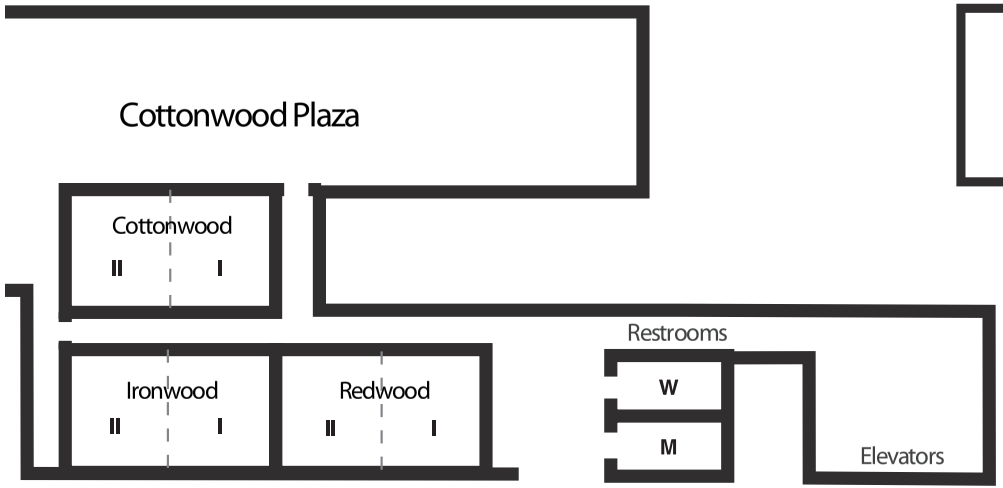
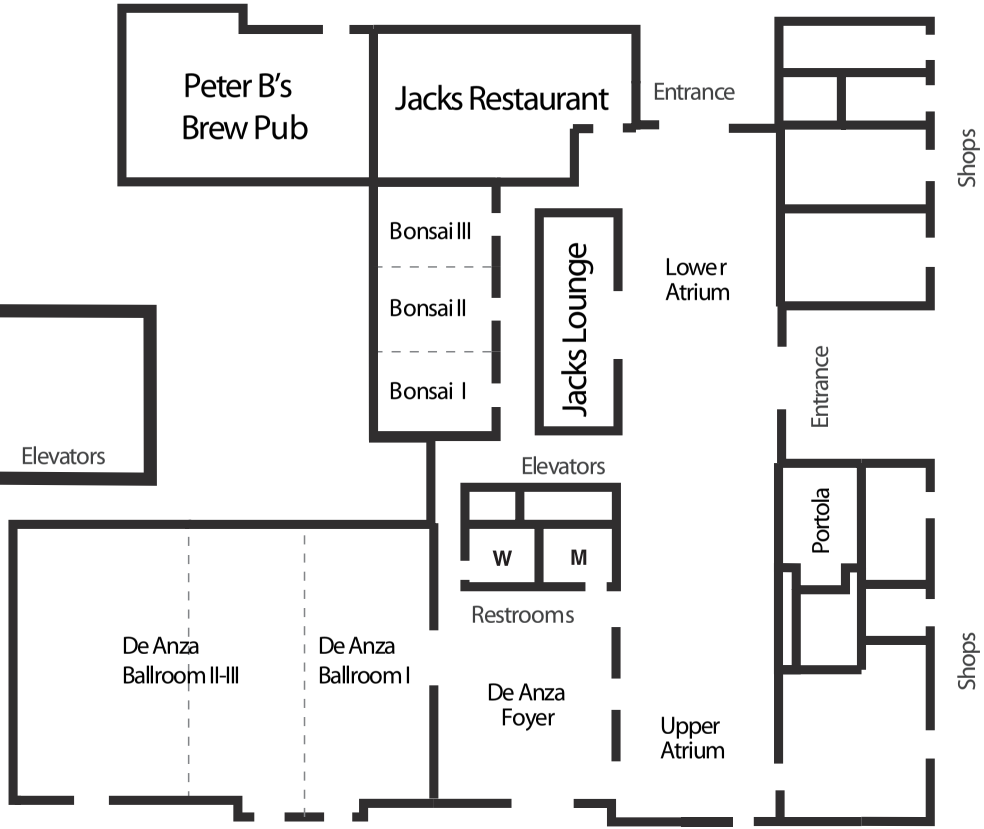
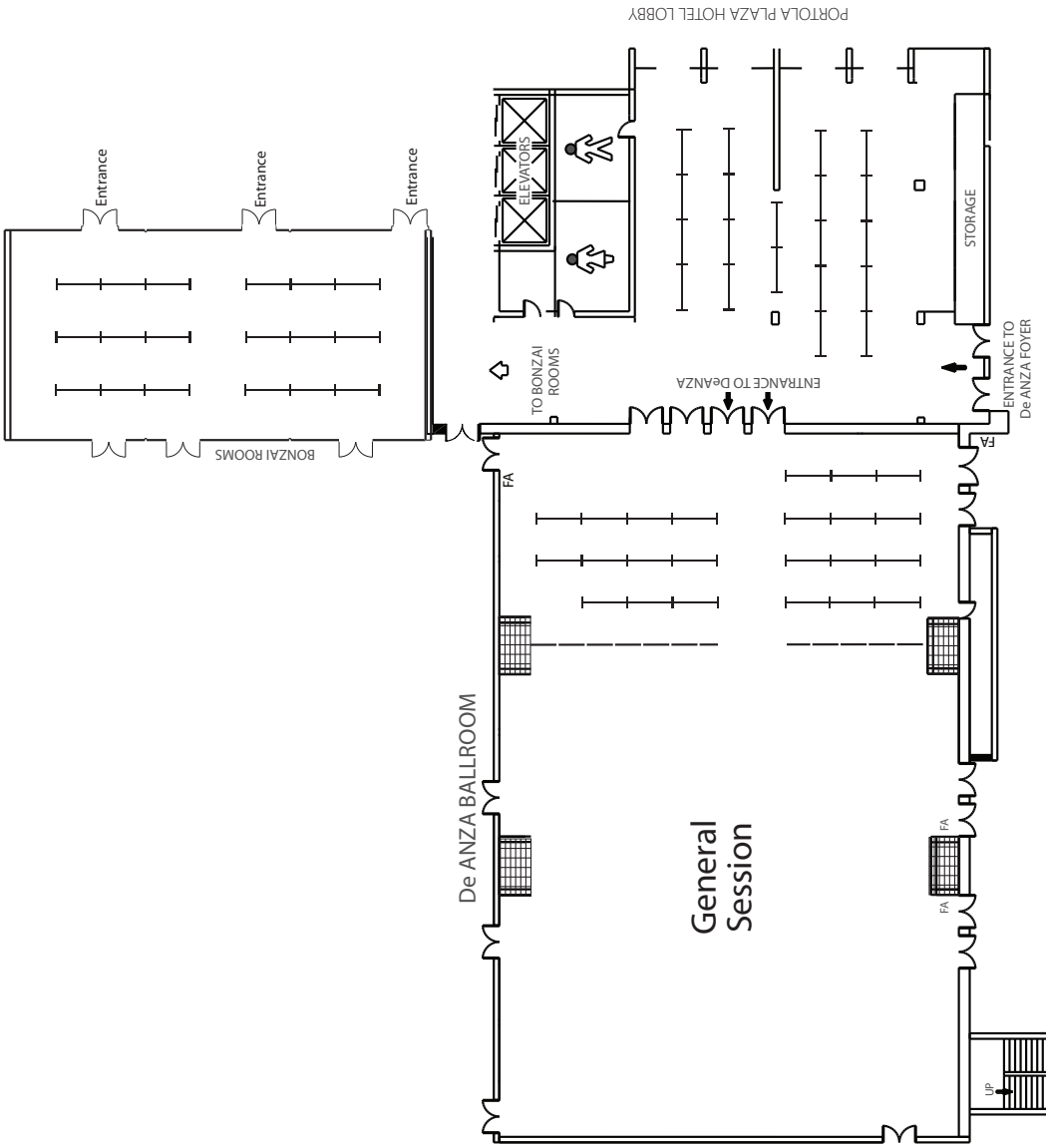
LEVEL THREE



LEVEL ONE




Entrance
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BONZAI ROOMS
TO BONZAI ROOMS
ELEVATORS
PORTOLA PLAZA HOTEL LOBBY
ENTRANCE TO De ANZA
STORAGE
ENTRANCE TO De ANZA FOYER
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De ANZA BALLROOM
General Session
UP

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 net work problems.
- Wireless connection information will be printed on the back of your badge.

HEAD would like to thank our Meeting Sponsor

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Sunday, 7 April 2013	
1:00pm	Registration, 1:00pm-7:00pm, De Anza Foyer
	Speaker Ready, 1:00pm-7:00pm, De Anza
7:00pm	Opening Reception, 7:00pm-9:00pm, Portola Hotel and Spa

Monday, 8 April 2013		
7:30am	Grab-and-Go Breakfast, 7:00am-8:30am, Lower Atrium	
	Registration, 7:30am-6:00pm, De Anza Foyer	
	Speaker Ready, 7:30am-6:00pm, De Anza	
	Poster Viewing, 7:30am-6:45pm, De Anza Ballroom I	
8:20am	**100** Opening Remarks, 8:20am-8:30am, De Anza Ballroom II-III	
8:30am	**101** AGN I: Winds/Jets/Accretion (obs) and Variability, 8:30am-10:00am, De Anza Ballroom II-III	
10:00am	Break, 10:00am-10:30am	
10:30am	**102 Plenary** HEAD Dissertation Prize Talk, 10:30am-11:00am, De Anza Ballroom II-III	
11:00am	**103** Stellar Compact I: CVs, Isolated Neutron Stars, Planetary Nebula, 11:00am-12:30pm, De Anza Ballroom II-III	
12:30pm	Lunch Break, 12:30pm-2:00pm Grab-and-Go Lunch, 12:30pm-2:00pm, Lowr Atrium	
	Poster Session I, 12:30pm-2:00pm, De Anza Ballroom I	
	108 AGN Structure and Variability **109** AGN Surveys and Catalogs **110** AGN/Galaxy Connections **111** AGN/QSO Jets **112** Astroparticles **113** Black Holes in Globular Clusters **114** Blazars and BL Lacs **115** Charge Exchange **116** Clusters & Surveys **117** Data Analysis and Modeling Techniques **118** Extragalactic Background	**119** Future Prospects in X-ray Astronomy **120** Galaxies, ISM **121** Gravitational Waves **122** Lab Astro **123** Missions and Instruments **124** SMBH, GRB **125** Solar and Stellar **126** Stellar Compact Poster Session **127** Supernova Remnants and Gamma-ray Bursters **128** Tidal Disruptions **129** X-ray Binaries **130** Public Outreach
2:00pm	**104** Future Instrumentation And Missions in X-Ray Astronomy, 2:00pm-3:45pm, De Anza Ballroom II-III	
	105 On the Detection of the Extragalactic Background Light, 2:00pm-3:45pm, Portola Room	
3:45pm	Break, 3:45pm-4:15pm	
4:15pm	**106** Public Policy; Working Internationally, 4:15pm-5:45pm, De Anza Ballroom II-III	
5:45pm	Happy Hour: Poster Session II, 5:45pm-6:45pm, De Anza Ballroom I	
6:45pm	Break, 6:45pm-7:30pm	
7:30pm	**131** Astrostatistics in High Energy Astrophysics - Session in Memory of Alanna Connors, 7:30pm-9:00pm, Portola Room	

Tuesday, 9 April 2013	
7:30am	Grab-and-Go Breakfast, 7:00am-8:30am, Lower Atrium
	Employment Breakfast with EXCOM (Advance Registration Required), 7:30am-8:30am, Portola Room
	Registration, 7:30am-6:00pm, De Anza Foyer
	Speaker Ready, 7:30am-6:00pm, De Anza
	Poster Viewing, 7:30am-6:45pm, De Anza Ballroom I
8:30am	**200** Missions and Miscellaneous 8:30am-10:00am, De Anza Ballroom II-III
10:00am	Break, 10:00am-10:30am
10:30am	**201** NuSTAR, 10:30am-12:05pm, De Anza Ballroom II-III
12:00pm	Lunch Break, 12:05pm-12:30pm
	Grab-and-Go Lunch, 12:00pm-1:30pm, Lower Atrium
12:30pm	**202** PCOS Town Hall, 12:30pm-1:30pm, De Anza Ballroom II-III
1:30pm	**203 Plenary**: The Fermi Bubbles, 1:30pm-2:15pm, De Anza Ballroom II-III
2:15pm	**204** Stellar Compact II: Stellar Mass Black Holes and X-ray Binary Surveys, 2:15PM - 3:45PM, De Anza Ballroom II-III
3:45pm	Break, 3:45pm-4:15pm
4:15pm	**205** Accretion, Spin, and Feedback: How are AGN Jets Produced?, 4:15pm-5:45pm, Portola Room
	206 Black Holes in Globular Clusters, 4:15pm-5:45pm, De Anza Ballroom II-III
5:45pm	Happy Hour: Poster Session III, 5:45pm-6:45pm, De Anza Ballroom I
6:45pm	Break, 6:45pm-7:30pm
7:30pm	**207** Science of Future X-ray Missions, 7:30pm-9:00pm, De Anza Ballroom II-III

Wednesday, 10 April 2013	
7:30am	Grab-and-Go Breakfast, 7:00am-8:30am, Lower Atrium
	Registration, 7:30am-6:00pm, De Anza Foyer
	Speaker Ready, 7:30am-6:00pm, De Anza
	Poster Viewing, 7:30am-6:45pm, De Anza Ballroom I
8:30am	**300** AGN II: Winds/jets/accretion (theory) and AGN/Galaxy Connections, 8:30am-10:00am, De Anza Ballroom II-III
10:00am	Break, 10:00am-10:30am
10:30am	**301** Galaxies & ISM, 10:30am-12:00pm, De Anza Ballroom II-III
12:00pm	Lunch Break, 12:00pm-1:30pm
1:30pm	**302** Gravitational Wave Mission Plans, 1:30pm-3:00pm, De Anza Ballroom II-III
	303 The Charge Exchange Process in the Solar System and Beyond, 3:30pm-3:00pm, Portola Room
3:00pm	Break, 3:00pm-3:30pm
3:30pm	**304** Bridging Laboratory and High Energy Astrophysics, 3:30pm-5:00pm, De Anza Ballroom II-III
	305 Understanding Gamma-Ray Bursts Emission Mechanism in the Fermi Era, 3:30pm-5:00pm, Portola Room
5:00pm	Happy Hour: Poster Session IV, 5:00pm-6:00pm, De Anza Ballroom I
6:00pm	Break, 6:00pm-7:30pm
7:30pm	HEAD Banquet, 7:30pm-9:00pm, Portola Hotel and Spa

Thursday, 11 April 2013	
7:30am	Registration, 7:30am-5:00pm, De Anza Foyer
	Speaker Ready, 7:30am-5:00pm, De Anza
	Poster Viewing, 7:30am-5:00pm, De Anza Ballroom I
8:30am	**400** SNR/GRB, 8:30am-10:00am, De Anza Ballroom II-III
10:00am	Break, 10:00am-10:30am
10:30am	**401** Galaxy Clusters, 10:30am-12:00pm, De Anza Ballroom II-III
12:00pm	Lunch Break, 12:00pm-1:30pm
1:30pm	**402** Stellar Compact III: X-ray Binaries, Transients and ULX Sources, 1:30pm-3:00pm, De Anza Ballroom II-III
3:00pm	Break, 3:00pm-3:30pm
3:30pm	**403** AGN III: Transients and Low Luminosity/Mass AGN, 3:30pm-5:00pm, De Anza Ballroom II-III

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[1]
[1]Northwestern University/CIERA.

101.01 Microlensing Constraints on Quasar X-ray Emission Regions

Xinyu Dai[1], B. Chen[1], C.S. Kochanek[2], G. Chartas[3], C.W. Morgan[4], A.M. Mosquera[2], J.A. Blackburne[2]
[1]University of Oklahoma, [2]Ohio State University, [3]College of Charleston, [4]US Navy Academy.

101.02 X-ray Reverberation Lags in 1H0707-495 and IRAS 13224-3809

Erin Kara[1]
[1]Institute of Astronomy, United Kingdom.

101.03 X-ray Reverberation Mapping in AGN

Abderahmen Zoghbi[1], C.S. Reynolds[1], A.C. Fabian[2], E. Cackett[3]
[1]University of Maryland, [2]University of Cambridge, United Kingdom, [3]Wayne State University.

101.04 Fermi LAT Observations of Gamma-ray Flaring in the Gravitationally Lensed Blazar B0218+357

Chi (Teddy) C. Cheung[1], J.D. Scargle[2], R.H.D. Corbet[3, 4], Fermi-LAT Collaboration
[1]NRL, [2]NASA Ames, [3]UMBC, [4]NASA/GSFC.

101.05 Emergence of an Outflow in the Seyfert Galaxy Mrk 335 Revealed by XMM-Newton and HST

Anna Lia Longinotti[1, 2], Y. Krongold[3], G.A. Kriss[4], J. Ely[4], L.C. Gallo[5], D. Grupe[6], S. Komossa[7], S. Mathur[8], A.K. Pradhan[8]
[1]ESAC XMM-Newton SOC, Spain, [2]MIT Kavli Institute, [3]Universidad Nacional Autonoma de Mexico, Mexico, [4]Space Telescope Science Institute, [5]Department of Astronomy and Physics, St. Mary's University, Canada, [6]Department of Astronomy and Astrophysics, Pennsylvania State University, [7]Max Planck Institut fuer Radioastronomie, Germany, [8]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[1, 2], M. Cappi[3], J. Reeves[4], R. Nemmen[2], V. Braito[5], M. Gaspari[6], C.S. Reynolds[1]
[1]University of Maryland, [2]NASA/Goddard, [3]INAF-IASF, Italy, [4]Keele University, United Kingdom, [5]INAF-OA Brera, Italy, [6]MPA, Germany.

101.07 Zooming in on the Central Regions of a Radio-loud AGN -- 3C120

Anne M. Lohfink[1], C.S. Reynolds[1], E.D. Miller[2], R. Mushotzky[1], L. Brenneman[3]
[1]University of Maryland, [2]MIT, Kavli Institute for Astrophysics, [3]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[1, 2], Fermi Collaboration
[1]*INAF/IASF, Italy*, [2]*INFN, Italy*.

103.06 Magnetohydrodynamic Simulations of Oblique Pulsar Magnetospheres

Alexander Tchekhovskoy[1], A. Spitkovsky[1], J.G. Li[1]
[1]*Princeton University*.

103.07 New Results on the Spectral Evolution of Magnetar Bright Bursts

George A. Younes[1], C. Kouveliotou[2], A. van der Horst[3], GBM Magnetar Team
[1]*USRA/NASA-MSFC*, [2]*NASA-MSFC*, [3]*University of Amsterdam, Netherlands*.

103.08 Mass and Radius Constraints Using Magnetar Giant Flare Oscillations

Alex T. Deibel[1], A.W. Steiner[2], E.F. Brown[1, 3]
[1]*Michigan State University*, [2]*Institute for Nuclear Theory, University of Washington*, [3]*National Superconducting Cyclotron Laboratory*.

103.09 Anti-Glitch in the Magnetar 1E 2259+586

Robert F. Archibald[1], V.M. Kaspi[1], C. Ng[2, 1], K.N. Gourgouliatos[1], D. Tsang[1], P. Scholz[1], A.P. Beardmore[3], N. Gehrels[4], J.A. Kennea[5]
[1]*McGill, Canada*, [2]*The University of Hong Kong, Hong Kong*, [3]*University of Leicester, United Kingdom*, [4]*Goddard Space Flight Center*, [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[1]
[1]*Caltech*.

104.01 Future Development Trajectories for Imaging X-ray Spectrometers Based on Microcalorimeters

Caroline Kilbourne[1], S. Bandler[1, 2]
[1]*NASA Goddard Space Flight Center*, [2]*University of Maryland*.

104.02 The Future of X-ray Optics

Paul B. Reid[1], SAO, PSU, MSFC, GSFC, ESTEC
[1]*Harvard-Smithsonian Center for Astrophysics*.

The near vision (next 10 years) of X-ray astronomy in Japan

Takaya Ohashi[1]
[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 Finke[1]
[1]*US Naval Research Laboratory*.

105.01 Highlights of Recent Measurements and Constraints of the EBL Using Imaging Atmospheric Cherenkov Telescopes

Matthew Orr[1]
[1]*Iowa State University*.

105.02 The Detection of the Cosmic Gamma-ray Horizon

Alberto Dominguez[1], J. Finke[2], F. Prada[3, 4], J.R. Primack[5], F.S. Kitaura[6], B.D. Siana[1], D. Paneque[7, 8]
[1]*University of California, Riverside,* [2]*U.S. Naval Research Laboratory,* [3]*UAM-CSIC, Spain,* [4]*IAA-CSIC, Spain,* [5]*University of California, Santa Cruz,* [6]*AIP, Germany,* [7]*SLAC,* [8]*Max-Planck, Germany*.

105.03 Secondary TeV Gamma Rays from Distant Blazars, and Extragalactic Background Light

Alexander Kusenko[1, 2]
[1]*UCLA,* [2]*IPMU, Japan*.

105.04 The Imprint of the Extragalactic Background Light in the Gamma-ray Spectra of Blazars

Marco Ajello[1], R. Buehler[3], A. Reimer[2], Fermi-LAT Collaboration
[1]*Berkeley,* [2]*Innsbruck University, Austria,* [3]*Desy Zeuthen, Germany*.

105.05 Extragalactic Background Light up to the Epoch of Cosmic Reionization

Yoshiyuki Inoue[1], S. Inoue[2], M.A. Kobayashi[5], R. Makiya[4], Y. Niino[3], T. Totani[4], Y. Tanaka[6]
[1]*KIPAC/SLAC/Stanford,* [2]*MPIK, Germany,* [3]*NAOJ, Japan,* [4]*Kyoto University, Japan,* [5]*Ehime University, Japan,* [6]*Hiroshima University, Japan*.

106 Public Policy; Working Internationally

Monday, 4:15 PM - 5:45 PM, De Anza Ballroom II-III

Chair
Ann E. Hornschemeier[1]
[1]*NASA GSFC*.

106.01 The Atacama Large Millimeter/Submillimeter Array (ALMA) - A Successful Three-Way International Partnership Without a Majority Stakeholder

Paul A. Vanden Bout[1]
[1]*NRAO*.

106.02 Building International Space Observatories

Harvey Tananbaum[1]
[1]*Harvard-Smithsonian, CfA*.

106.03 NASA's Astrophysics Program

Paul L. Hertz[1]

[1]*NASA Headquarters*.

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 Tatum[1], T. Turner[1], L. Miller[2], J. Reeves[3, 1]

[1]UMBC, [2]University of Oxford, United Kingdom, [3]Keele University, United Kingdom.

108.02 Ten-year History of Warm Absorbers in Mrk 290: COS and FUSE Observations

Shuinai Zhang[1], L. Ji[1], T. Kallman[2], Y. Yao[3], Q. Gu[4], C.S. Froning[3]

[1]Purple Mountain Observatory, China, [2]Goddard space flight center, NASA, [3]Department of Astrophysical and Planetary Sciences, University of Colorado, [4]School of Astronomy and Space Science, China.

108.03 Simulating the Spectra of BAL QSOs with a Biconical Wind

Nicholas Higginbottom[1], K.S. Long[2], C. Knigge[1], S. Sim[3]

[1]University of Southampton, United Kingdom, [2]Space Telescope Science Institute, [3]Queens University, United Kingdom.

108.05 A Half-Megasecond X-ray Study of the ULIRG Mrk 231

Stacy H. Teng[1], S. Veilleux[2], D. Rupke[3]

[1]NASA/GSFC, [2]University of Maryland, [3]Rhodes College.

108.06 Chandra and VLA Observations of Supermassive Black Hole Outbursts in M87 and Implications for Feedback in Early-Type Galaxies

William R. Forman[1], E. Churazov[2, 3], C. Jones[1]

[1]SAO-CfA, [2]MPA, Germany, [3]IKI, Russian Federation.

108.07 Do Unification Models Explain the X-ray Properties of Radio Sources?

Belinda J. Wilkes[1], J. Kuraszkiewicz[1], M. Haas[2], P. Barthel[3], S.P. Willner[1], C. Leipski[4], D. Worrall[5], M. Birkinshaw[5], R.R.J. Antonucci[6], M. Ashby[1], R. Chini[7], G.G. Fazio[1], C.R. Lawrence[8], P.M. Ogle[9], B. Schulz[10]

[1]Harvard-Smithsonian, CfA, [2]Astronomisches Institut, Ruhr-University, Germany, [3]Kapteyn Institute, University of Groningen, Netherlands, [4]MPIA, Germany, [5]H.H. Wills Physics Laboraroty, University of Bristol, United Kingdom, [6]Department of Physics, University of California, [7]Instituto de Astronomia, Universidad Catolica del Norte, Chile, [8]JPL, [9]Spitzer Science Center,Caltech, [10]IPAC, Caltech.

108.08 Inclination-Dependent Active Galactic Nucleus Flux Profiles From Strong Lensing of The Kerr Spacetime

Bin Chen[1], X. Dai[1], E.A. Baron[1], R. Kantowski[1]

[1]University of Oklahoma.

108.09 Charged Off-equatorial Structures in Astrophysical Gravitational and Magnetic Fields

Jiri Kovar[1], P. Slany[1], V. Karas[2], Z. Stuchlik[1]

[1]Institute of Physics, Silesian University in Opava, Czech Republic, [2]Astronomical Institute, Academy of Sciences, Czech Republic.

108.10 First Statistical Tests for Clumpy Torii Models: Constraints

from RXTE Monitoring of Seyfert AGN

Alex Markowitz[1, 2], M. Krumpe[3, 1], R. Nikutta[4]

[1]UC, San Diego, [2]Karl Remeis Sternwarte, Germany, [3]European Southern Observatory, Germany, [4]Universidad Andres Bello, Chile.

108.11 Tackling the Soft X-ray Excess in AGN with Variability Studies

Anne M. Lohfink[1], C.S. Reynolds[1], R. Mushotzky[1], M. Nowak[2]

[1]University of Maryland, [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[1]

[1]Rice University

108.13 Probing the Evolving X-ray Sources of Accreting Black Holes

Dan Wilkins[1]

[1]University of Cambridge, United Kingdom.

108.14 Exploring Plasma Evolution During Flares from Sgr A*

Salome Dibi[1], S. Markoff[1], R. Belmont[2], J. Malzac[2], M. Nowak[3], F.K. Baganoff[3], J. Neilsen[4]

[1]Astronomical Institute Anton Pannekoek, Netherlands, [2]IRAP, France, [3]MIT, [4]Boston University.

108.15 Modeling X-ray Absorbers in AGNs with MHD-Driven Accretion-Disk Winds

Keigo Fukumura[1], D. Kazanas[2], C.R. Shrader[2], F. Tombesi[2, 3], J. Contopoulos[5], E. Behar[4]

[1]James Madison University, [2]NASA/GSFC, [3]NASA/GSFC/UMD, [4]Technion, Israel, [5]Academy of Athen, Greece.

108.16 First Results from the NuSTAR AGN Physics Program

Laura Brenneman[1], F. Fuerst[4], G. Matt[2], D. Walton[4], G.M. Madejski[3], A. Marinucci[2, 1], M. Elvis[1], G. Risaliti[10, 1], F. Harrison[4], D. Stern[5], S. Boggs[6], F. Christensen[7], W.W. Craig[8], W. Zhang[9], NuSTAR Team

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108.17 NuSTAR Observations of Blazar Mkn 421

Mislav Balokovic[1], M. Ajello[2], R.D. Blandford[2], S.E. Boggs[3], K. Boydstun[1], F. Christensen[4], W.W. Craig[3], A. Furniss[5], P. Giommi[6], C.J. Hailey[7], M. Hayashida[2], B. Humensky[7], Y. Inoue[2], J. Koglin[7], G.M. Madejski[2], D.L. Meier[8], P.M. Ogle[1], M. Perri[6], S. Puccetti[6], A.C.S. Readhead[1], D. Stern[8], G. Tagliaferri[9], C.M. Urry[10], A.E. Wehrle[11], W. Zhang[12], T. Nelson[13], D. Paneque[14]

[1]California Institute of Technology, [2]Stanford University, [3]University of California, [4]Technical University of Denmark, Denmark, [5]University of California, [6]ASI Science Data Center, Italy, [7]Columbia University, [8]Jet Propulsion Laboratory, [9]National Institute for Astrophysics, Italy, [10]Yale University, [11]Space Science Institute, [12]Goddard Space Flight Center, [13]University of MInnesota, [14]Max Planck Institute for Physics, Germany.

108.18 Probing AGN Shutdown on the Shortest Timescales

W. P. Maksym[1], W.C. Keel[1], V. Bennert[2], K. Schawinski[3], D. Chojnowski[4], C. Lintott[5], Galaxy Zoo

[1]University of Alabama, [2]California Polytechnic State University, [3]ETH Zürich, Switzerland, [4]University of Virginia, [5]Oxford University, United Kingdom.

108.19 An XMM View of 3C 411

Allison Bostrom[1], C.S. Reynolds[1], F. Tombesi[1]
[1]*University of Maryland*.

109 AGN Surveys and Catalogs Poster Session

De Anza Ballroom I

109.01 Photoionized X-ray Emission

Timothy R. Kallman[1]
[1]*NASA's GSFC*.

109.02 The Average 0.5-200 keV Spectrum of AGNs at z~0

David R. Ballantyne[1]
[1]*Georgia Institute of Technology*.

109.03 Full Spectral Survey of Active Galactic Nuclei in the Rossi X-ray Timing Explorer Archive

Elizabeth Rivers[1], A. Markowitz[1], R.E. Rothschild[1]
[1]*UCSD*.

109.05 Stripe 82 X: X-ray Survey of SDSS Stripe 82

Stephanie M. LaMassa[1], C.M. Urry[1], E. Glikman[1], N. Cappelluti[2], A. Comastri[2], H. Boehringer[3], G.T. Richards[4], S.S. Murray[5, 6]
[1]*Yale University*, [2]*INAF, Italy*, [3]*MPE, Germany*, [4]*Drexel University*, [5]*Johns Hopkins University*, [6]*Harvard-Smithsonian Center for Astrophysics*.

109.06 The Northern Galactic Cap AGN from the 58-month BAT Catalogue: A Comprehensive X-ray Spectral Study

Ranjan Vasudevan[1], W.N. Brandt[2], R. Mushotzky[1], L.M. Winter[4], W.H. Baumgartner[5], T. Shimizu[1], J.A. Nousek[2], D.P. Schneider[2], P. Gandhi[3]
[1]*University of Maryland*, [2]*Penn State University*, [3]*JAXA, Japan*, [4]*AER*, [5]*NASA/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 Koss[1], R. Mushotzky[2], W.H. Baumgartner[3], S. Veilleux[2], J. Tueller[3], C. Markwardt[3], C. Casey[1], N. Gehrels[3], Swift BAT Team
[1]*University of Hawaii*, [2]*University of Maryland*, [3]*NASA Goddard*.

109.08 The Combined Swift - INTEGRAL X-ray (SIX) Survey

Eugenio Bottacini[1], M. Ajello[2], J. Greiner[3]
[1]*Stanford University*, [2]*Space Science Laboratory*, [3]*Max-Plank-Institut für Extraterrestrische Physik, Germany*.

109.09 The NuSTAR View of the Extragalactic Sky

Francesca Civano[1], NuStar Extragalactic Team
[1]*Dartmouth College*

110 AGN/Galaxy Connections Poster Session

De Anza Ballroom I

110.01 The Dichotomous Evolution of AGN Host-galaxies

Andy D. Goulding[1], W.R. Forman[1], C. Jones[1], R.C. Hickox[2], S.S. Murray[3], Members of XDEEP2, Members of AGES
[1]Harvard Smithsonian, CfA, [2]Dartmouth College, [3]Johns Hopkins University.

110.02 A Correlation Between Star Formation Rate and Average Black Hole Accretion Rate in Star-forming Galaxies

Chien-Ting J. Chen[1], R.C. Hickox[1], S. Alberts[2], A. Pope[2], BoötesSurvey Collaboration
[1]Dartmouth College, [2]University of Massachusetts.

110.03 Observational Constraints on the Local Black Hole Occupation Fraction from X-ray Observations of Nearby (Formally) Inactive Galactic Nuclei

Elena Gallo[1], B.P. Miller[1]
[1]University of Michigan.

111 AGN/QSO Jets Poster Session

De Anza Ballroom I

111.01 Unifying Black Hole Jets Across the Mass Scale with Fermi and Swift

Rodrigo Nemmen[1], M. Georganopoulos[2], E.T. Meyer[3], S. Guiriec[1], N. Gehrels[1], R.M. Sambruna[4]
[1]NASA GSFC, [2]University of Maryland Baltimore County, [3]Space Telescope Science Institute, [4]George Mason University.

111.02 The Large Scale Jets of Powerful Quasars: Not as Fast, Not as Powerful, but Efficient Particle Accelerators

Markos Georganopoulos[1, 2], E.T. Meyer[3]
[1]UMBC, [2]NASA/GSFC, [3]STSCI.

111.03 Tracing the Origins of the Relativistic Jet Dichotomy - Accretion Mode, Spin, or Something More?

Eileen T. Meyer[1], M. Georganopoulos[2], G. Fossati[3], M.L. Lister[4]
[1]Space Telescope Science Institute, [2]University of Maryland, Baltimore County, [3]Rice University, [4]Purdue University.

111.04 What Did We Learn From Chandra, Xmm-Newton And Fermi-Lat About The High Energy Emission In Young Radio Sources?

Aneta Siemiginowska[1], M. Guainazzi[2], M. Hardcastle[3], B.C. Kelly[4], M. Kunert-Bajraszewska[5], G. Migliori[1], M. Sobolewska[1], L. Stawarz[6]
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112 Astroparticles Poster Session

De Anza Ballroom I

112.01 Energy Exchange Through Cross-Shock Potentials in Relativistic Plasma Shocks

Joseph Barchas[1], M.G. Baring[1]

[1]Rice University.

112.02 Recent Evidence for Gamma-ray Line Emission from Fermi-LAT: WIMP or Artifact?

Meng Su[1, 2], D.P. Finkbeiner[2]

[1]MIT, [2]Harvard University.

112.03 Cosmic Ray Electrons, Positrons and the Synchrotron emission of the Galaxy: consistent analysis and implications

Giuseppe Di Bernardo[1, 6], C. Evoli[4], D. Gaggero[3], D. Grasso[2, 7], L. Maccione[5, 8]

[1]University of Gothenburg, Sweden, [2]INFN, Italy, [3]SISSA, Italy, [4]University of Hamburg, Germany, [5]Max-Planck-Institut fur Physik, Germany, [6]Department of Astronomy and Theoretical Astrophysics Center, Universiity of California Berkeley, [7]Dipartimento di Fisica, University of Siena, Italy, [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[1], A. Cool[2], C.O. Heinke[3], H.N. Cohn[4], P.M. Lugger[4], R.P. Van Der Marel[5], J. Anderson[5]

[1]Northwestern University/CIERA, [2]San Francisco State University, [3]University of Alberta, Canada, [4]Indiana University, [5]Space Telescope Science Institute.

113.02 Striking Variability from the Globular Cluster Black Hole XMMU 122939.7+075333

Tana Joseph[1, 3], T.J. Maccarone[2], R.P. Kraft[3], G.R. Sivakoff[4], Chandra LP Team

[1]University of Southampton, United Kingdom, [2]Texas Tech University, [3]Harvard-Smithsonian Center of Astrophysics, [4]University of Alberta, Canada.

113.03 Spatially Resolved Spectroscopy of the Globular Cluster RZ2109 and the Nature of its Black Hole

Mark Peacock[1], S.E. Zepf[1], A. Kundu[2], T.J. Maccarone[3], K.L. Rhode[4], J.J. Salzer[4], C.Z. Waters[5], R. Ciardullo[6], C. Gronwall[6], D. Stern[7]

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113.04 Radio Continuum Observations of Black Holes and Neutron Stars in Galactic Globular Clusters

Jay Strader[1], L. Chomiuk[1, 4], T.J. Maccarone[3], J. Miler-Jones[5], A. Seth[2], S.M. Ransom[4], E. Noyola[6]

[1]Michigan State University, [2]University of Utah, [3]Texas Tech University, [4]NRAO, [5]Curtin University of Technology, Australia, [6]UNAM, Mexico.

114 Blazars and BL Lacs Poster Session

De Anza Ballroom I

114.01 Compton Dominance and the Blazar Sequence

Justin Finke[1]

[1]US Naval Research Laboratory.

114.02 Insight into the Blazar Emission Environment from X-ray

Absorption

Amy Furniss[1], M. Fumagalli[2], A. Falcone[3], D.A. Williams[1]
[1]Department of Physics, University of California Santa Cruz, [2]Department of Astrophysics, Princeton University, [3]Department of Astronomy and Astrophysics, Penn State University.

114.03 Highlights of the VERITAS Blazar Observation Program

Thomas Nelson[1], VERITAS Collaboration
[1]University of Minnesota.

114.04 Swift Monitoring of 3C 454.3 During a Prolonged Low Gamma-ray State

Stefano Vercellone[1], P. Romano[1]
[1]INAF-IASF Palermo, Italy.

114.05 A Systematic Study of Spectral Breaks in Gamma-Ray Flares of Blazars

Susanna Kohler[1], K. Nalewajko[1]
[1]JILA, University of Colorado and NIST.

114.06 Localizing the Brightest Blazar Gamma-ray Flare Ever

Amanda Dotson[1], M. Georganopoulos[1, 2]
[1]UMBC, [2]NASA Goddard Space Flight Center.

114.07 Two Swift Public Monitoring Programs on Fermi Blazars and Fermi Unassociated Sources

Abraham Falcone[1]
[1]Penn State University.

114.08 High-Energy Polarization Signatures of Leptonic and Hadronic Models for Blazars

Haocheng Zhang[1], M. Boettcher[2, 1]
[1]Ohio University, [2]North-West University, South Africa.

114.10 Multiwavelength Probes of Relativistic Shock Environs in Blazar Jets

Matthew G. Baring[1], M. Boettcher[2], E.J. Summerlin[3]
[1]Rice University, [2]North-West University, South Africa, [3]NASA's Goddard Space Flight Center.

114.11 Time Dependent Leptonic Modeling of Blazar Jets

Chris Diltz[1], M. Boettcher[1]

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. Christian[1], I. Ewing[1], D. Bodewits[2], K. Dennerl[3], C.M. Lisse[4], S.J. Wolk[5]
[1]California State University, [2]UMD, [3]Max-Planck-Institut fur extraterrestrische Physik, Germany, [4]JHU/APL, [5]Harvard-Smithsonian CfA.

X-rays via Charge Exchange from the Solar System and Beyond

Randall K. Smith[1], A. Foster[1], N.S. Brickhouse[1]
[1]Smithsonian Astrophysical Observatory.

Characterization of Solar Wind Charge Exchange with Suzaku

Eugenio Ursino[1], M. Galeazzi[1], T. Cravens[2], D. Koutroumpa[3], K.D. Kuntz[4], K. Mitsuda[5], I. Robertson[2], S. Snowden[6], N.Y. Yamasaki[5]

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116 Clusters & Surveys Poster Session

De Anza Ballroom I

116.01 XMM-Newton Observation of the IGR J17448-3232 Field

Nicolas Barriere[1], J. Tomsick[1]

[1]UC Berkeley - SSL.

116.02 A Supercluster at Redshift 1.71 in the Lockman Hole

J. P. Henry[1], K. Aoki[2], A. Finoguenov[3], S. Fotopoulou[4], G. Hasinger[1], M. Salvato[3], M. Tanaka[5], H. Suh[1]

[1]University of Hawaii, [2]Subaru Telescope, [3]MPE, Germany, [4]IPP, Germany, [5]IPMU, Japan.

116.03 Probing the Outskirts of Galaxy Clusters: Progress and Pitfalls

Eric D. Miller[1], M.W. Bautz[1], J.V. George[2], R. Mushotzky[2], D.S. Davis[3, 4], J.P. Henry[5]

[1]MIT, [2]U. Maryland, [3]GSFC, [4]U. Maryland, Baltimore County, [5]U. Hawaii.

116.04 The Outskirts of Galaxy Clusters: To r200 and Beyond with Suzaku, XMM-Newton and Chandra

Jithin V. George[1], R. Mushotzky[1], E.D. Miller[2], M.W. Bautz[2], D.S. Davis[3, 4], J.P. Henry[5]

[1]University of Maryland, [2]MIT, [3]GSFC, [4]University of Maryland, Baltimore County, [5]University of Hawaii.

116.05 Investigating the Properties of a WHIM Filament in the Shapley Supercluster

Eugenio Ursino[1], M. Galeazzi[1], I. Mitsuishi[2], A. Gupta[7], N.Y. Yamasaki[2], Y. Takei[2], T. Ohashi[3], K. Sato[4], J.P. Henry[5], R.L. Kelley[6]

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116.06 CLoGS - The Complete Local-Volume Groups Survey

Jan M. Vrtilek[1], E. O'Sullivan[1], L.P. David[1], K. Kolokythas[2], S. Giacintucci[3], S. Raychaudhury[2], T.J. Ponman[2]

[1]Harvard-Smithsonian, CfA, [2]University of Birmingham, United Kingdom, [3]University of Maryland.

116.07 The Infall of the MCG+10+24-117 Into the NGC 6338 Galaxy Cluster

Renato A. Dupke[1, 2], S. Martins[2]

[1]University of Michigan, [2]Observatorio Nacional, Brazil.

116.09 Dulling Occam's Razor: ICM Enrichment, the Elliptical Galaxy IMF, and the Diversity of Star Formation

Michael Loewenstein[1]

[1]NASA's GSFC/UMCP/CRESST.

116.10 Characterization of ICM Temperature Distributions of 62 Galaxy Clusters with XMM-Newton

Kari A. Frank[1], J.R. Peterson[1], K. Andersson[2], A.C. Fabian[3], J. Sanders[3]
[1]Purdue University, [2]Ludwig-Maximilians-Universität, Germany, [3]Institute of Astronomy, United Kingdom.

116.11 A Deep XMM-Newton Look at the Most Powerful Radio Halo Merging Galaxy Cluster MACSJ0717.5+3745

Evan Million[1], J. Irwin[1], K. Wong[1], M. Yukita[1]
[1]University of Alabama.

116.12 Metallicity Distributions of the Innermost 100 kpc of Galaxy Clusters

Ka-Wah Wong[1], M. Yukita[1], E. Million[1], J. Irwin[1]
[1]University of Alabama - Tuscaloosa.

116.13 Cosmic Ray Dynamics Inside the Cygnus A Radio-X-ray Cavity

William G. Mathews[1], F. Guo[1]
[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[1], C.S. Reynolds[1, 2], T. Bogdanovic[3]
[1]University of Maryland, [2]Joint Space Science Institute (JSI), UMD, [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[1, 2], M.L. Markevitch[2]
[1]Center for Astrophysics, [2]NASA/GSFC.

116.18 First Results from the Chandra COSMOS Legacy Survey: A New Window on the High-z Universe

Francesca M. Civano[1, 2], Chandra COSMOS Legacy Survey Team
[1]Dartmouth College, [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[1, 2], T. Dauser[3], C.S. Reynolds[2], T.R. Kallman[4], J.E. McClintock[1], R. Narayan[1], J. Wilms[3], W. Eikmann[3]
[1]Harvard-Smithsonian Center for Astrophysics, [2]University of Maryland, [3]Karl Remeis-Observatory and Erlangen Centre for Astroparticle Physics, Germany, [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[1]
[1]University of Iowa.

117.03 Modeling the Background in the HETGS Observations of the Galactic Center

John E. Davis[1]
[1]MIT.

117.04 Statistical Methods in XSPEC

Keith A. Arnaud[1]
[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[3], C. Wilson[3], A. Camero-Arranz[4], 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

119.01 The Advanced X-ray Spectroscopic Imaging Observatory (AXSIO): Mission and Technology Overview

Jay A. Bookbinder[1], R.K. Smith[1], A. Ptak[2], R. Petre[2], N.E. White[2], J.N. Bregman[3]
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119.02 AXSIO: The Science Return of a High-Resolution Spectroscopic X-ray Observatory

Randall K. Smith[1], J.A. Bookbinder[1], A. Ptak[3], R. Petre[3], N.E. White[3], J.N. Bregman[2]
[1]Smithsonian Astrophysical Observatory, [2]University of Michigan, [3]NASA's Goddard Space Flight Center.

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

Simon Bandler[3, 2], J.D. Adams[3, 2], S.E. Busch[2], J.A. Chervenak[2], M.E. Eckart[3, 2], F.M. Finkbeiner[2], C. Kilbourne[2], S. Lee[2], F.S. Porter[2], J. Porst[3, 2], J.E. Sadleir[2], S.J. Smith[3, 2], W.B. Doriese[1], J.W. Fowler[1], G.C. Hilton[1], K. Irwin[1], C.D. Reintsema[1], J.N. Ullom[1]
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119.04 Developments in Off-Plane X-ray Reflection Grating Spectrometers

Randall L. McEntaffer[1], Off-Plane X-ray Grating Spectrometer (OP-XGS) Team
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119.05 Critical-angle Transmission Grating Development for AXSIO

Mark W. Bautz[1], R.K. Heilmann[1], M. Schattenburg[1], H.L. Marshall[1], D. Huenemoerder[1], D. Dewey[1], N.S. Schulz[1], J.E. Davis[1]
[1]MIT.

119.06 Laboratory Progress Toward a Soft X-ray Polarimeter

Herman L. Marshall[1], N.S. Schulz[1], R.K. Heilmann[1]
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119.07 X-Ray Polarimetery of Neutron Stars from a CubeSat

Philip Kaaret[1]
[1]University of Iowa.

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

Patrizia Romano[1], V. Mangano[1], E. Bozzo[2], P. Esposito[3], C. Ferrigno[2]
[1]INAF-IASF Palermo, Italy, [2]ISDC, Switzerland, [3]INAF-IASF Milano, Italy.

120 Galaxies, ISM Poster Session

De Anza Ballroom I

120.02 In Search of Bok Globules in the X-Ray

Michael L. McCollough[1]
[1]Harvard-Smithsonian, CfA.

120.03 Revisiting the Interstellar Abundances Toward X Per

Lynne A. Valencic[1, 2], R.K. Smith[3]
[1]Johns Hopkins University, [2]NASA-GSFC, [3]SAO-CfA.

120.04 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[3], 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[2], K. Bechtol[3], S.E. Boggs[4], F. Christensen[5], W.W. Craig[4], C.J. Hailey[6], F. Harrison[7], A.E. Hornschemeier[1], B. Lehmer[1, 8], J. Leyder[1, 12], T.J. Maccarone[9], 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. Baker[1], B. Giacomazzo[2], J. Kanner[1], B.J. Kelly[1, 3], J. Schnittman[1]
[1]*NASA/GSFC*, [2]*University of Colorado/JILA*, [3]*University of Maryland - Baltimore County*.

121.02 Prospects for GW Transients in Early Advanced LIGO and Virgo Science Runs

Larry Price[1], David Reitze[1], LIGO Scientific Collaboration, Virgo Collaboration
[1]*Caltech*.

121.03 Proposed Atom Interferometry Gravitational Wave Measurements Over a Single Baseline

Peter L. Bender[1]
[1]*JILA, 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. Stebbins[1]
[1]*NASA 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. Savin[1], M. Hahn[1], A. Becker[2, 3], D. Bernhardt[2], M. Grieser[3], C. Krantz[3], M. Lestinksy[4], A. Mueller[2], O. Novotny[1], R. Repnow[3], S. Schippers[2], K. Spruck[2], A. Wolf[3]
[1]*Columbia Astrophysics Lab.*, [2]*Justus-Liebig-Universitaet, Germany*, [3]*Max-Planck-Institut fuer Kernphysik, Germany*, [4]*GSI 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. Brown[1], Hi-Light Collaboration
[1]*LLNL*.

122.03 Low Charge States of Si and S: from Cygnus X-1 to the Lab and Back

Natalie Hell[1, 2], I. Miškovičova[1], M. Hanke[1], G.V. Brown[2], J. Wilms[1], J. Clementson[2, 3], P. Beiersdorfer[2], D.A. Liedahl[2], K. Pottschmidt[5, 4], F. Porter[4], C. Kilbourne[4], R.L. Kelley[4], M. Nowak[6], N.S. Schulz[6]
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122.04 Extreme Ultraviolet Emission Lines of Iron Fe XI-XIII

Jaan Lepson[1], P. Beiersdorfer[2], G.V. Brown[2], D.A. Liedahl[2], N.S. Brickhouse[3], A.K. Dupree[3]
[1]*University of California*, [2]*Lawrence Livermore National Laboratory*, [3]*Center for Astrophysics*.

122.05 Magnetized Collisionless Shock Studies Using High Velocity Plasmoids

Thomas Weber[1], T. Intrator[1]
[1]*LANL*.

122.06 Magnetic Micro-turbulence: Relation of Electron Diffusion to Their Emitted Radiation Spectra

Mikhail Medvedev[1], B. Keenan[1]
[1]*University of Kansas*.

122.07 Laboratory Observation of Magnetic Field Growth Driven by Shear Flow

Thomas Intrator[1], L. Dorf[1], X. Sun[1], J. Sears[1], T. Weber[1], Y. Feng[1]
[1]*Los Alamos National Laboratory*.

122.08 Radiative Cooling of Non-equilibrium Ionization Plasmas Based on AtomDB

Li Ji[1], X. Zhou[1], S. Zhang[1], A. Foster[2], R.K. Smith[2], N.S. Brickhouse[2]
[1]*Purple Mountain Observatory, CAS, China*, [2]*Harvard-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. Abeysekara[1], Milagro Collaboration
[1]*Michigan State University*.

123.02 Monitoring the Hard X-ray/Soft Gamma-Ray Sky with Fermi/GBM - The First Four Years

Gary L. Case[1], E. Beklen[7], A. Camero-Arranz[6], V. Chaplin[4], M.L. Cherry[2], M.H. Finger[5], P. Jenke[4], J. Rodi[2], J. Taylor[2], C. Wilson[3]
[1]*La Sierra University*, [2]*Louisiana State University*, [3]*Marshall Space Flight Center*, [4]*University of Alabama, Huntsville*, [5]*Universities Space Research Association*, [6]*Instituto de Cienceas del Espacio, Spain*, [7]*Suleyman Demiel University, Turkey*.

123.04 Twelve Years of Education and Public Outreach with the *Fermi Gamma-ray Space Telescope*

Lynn R. Cominsky[1], K.M. McLin[1], A. Simonnet[1], Fermi E/PO Team
[1]*Sonoma State University*

123.05 The *NuSTAR* Education and Public Outreach Program

Lynn R. Cominsky[1], K.M. McLin[1], S.E. Boggs[2], F. Christensen[3], C.J. Hailey[4], F. Harrison[5], D. Stern[6, 5], W. Zhang[7], NuSTAR Team
[1]*Sonoma State University*, [2]*UC Berkeley*, [3]*Technical University of Denmark, Denmark*, [4]*Columbia*, [5]*Caltech*, [6]*JPL*, [7]*NASA Goddard Space Flight Center*.

123.06 Performance, Goals, and Status of the Upcoming Nuclear Compton Telescope Balloon Campaigns

Alexander Lowell[1], N. Barriere[1], S.E. Boggs[1], J. Tomsick[1], P. von Doetinchem[1], A. Zoglauer[1], M. Amman[2], P. Luke[2], P. Jean[3], P. von Ballmoos[3], H. Chang[4], J. Chiu[4], C. Yang[4], J. Shang[4], C.H. Lin[5], Y. Chou[6], Y.H. Chang[7]
[1]*Space Sciences Laboratory, UC Berkeley*, [2]*Lawrence Berkeley National Laboratory*, [3]*Research Institute in Astrophysics and Planetology, France*, [4]*Institute of Astronomy, National Tsing Hua University, Taiwan*, [5]*Institute of Physics, Academia Sinica, Taiwan*, [6]*Institute of Astronomy, National Central University, Taiwan*, [7]*Department of Physics, National Central University, Taiwan*.

123.07 The Black Hole Evolution and Space Time (BEST) Observatory

Henric Krawczynski[1], J. Tueller[2], S.D. Barthelmy[2], J. Schnittman[2], W. Zhang[2], J.H. Krolik[3], M.G. Baring[4], E. Treister[5], R. Mushotzky[6], M. Beilicke[1], F. Kislat[1], A. Zajczyk[1], J.H. Buckley[1], R. Cowsik[1], M.H. Israel[1]

[1]Washington Univ, St. Louis, [2]NASA Goddard Space Flight Center, [3]John Hopkins University, [4]Rice University, [5]Universidad de Concepcion, Chile, [6]University of Maryland.

123.08 Critical Developments Toward Building Laue Lenses for Gamma-Ray Astronomy

Nicolas Barriere[1], J. Tomsick[1], S.E. Boggs[1], A. Lowell[1], C. Wade[2], M. Jentschel[3], P. von Ballmoos[4]

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123.09 A Combined Compton and Coded Mask Telescope for Gamma-Ray Astrophysics

Michelle Galloway[1], A. Zoglauer[1], S.E. Boggs[1], M. Amman[2]

[1]Space Sciences Laboratory, University of California at Berkeley, [2]Lawrence Berkeley National Laboratory.

123.10 The First Science Flight of the Gamma-RAy Polarimeter Experiment (GRAPE)

Peter F. Bloser[1], M.L. McConnell[1], T. Connor[1], C. Ertley[1], J.S. Legere[1], J.M. Ryan[1]

[1]University of New Hampshire.

123.11 PETS - A GRB Polarimetry Mission on the International Space Station

Mark L. McConnell[1], M.G. Baring[2], P.F. Bloser[1], J. Greiner[3], A.K. Harding[4], D. Hartmann[5], J.E. Hill[4], P. Kaaret[6], R.M. Kippen[7], M. Pearce[8], N. Produit[9], P. Roming[10], J.M. Ryan[1], F. Ryde[8], T. Sakamoto[11], K. Toma[12], B. Zhang[13]

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123.12 Solar Particle Acceleration and The Gamma Ray Imager/Polarimeter for Solar Flares (GRIPS) Instrument

Nicole Duncan[1, 2], A.Y. Shih[3], G.J. Hurford[2], P. Saint-Hilaire[2], H. Bain[2], A. Zoglauer[2], R.P. Lin[1, 2], S.E. Boggs[1, 2]

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123.13 Pushing the Boundaries of X-ray Grating Spectroscopy in a Suborbital Rocket

Randall L. McEntaffer[1], Off-Plane Grating Rocket Experiment (OGRE) Team

[1]University of Iowa.

123.14 The Focusing Optics X-ray Solar Imager (FOXSI): Instrument and First Flight

Lindsay Glesener[1], S. Christe[2], S. Ishikawa[3], B. Ramsey[4], T. Takahashi[5, 6], S. Saito[5, 6], R.P. Lin[1, 7], S. Krucker[1, 8], FOXSI Team

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123.15 Latest Advancements in Microchannel Plate Detectors

John Vallerga[1], O. Siegmund[1], J.B. McPhate[1], A. Tremsin[1], B. Welsh[1], H. Frisch[2], R.G. Wagner[3], J. Elam[3], A. Mane[3], G. Varner[4]

[1]University of California, Berkeley, [2]University of Chicago, [3]Argonne National Laboratory, [4]University of Hawaii.

123.16 The Science Payload of the LOFT Mission

Marco Feroci[1], J. den Herder[2], M. van der Klis[3], P.S. Ray[11], T. Takahashi[10], J. Wilms[9], D. Barret[8], E. Bozzo[6], S. Zane[13], L. Stella[12], S. Brandt[4], M. Pohl[6], M. Hernanz[5], A. Santangelo[7], A. Watts[3], LOFT Team

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123.17 The Hard X-ray Polarimeter X-Calibur - Astrophysical Motivation and Performance

Matthias Beilicke[1], M.G. Baring[3], J. Tueller[2], H. Krawczynski[1], S.D. Barthelmy[2], W. Binns[1], J.H. Buckley[1], R. Cowsik[1], Q. Guo[1], M.H. Israel[1], F. Kislat[1], H. Matsumoto[4], T. Okajima[2], J. Schnittman[2]

[1]Washington University of ST.LOUIS, [2]Goddard Space Flight Center, [3]Rice University, [4]Nagoya University, Japan.

123.18 Characterization of Si Hybrid CMOS Detectors for use in the Soft X-ray Band

Zachary Prieskorn[1], C. Griffith[1], S. Bongiorno[1], A. Falcone[1], D.N. Burrows[1]

[1]Penn State University.

123.19 Using ACIS on the Chandra X-ray Observatory as a Particle Radiation Monitor

Catherine E. Grant[1], P.G. Ford[1], M.W. Bautz[1], S.L. O'Dell[2]

[1]MIT, [2]NASA Marshall Space Flight Center.

123.20 CCD Performance Evolution on Chandra and Suzaku

Beverly LaMarr[1], C.E. Grant[1], E.D. Miller[1], M.W. Bautz[1]

[1]Massachusetts 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

Paul P. Plucinsky[1], A.P. Beardmore[2], J.M. DePasquale[1], D. Dewey[3], A. Foster[1], F. Haberl[4], E.D. Miller[3], A. Pollock[5], J. Posson-Brown[1], S. Sembay[2], R.K. Smith[1]

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123.22 The TEST Pilot Sounding Rocket Payload

Benjamin R. Zeiger[1], W.C. Cash[2], D. Swetz[3], Randall McEntaffer[4]

[1]NASA-GSFC, [2]University of Colorado, [3]National Institute of Standards and Technology, [4]Iowa State University.

123.24 Performance of the ASTRO-H Soft X-ray Telescope (SXT-1)

Takashi Okajima[1], P.J. Serlemitsos[1], Y. Soong[1]

[1]NASA'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 Balsamo[1, 3], T. Okajima[2], K. Gendreau[2], Z. Arzoumanian[2], L. Jalota[3, 2], Y. Soong[3, 2], P.J. Serlemitsos[2]

[1]University of Maryland Baltimore County, [2]NASA Goddard Space Flight Center, [3]Center 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[3], D.A. Schwartz[1], S. Trolier-McKinstry[3], A. Vikhlinin[1], R. Wilke[3]

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123.29 SMART-X: Square Meter, Arcsecond Resolution Telescope for X-rays

Alexey Vikhlinin[1], SMART-X Collaboration

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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]

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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[3], P. Caraveo[4], 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[3], G. Bonnoli[3], G. Pareschi[3], G. Tosti[4], P. Caraveo[5], ASTRI Collaboration

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123.33 Results and Highlights from the Pierre Auger Observatory

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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]

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124.02 Radiation from Accelerated Particles in Relativistic Jets with Shocks, Shear-flow, and Reconnection

Ken-Ichi Nishikawa[1]
[1]*NSSTC*.

124.03 GRB Flares: A New Detection Algorithm, Previously Undetected Flares, and Implications on GRB Physics

Craig A. Swenson[1], P. Roming[2, 1]
[1]*The Pennsylvania State University*, [2]*Southwest Research Institute*.

124.05 Could High-energy Gamma-ray Photon Emission be Associated to External Shocks?

Nissim I. Fraija[1], M. Gonzalez[1], R. Sacahui[1], J.L. Ramirez[2], W.H. Lee[1]
[1]*IA-UNAM, Mexico*, [2]*IF-UNAM, Mexico*.

124.06 High-Energy Neutrino Oscillation in Hidden Jets from GRBs

Nissim I. Fraija[1]
[1]*IA-UNAM, Mexico*.

124.07 Propogation and Neutrino Oscillations in the Base of a Highly Magnetized Gamma-ray Burst Fireball Flow

Nissim I. Fraija[1]
[1]*IA-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. Leutenegger[1], D.H. Cohen[2], J. Sundqvist[3, 4], S.P. Owocki[3]
[1]*NASA/GSFC*, [2]*Swarthmore College*, [3]*University of Delaware*, [4]*Universitaetssternwarte Muenchen, Germany*.

125.02 New Line Identifications in the Spectrum of Procyon Observed with the Chandra X-ray Observatory

Peter Beiersdorfer[1], J. Lepson[2], P. Desai[2], F. Diaz[3], Y. Ishikawa[3]
[1]*LLNL*, [2]*Space Sciences Laboratory*, [3]*University 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 Chomiuk[1, 2], T. Nelson[3], K. Mukai[4, 5], J.L. Sokoloski[6], M.P. Rupen[2], J. Weston[6], Y. Zheng[6], A.J. Mioduszewski[2], N. Roy[2], M.I. Krauss[2]
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126.02 The E-Nova Project: Insights from X-ray Observations

Koji Mukai[1], T. Nelson[2], L. Chomiuk[3], J.L. Sokoloski[4], A.J. Mioduszewski[5], M.P. Rupen[5], J. Weston[4], Y. Zheng[4]
[1]*UMBC and NASA/GSFC/CRESST*, [2]*University of Minnesota*, [3]*Michigan State University*, [4]*Columbia University*, [5]*NRAO*.

126.03 The Effect of Micro-lensing in Eclipsing Binary-star Systems

Kelsey L. Hoffman[1], J. Rowe[2], B. Hansen[3]
[1]CITA, Canada, [2]NASA-Ames / SETI Institute, [3]University of Toronto, Canada.

126.04 Characterization of New Hard X-ray Cataclysmic Variables

Federico Bernardini[1], Observatory of Naples, CEA Saclay, Dipartimento di Fisica, Universitá Roma III, INAF, CRESST, Laboratory of APC
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126.05 On the X-ray Variability and Disk Truncation in Dwarf Novae

Solen Balman[1], M. Revnivtsev[2]
[1]METU, Turkey, [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[1], C. Venter[2], A.K. Harding[3], J.E. Grove[4]
[1]NRC Fellow at NRL, [2]North-West University, South Africa, [3]NASA GSFC, [4]Naval Research Laboratory.

126.08 Pulsar Astrophysics at Very High Energies in the Fermi-HAWC Era

Pablo Saz Parkinson[1, 2], A. Belfiore[1, 2], HAWC Collaboration, Fermi LAT Collaboration
[1]UC, Santa Cruz, [2]Santa Cruz Institute for Particle Physics.

126.09 Hard X-ray Emission by Resonant Compton Upscattering in Magnetars

Zorawar Wadiasingh[1], M.G. Baring[1], P.L. Gonthier[2]
[1]Rice University, [2]Hope College.

126.10 On the X-ray Variability of Magnetar 1RXS J170849.0-400910

Paul Scholz[1], V.M. Kaspi[1], C. Ng[2], Robert F. Archibald[1]
[1]McGill University, Department of Physics, Canada, [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[2, 1], C. He[2], V.M. Kaspi[2]
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126.13 Magnetic Pair Creation Transparency in Pulsars

Sarah Story[1], M.G. Baring[1]
[1]Rice University.

126.14 Compton Scattering Cross Sections in Strong Magnetic Fields: Advances for Neutron Star Applications

Matthew Eiles[1], P.L. Gonthier[1], M.G. Baring[2], Z. Wadiasingh[2]
[1]Hope College, [2]Rice University.

126.15 A Complete Set of Timing Solutions for all Three Anti-Magnetars

Eric V. Gotthelf[1], J.P. Halpern[1]
[1]Columbia Astrophysics Lab.

126.16 Population Synthesis of Radio and Y-ray Normal, Isolated Pulsars Using Markov Chain Monte Carlo

Caleb Billman[1], P.L. Gonthier[1], A.K. Harding[2]
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126.17 Population Synthesis of Radio and Y-ray Millisecond Pulsars Using Markov Chain Monte Carlo

Peter L. Gonthier[1], C. Billman[1], A.K. Harding[2]
[1]*Hope College*, [2]*NASA Goddard Space Flight Center*.

126.18 A Multi-wavelength Campaign to Study Crab Giant Pulses

Walid A. Majid[1]
[1]*JPL/Caltech*.

126.19 Suzaku Observations of Orbital Phase-Dependent Dipping and Obscuration in Cyg X-1

Michael Nowak[1], J. Wilms[2], K. Pottschmidt[3], N.S. Schulz[1]
[1]*MIT Kavli Institute*, [2]*Dr. Karl Remeis-Stermwarte and Erlangen Centre for Astroparticle Physics, Germany*, [3]*CRESST, UMBC, and NASA GSFC*.

126.20 Influence of Non-geodesic Effects on Black Hole Spin Estimations Obtained from QPO Models

Jiri Kovar[1], E. Sramkova[1], G. Torok[1], P. Bakala[1], Z. Stuchlik[1]
[1]*Silesian University in Opava, Czech Republic*.

126.21 Diskoseismology and QPOs Confront Black Hole Spin

Robert V. Wagoner[1], M. Ortega-Rodriguez[2]
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126.22 Discovering Nearby Compact Objects with Gravitational Lensing

Rosanne Di Stefano[1], F. Primini[1]
[1]*Harvard-Smithsonian CfA*.

126.23 A Swift Survey of Accretion onto Stellar-Mass Black Holes

Mark Reynolds[1], J.M. Miller[1]
[1]*University of Michigan*.

126.24 The Quiescent X-ray Spectrum: Constraints from Stellar Mass Black Holes

Mark Reynolds[1], R.C. Reis[1], J.M. Miller[1], E. Cackett[2], N. Degenaar[1]
[1]*University of Michigan*, [2]*Wayne State University*.

126.25 Constraints on Deviations from the Kerr Metric by XTE J1550-564

Tim Johannsen[1, 2], D. Psaltis[3], J.F. Steiner[4]
[1]*University of Waterloo, Canada*, [2]*Perimeter Institute for Theoretical Physics, Canada*, [3]*University of Arizona*, [4]*Harvard-Smithsonian Center for Astrophysics*.

126.26 Evidence of Energy-dependence of Power Spectral States of Black Hole Binaries and the Origin of the X-ray Variability

Wenfei Yu[1], W. Zhang[1]
[1]*Shanghai Astronomical Observatory, China*.

126.27 Using CCI to Unravel the States of GRS 1915+105

Charith Peris[1, 2], S. Buchan[1, 3], S.D. Vrtilek[1]
[1]*Harvard-Smithsonian Center for Astrophysics*, [2]*Northeastern University*, [3]*University 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. Cambier[1], D.M. Smith[1]
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126.29 Properties and Distribution of Current Sheets in Accretion Disk Coronae

Greg Salvesen[1, 2], M.C. Begelman[2], J.B. Simon[2], K. Beckwith[2, 3]
[1]*University of Colorado at Boulder,* [2]*JILA,* [3]*Tech-X Corporation.*

126.30 Testing the Stability of Three-Dimensional Hoyle-Lyttleton Accretion with Large Upstream Gradients

Eric Raymer[1], J.M. Blondin[1]
[1]*North Carolina State University.*

126.31 A Hybrid Model for the Spectra of Neutron Star Accretion Columns Including Comptonization and Cyclotron Lines

Fritz-Walter Schwarm[1, 2], G. Schönherr[3], P.A. Becker[4], M.T. Wolff[5], J. Wilms[1, 2], C. Ferrigno[6], B. West[4]
[1]*Dr. Remeis-Sternwarte Bamberg, Germany,* [2]*Erlangen Centre for Astroparticle Physics (ECAP), Germany,* [3]*Leibniz-Institut für Astrophysik, Germany,* [4]*Center for Earth Observing and Space Research, George Mason University,* [5]*Space Science Division, Naval Research Laboratory,* [6]*INTEGRAL Science Data Centre, Switzerland.*

126.32 Accretion Regime of A0535+26 During its 2011 Giant Outburst

Isabel Caballero[1], M. Kühnel[3], K. Pottschmidt[2], J. Zurita Heras[8], D. Marcu[2], S. Müller[3], P. Laurent[1, 8], D. Klochkov[4], P. Kretschmar[5], C. Ferrigno[6], I. Kreykenbohm[3], J. Wilms[3], R.E. Rothschild[7], A. Santangelo[4], R. Staubert[4], S. Suchy[4]
[1]*AIM/CEA Saclay, France,* [2]*CRESST UMBC/NASA GSFC,* [3]*Dr. Karl Remeis-Sternwarte and ECAP, FAU Erlangen-Nuremberg, Germany,* [4]*Institut fuer Astronomie und Astrophysik,University of Tuebingen, Germany,* [5]*ESAC/ESA, Spain,* [6]*ISDC Data Centre for Astrophysics, Switzerland,* [7]*Center for Astrophysics and Space Science, USDC,* [8]*APC, France.*

126.33 High-Mass X-ray Binaries in our Backyard: Studying Their Formation and Evolution in the Magellanic Clouds

Vallia Antoniou[1]
[1]*Iowa State University.*

126.34 Exposing the Symbiosis of 3A 1954+319

Katja Pottschmidt[1, 2], D.M. Marcu[1, 2], N. Hell[3, 4], F. Fuerst[5], I. Miškoviča[3], S. Müller[3], V. Grinberg[3], R.H.D. Corbet[1, 2], J. Wilms[3]
[1]*University of Maryland - Baltimore County,* [2]*NASA Goddard Space Flight Center,* [3]*Dr. Karl-Remeis-Sternwarte and Erlangen Centre for Astroparticle Physics, Germany,* [4]*Lawrence Livermore National Laboratory,* [5]*Space Radiation Laboratory Caltech.*

126.35 Cyclotron Line Measurements and a Torque Reversal in 4U 1538-522 as Seen by INTEGRAL

Paul B. Hemphill[1], R.E. Rothschild[1], K. Pottschmidt[3, 6], I. Caballero[2], M. Kühnel[4, 7], F. Fuerst[5], J. Wilms[4, 7]
[1]*CASS/UCSD,* [2]*CEA Saclay, France,* [3]*CRESST/NASA-GSFC,* [4]*Dr. Karl Remeis-Observatory, Germany,* [5]*Caltech,* [6]*UMBC,* [7]*ECAP, Germany.*

126.36 The Accreting Pulsar XTE J1946+274: Further Indication for a Cyclotron Line from Suzaku?

Diana Marcu[1, 2], K. Pottschmidt[1, 2], S. Müller[3], M. Kühnel[3], I. Caballero[4], F. Fuerst[5], A. Mahmoud[6], I. Kreykenbohm[3], D. Klochkov[6], R.E. Rothschild[7], Y. Terada[8], T. Enoto[9], W. Iwakiri[8], M. Nakajima[10], J. Wilms[3]
[1]*UMBC,* [2]*CRESST,GSFC,* [3]*Dr. Karl Remeis-Sternwarte and ECAP, Germany,* [4]*CNRS/CEA/Université P. Diderot, France,* [5]*California Institute of Technology,* [6]*IAAT, Germany,* [7]*CASS UCSD,* [8]*Saitama University,*

Japan, [9]RIKEN, Japan, [10]Nihon University, Japan.

126.37 Toward a New Spectral Modeling Capability for Accreting X-Ray Pulsars

Michael T. Wolff[1], P.A. Becker[4], D. Marcu[2], K. Pottschmidt[2], J. Wilms[3], K.S. Wood[1]
[1]NRL, [2]UMBC, [3]Universitat Erlangen-Nuernberg, Germany, [4]GMU.

126.38 A New Method to Search for Quiescent Low-Mass X-ray Binary

Ping Zhao[1], J.E. Grindlay[1], J. Hong[1], M. Servillat[2], M. Van Den Berg[3]
[1]Harvard-Smithsonian, CfA, [2]CEA Saclay, France, [3]University of Amsterdam, Netherlands.

126.39 A Multiwavelength Study of the Field Low Mass X-Ray Binaries in the Bulge of M31

Arunav Kundu[1, 2], D. Maitra[3], T.J. Maccarone[4], S.E. Zepf[5], M. Peacock[5]
[1]Eureka Scientific, [2]TIFR, India, [3]University of Michigan, [4]Texas Tech University, [5]Michigan State University.

126.40 Monitoring the Spectral and Flux Evolution of MAXI Discovered Galactic Black Hole Candidates with Swift

Jamie A. Kennea[1], P. Romano[2], V. Mangano[2], H.A. Krimm[3], K. Yamaoka[4], H. Negoro[5], P. Evans[6], A.P. Beardmore[6]
[1]Penn State University, [2]ISTITUTO DI ASTROFISICA SPAZIALE E FISICA COSMICA, Italy, [3]NASA/GSFC & CRESST, [4]ISAS/JAXA, Japan, [5]NIHON UNIVERSITY, Japan, [6]UNIVERSITY OF LEICESTER, United Kingdom.

126.42 Probing the Accretion-flow Dynamics using an Energy Dependent Timing Analysis in Black Hole X-ray Binaries

Maithili Kalamkar[1], M. van der Klis[1], P. Uttley[1], D. Altamirano[1], R. Wijnands[1]
[1]University 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 Pasham[1, 2], T.E. Strohmayer[2]
[1]University of Maryland College Park, [2]NASA/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 Krawczynski[1]
[1]Washington Univ, St. Louis.

126.45 Constraints on R-mode Amplitudes in LMXB Neutron Stars: Probing the Phases of Ultra-dense Matter

Simin Mahmoodifar[1], T.E. Strohmayer[2]
[1]University of Maryland, [2]NASA's GSFC.

126.46 Collisionally Heated Disk Dynamics and Torque Reversals in the Ultracompact Binary 4U 1626-67

Norbert S. Schulz[1], H.L. Marshall[1], D. Chakrabarty[1]
[1]MIT.

126.47 The Spectral Evolution along the Z Track of the Bright Neutron Star X-Ray Binary GX 17+2

Dacheng Lin[1], R.A. Remillard[2], J. Homan[2], D. Barret[1]
[1]IRAP, France, [2]MIT.

126.48 Preliminary Results of the NuSTAR Galactic Center Mini-survey

Shuo Zhang[1], F.K. Baganoff[2], N. Barriere[3], F.E. Bauer[4], S.E. Boggs[3], F. Christensen[5], W.W. Craig[3], F. Dufour[6], E.V. Gotthelf[1], J.E. Grindlay[7], C.J. Hailey[1], F. Harrison[8], D.J. Helfand[1], J. Hong[7], A. Hornstrup[5], S. Jacobsen[5], V.M. Kaspi[6], R. Krivonos[3], K. Madsen[8], K. Mori[1], L. Natalucci[9], K. Perez[1], D.M. Smith[10], D. Stern[11], J. Tomsick[3], W. Zhang[12]

[1]Columbia University, [2]MIT, [3]UC-Berkeley, [4]PUC, Chile, [5]DTU Space, Denmark, [6]McGill University, Canada, [7]Harvard University, [8]Caltech, [9]INAF/IASF, Italy, [10]UC Santa Cruz, [11]JPL, [12]NASA/GSFC.

126.49 Distribution of High Mass X-ray Binaries in the Milky Way

Alexis Coleiro[1], S. Chaty[1, 2]

[1]CEA Saclay, France, [2]University Paris Diderot, France.

126.50 X-ray Binaries and Their Makers

Stefano Mineo[1], G. Fabbiano[2], S.A. Rappaport[3], M. Gilfanov[4]

[1]Harvard-Smithsonian Center for Astrophysics, [2]Harvard-Smithsonian Center for Astrophysics, [3]M.I.T. Department of Physics and Kavli Institute for Astrophysics and Space Research, [4]Max 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 Servillat[1, 2]

[1]CEA Saclay, France, [2]Harvard-Smithsonian Center for Astrophysics.

126.52 Discovery of a Highly Variable ULX Within NGC 4736

Dacheng Lin[1, 2], N. Webb[2], D. Barret[2], J. Irwin[1]

[1]University of Alabama, [2]IRAP, 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 Pasham[1, 2], T.E. Strohmayer[2]

[1]University of Maryland College Park, [2]NASA/GSFC.

126.54 GRS 1758-258: Long Term Evolution of a Rare Persistent Hard State Black Hole

Maria Obst[1], K. Pottschmidt[2, 3], A.M. Lohfink[4], J. Wilms[1], D.M. Smith[5], J. Tomsick[6], I. Kreykenbohm[1], B.H. Rodrigues[7, 8]

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126.55 A Comprehensive Study of GBM Bursts of SGR J1550-5418

Andrew C. Collazzi[1], GRB Magnetar Team

[1]NASA/ORAU.

126.56 Multi-wavelength Observations of Cyg X-3 During a Hard X-ray Flare

Jeremy S. Perkins[2], N.K. Matthews[1], VERITAS Collaboration

[1]UMCP, [2]UMBC/CRESST/GSFC.

126.57 Simultaneous Chandra/Swift Observations of the RT Cru Symbiotic System

Vinay Kashyap[1], J.A. Kennea[2], M. Karovska[1], Chandra Calibration

[1]Smithsonian Astrophysical Observatory, [2]Penn 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. Weisskopf[1], T. Schweitzer[2], N. Bucciantini[3, 6], W. Idec[2, 7], K. Nilsson[4], A. Tennant[1], R. Zanin[5]

[1]NASA/MSFC, [2]Max-Planck-Institute for Physics, Germany, [3]INAF-Observatorio Astrofisico di Arcetri, Italy, [4]Finnish Centre for Astronomy with ESO, Univeristy of Turku, Finland, [5]Univesitat de Barcelona, Spain, [6]INFN-Sezione di Firenze, Italy, [7]Department of Astrophysics, University of Lodz, Poland.

127.02 Hard X-ray Variations in the Crab Nebula

Colleen Wilson[1], M.L. Cherry[2], G.L. Case[2, 3], W.H. Baumgartner[4], E. Beklen[8], N.P. Bhat[5], M.S. Briggs[5], A. Camero-Arranz[9], V. Chaplin[5], V. Connaughton[5], M.H. Finger[6], N. Gehrels[4], J. Greiner[10], K. Jahoda[4], P. Jenke[5], R.M. Kippen[7], C. Kouveliotou[1], H.A. Krimm[4], E. Kuulkers[11], N. Lund[12], C.A. Meegan[5], W.S. Paciesas[6], R.D. Preece[5], J. Rodi[2], N. Shaposhnikov[4], G.K. Skinner[4], D.A. Swartz[6], A. von Kienlin[10], R. Diehl[10], X. Zhang[10], L. Natalucci[13]

[1]NASA's MSFC, [2]LSU, [3]La Sierra University, [4]NASA's GSFC, [5]UAH, [6]USRA, [7]LANL, [8]MPE/SDU, Germany, [9]IEECC-CSIC, Spain, [10]MPE, Germany, [11]ISOC/ESA/ESAC, Spain, [12]Danish National Space Center, Denmark, [13]INAF/IAPS, Italy.

127.03 Modeling Gamma-ray Flares in the Crab Nebula

Yajie Yuan[1], R.D. Blandford[1], P. Simeon[1]

[1]W. 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. Slane[1]

[1]Harvard-Smithsonian, CfA.

127.05 Spatially-resolved Spectroscopy of the IC443 Pulsar Wind Nebula and Environs

Douglas A. Swartz[1], M.C. Weisskopf[2], V. Zavlin[1], N. Bucciantini[3], T.E. Clarke[4], M. Karovska[5], G.G. Pavlov[6], A. van der Horst[7], M. Yukita[8]

[1]USRA/MSFC, [2]NASA/MSFC, [3]INAF, Italy, [4]NRL, [5]SAO, [6]PSU, [7]UVA, Netherlands, [8]UA.

127.06 Heavy-Element Ejecta in G1.9+0.3

Kazimierz J. Borkowski[1], S.P. Reynolds[1], D. Green[3], U. Hwang[2], R. Petre[2], K. Krishnamurthy[4], R. Willett[4]

[1]North Carolina State University, [2]NASA/Goddard Space Flight Center, [3]Cambridge University, United Kingdom, [4]Duke University.

127.07 A Decade-Baseline Study of the X-ray Knots of Cas A: The Paradox of Non-Evolution

John Rutherford[1], E. Figueroa-Feliciano[1], D. Dewey[1], S.N. Trowbridge[1]

[1]MIT.

127.08 First Results from an XMM-Newton LP on SN1006

Jiang-Tao Li[1], A. Decourchelle[1]

[1]CEA Saclay, France.

127.09 SN 1006 From Chandra: High-resolution Radial Profiles of the Ejecta

Brian J. Williams[1], P.F. Winkler[2], S. Katsuda[4], K.S. Long[5], R. Petre[1], S.P. Reynolds[3]

[1]NASA Goddard, [2]Middlebury College, [3]North Carolina State University, [4]RIKEN, Japan, [5]STScI.

127.10 Particle Acceleration and Magnetic Fields: Looking at the Northwestern Rim of RCW 86 with Chandra

Daniel Castro[1]

[1]MIT.

127.11 X-ray Emission from the Galactic Supernova Remnant G272.2-3.2

Randall L. McEntaffer[1], N. Grieves[1], T. Brantseg[1]

[1]*University of Iowa*.

127.12 Unraveling the Origin of Overionized Plasma in the Galactic Supernova Remnant W49B

Sarah Pearson[1], L.A. Lopez[2, 5], E. Ramirez-Ruiz[3], D. Castro[2], H. Yamaguchi[4], P.O. Slane[4], R.K. Smith[4]

[1]*DARK Cosmology Centre, Denmark,* [2]*MIT-Kavli Institute,* [3]*UCSC,* [4]*Harvard-Smithsonian Center for Astrophysics,* [5]*Pappalardo Fellow in Physics*.

127.13 G306.3-0.9: A Newly Discovered Young Galactic Supernova Remnant

Mark Reynolds[1], S.T. Loi[2], T. Murphy[2, 3], J.M. Miller[1], D. Maitra[1], K. Gultekin[1], N. Gehrels[4], J.A. Kennea[5], M.H. Siegel[5], J. Gelbord[5], P. Kuin[6], V. Moss[2], S. Reeves[2], W.J. Robbins[2], B.M. Gaensler[2], R.C. Reis[1], R. Petre[4]

[1]*University of Michigan,* [2]*Sydney Institute for Astronomy (SIfA), Australia,* [3]*The University of Sydney, Australia,* [4]*NASA/Goddard,* [5]*Pennsylvania State University,* [6]*MSSL/UCL, United Kingdom*.

127.14 The Complex Region Containing the Gamma-cygni Supernova Remnant

Denis A. Leahy[1], K. Green[1]

[1]*University of Calgary, Canada*.

127.15 Particle Acceleration and Magnetic Field Amplification at Non-relativistic Collisionless Shocks

Damiano Caprioli[1], A. Spitkovsky[1]

[1]*Princeton University*.

127.16 The Gamma-Ray Spectra of Supernova Remnants Arising from SNe of Various Types

Vikram Dwarkadas[1], I. Telezhinsky[2], M. Pohl[3, 2]

[1]*University of Chicago,* [2]*DESY, Germany,* [3]*University of Potsdam, Germany*.

127.17 Energetic Supernovae from the Cosmic Dawn

Ke-Jung Chen[1]

[1]*University of Minnesota, Twin Cities*.

127.18 VERITAS Studies of the TeV Emission from MGRO J1908+06/HESS J1908+063

Daniel D. Gall[1], VERITAS Collaboration

[1]*University of Iowa*.

127.19 Core Compactness of Progenitors

Tuguldur Sukhbold[1], S.E. Woosley[1], B. Paxton[2], A. Heger[3]

[1]*University of California, Santa Cruz,* [2]*University of California, Santa Barbara,* [3]*Monash University, Australia*.

127.21 On Poynting-Flux-Driven Bubbles and Shocks Around Merging NS/Magnetar Binaries and Implications for SGRBs

Mikhail Medvedev[1, 2], A. Loeb[1]

[1]*Harvard University,* [2]*University of Kansas*.

127.22 Are Short Bursts with Extended Duration Emission Powered by Magnetars?

P. T. O'Brien[1], B. Gompertz[1]
[1]*University of Leicester, United Kingdom*.

127.23 Gamma-Ray Bursts: Pulses and Populations

Thomas J. Loredo[1], J.E. Hakkila[2], M. Broadbent[3], I.M. Wasserman[1], R.L. Wolpert[3]
[1]*Cornell University*, [2]*College of Charleston*, [3]*Duke University*.

127.24 GCN/TAN -- Current and Future Functionality

Scott D. Barthelmy[1]
[1]*NASA's GSFC*.

127.25 A Correlation Between Intrinsic Luminosity and Average Decay Rate in GRB Afterglows

Judith L. Racusin[1], S.R. Oates[2]
[1]*NASA/GSFC*, [2]*MSSL-UCL, United Kingdom*.

127.26 Pulsars in the High Energy and Early Universe

John Middleditch[1], A.C. Schmidt[1, 2], J. Singleton[1, 3], H. Ardavan[4], A. Ardavan[5]
[1]*LANL*, [2]*University of New Mexico*, [3]*National High Magnetic Field Laboratory*, [4]*University of Cambridge, United Kingdom*, [5]*University of Oxford, United Kingdom*.

127.27 A Four-Year Fermi LAT Survey of Terrestrial Gamma-ray Flashes

J. E. Grove[1], A. Chekhtman[2], Fermi LAT Collaboration
[1]*NRL*, [2]*George Mason University*.

127.28 Gamma-ray and X-ray Observations Towards the Gamma-Cygni Supernova Remnant

Vikram Dwarkadas[1], A. Weinstein[2], M. Theiling[3], VERITAS Collaboration
[1]*University of Chicago*, [2]*Iowa State University*, [3]*Purdue University*.

127.29 Exploring the X-ray Morphology of the Supernova Remnant Kes 27 using Numerical Simulations

Vikram Dwarkadas[1], D. Dewey[2]
[1]*University of Chicago*, [2]*MIT*.

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 Tchekhovskoy[1], B. Metzger[2], D. Giannios[3], L.Z. Kelley[4]

[1]Princeton University, [2]Columbia University, [3]Purdue University, [4]Harvard University.

128.02 The Rise and Fall of Swift J164449.3+573451

David N. Burrows[1], Swift XRT Team

[1]Penn State University

128.03 Simulating Tidal Disruptions of Stars on Bound Orbits Around Supermassive Black Holes

Lixin J. Dai[1, 2], P.S. Coppi[1], A. Escala[2]

[1]Yale University, [2]Universidad 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 Bellm[1], F. Fuerst[1], K. Pottschmidt[2, 3], J. Wilms[4], S.E. Boggs[5], F. Christensen[6], W.W. Craig[7], C.J. Hailey[8], F. Harrison[1], D. Stern[9], J. Tomsick[5], W. Zhang[2], NuSTAR Science Team

[1]Caltech, [2]NASA-GSFC, [3]CSST, UMBC, [4]Remeis-Observatory & ECAP, Germany, [5]UC Berkeley, [6]DTU, Denmark, [7]LLNL, [8]Columbia, [9]JPL.

129.02 Angular Momentum Transport in Accreting White Dwarfs: Uniform or Differential Rotation?

Pranab Ghosh[1], J.C. Wheeler[2]

[1]TIFR, India, [2]University of Texas at Austin.

129.03 Observational Evidence for Intermediate Mass Black Holes: The State Transitions of ESO 243-41 HLX-1

Mathieu Servillat[1, 2]

[1]CEA Saclay, France, [2]Harvard-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 Watzke[1], P.O. Slane[2], K.K. Arcand[2], K. Lestition[2], P. Edmonds[2], W.H. Tucker[2]

[1]Chandra X-Ray Center, [2]Harvard-Smithsonian Center for Astrophysics.

130.02 Astrobites: The Astro-ph Reader's Digest For Undergraduates

Susanna Kohler[1], Astrobites Team

[1]University 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[1]
[1]*Washington Univ, St. Louis.*

200.01 Probing Temperatures in the Extreme Colliding-Wind Binary Eta Carinae using Iron-Line Diagnostics

Jean-Christophe Leyder[1, 2], Eta Carinae Team
[1]*NASA Goddard Space Flight Center,* [2]*Universities Space Research Association.*

200.02 The Fermi Large Area Telescope as a Cosmic-Ray Detector

Maria Elena Monzani[1], Fermi-LAT Collaboration
[1]*SLAC National Accelerator Laboratory.*

200.03 High-Energy Astrophysics with the High Altitude Water Cherenkov (HAWC) Observatory

John Pretz[1], HAWC Collaboration
[1]*Los Alamos National Lab.*

200.04 CTA - A New Observatory for Very High Energy Gamma-Ray Observations

David A. Williams[1], Cherenkov Telescope Array
[1]*UC, Santa Cruz.*

200.05 The ASTRO-H X-ray Observatory

Tadayuki Takahashi[1], K. Mitsuda[1], R.L. Kelley[2], ASTRO-H Team
[1]*ISAS/JAXA, Japan,* [2]*NASA/GSFC.*

200.06 The Large Observatory For X-ray Timing (LOFT): The ESA Mission and Proposed US Contributions

Paul S. Ray[1], M. Feroci[2], J. den Herder[3], E. Bozzo[4], D. Chakrabarty[5], C. Wilson[6], LOFT Consortium, US-LOFT Collaboration
[1]*NRL,* [2]*IAPS-INAF, Italy,* [3]*SRON, Netherlands,* [4]*ISDC, Switzerland,* [5]*MIT,* [6]*NASA/MSFC.*

200.07 This Is Not Your Advisor's CIAO

Jonathan C. McDowell[1], D.J. Burke[1], A. Fruscione[1], A. Siemiginowska[1], Chandra X-ray Center CIAO Team
[1]*Harvard-Smithsonian CfA.*

200.08 Modeling Non-Equilibrium Collisional Plasmas with AtomDB

Adam Foster[1], H. Yamaguchi[1], R.K. Smith[1], N.S. Brickhouse[1], L. Ji[2], T. Kallman[3], J. Wilms[4]
[1]*Harvard Smithsonian, CfA,* [2]*Purple Mountarin Observatory, China,* [3]*NASA Goddard Space Flight Center,* [4]*Universität Erlangen-Nürnberg, Germany.*

200.09 The High Resolution Microcalorimeter Soft X-ray Spectrometer for the Astro-H Mission

R.L. Kelley[1], K. Mitsuda[2]
[1]NASA/GSFC, [2]ISAS/JAXA, Japan.

201 NuSTAR

Tuesday, 10:30 AM - 12:05 PM, De Anza Ballroom II-III

Special Session 12

Chair
Fiona Harrison[1]
[1]Caltech.

201.01 The Nuclear Spectroscopic Telescope Array Mission Overview and First Results

Fiona Harrison[1], NuSTAR Team
[1]Caltech.

201.02 The NuSTAR Galactic Binary Program

John Tomsick[1], NuSTAR Team
[1]UC Berkeley/SSL.

201.03 The NuSTAR ULX Program

Dominic Walton[1], NuSTAR Team
[1]Caltech.

201.04 A Hard X-ray View of Star Formation: NGC 253 in Focus

Ann E. Hornschemeier[1, 2], B. Lehmer[2], D.R. Wik[1], M. Argo[3], K. Bechtol[4], S. Boggs[5], F. Christensen[6], W.W. Craig[5], C.J. Hailey[7], F. Harrison[8], J. Leyder[1], T.J. Maccarone[9], A. Ptak[1], D. Stern[10], T.M. Venters[1], A. Zezas[11]
[1]NASA GSFC, [2]Johns Hopkins, [3]ASTRON, Netherlands, [4]KICP, University of Chicago, [5]UC Berkeley, [6]DTU Space, Denmark, [7]Columbia University, [8]Caltech, [9]Texas Tech University, [10]NASA JPL, [11]Smithsonian Astrophysical Observatory.

202 PCOS Town Hall

Tuesday, 12:30 PM - 1:30 PM, De Anza Ballroom II-III

Chair
Ann E. Hornschemeier[1]
[1]NASA GSFC.

Chair
John A. Nousek[1]
[1]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[1]
[1]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. Coppi[1]
[1]*Yale University*

204.01 NuSTAR Spectroscopy of the Microquasar GRS 1915+105

Jon M. Miller[1], J. Tomsick[2], F. Harrison[3], NuSTAR Team
[1]*University of Michigan,* [2]*University of California at Berkeley,* [3]*Caltech.*

204.02 Accretion Variability in Black-Hole X-ray Binaries: The Optical and X-ray Connection

James F. Steiner[1]
[1]*Harvard-Smithsonian Center for Astrophysics.*

204.03 A Statistical Approach to Identifying Compact Objects in X-ray Binaries

Saeqa D. Vrtilek[1]
[1]*Harvard-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. Strohmayer[1], D.R. Pasham[2]
[1]*NASA's GSFC,* [2]*University of Maryland.*

204.05 On the Role of the X-ray Corona in Black Hole State Transitions

Ruben C. Reis[1], J.M. Miller[1], M. Reynolds[1], A.C. Fabian[2], D. Walton[3], E. Cackett[4], J.F. Steiner[2]
[1]*university of michigan,* [2]*Institute of astronomy, United Kingdom,* [3]*caltech,* [4]*wayne state university.*

204.06 What's on Tap? The Role of Spin in Compact Objects and Relativistic Jets

Ashley L. King[1], J.M. Miller[1], A.C. Fabian[4], C.S. Reynolds[2], D. Walton[3], K. Gultekin[1]
[1]*University of Michigan,* [2]*University of Maryland,* [3]*California Institute of Technology,* [4]*Cambridge University, United Kingdom.*

204.07 Gemini-GMOS Spectroscopy of X-ray Sources in the Galactic Bulge Survey

Jianfeng Wu[1], P.G. Jonker[2, 1], M. Torres[2, 1], J.E. McClintock[1]
[1]*Harvard-Smithsonian Center for Astrophysics,* [2]*SRON Netherlands Institute for Space Research, Netherlands.*

204.08 X-ray Populations in the Norma and Scutum-Crux Spiral Arms

Francesca Fornasini[1], J. Tomsick[2], F. Rahoui[6, 7], A. Bodaghee[2], R.A. Krivonos[2], H. An[4], E.V. Gotthelf[3], V.M. Kaspi[4], F.E. Bauer[8], D. Stern[5], S.E. Boggs[2]
[1]*University of California-Berkeley,* [2]*Space Sciences Laboratory, University of California-Berkeley,* [3]*Columbia University,* [4]*McGill University, Canada,* [5]*Jet Propulsion Laboratory, California Institute of Technology,* [6]*ESO Garching, Germany,* [7]*Harvard University,* [8]*Pontificia Universidad Catolica de Chile, Chile.*

204.09 Evolution of X-ray Binaries Across Cosmic Time and Energy Feedback at High Redshift

Tassos Fragos[1]
[1]*Harvard-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. Evans[1]
[1]*NSF*.

205.01 Relativistic Jets from Accreting Black Holes

Ramesh Narayan[1]
[1]*Harvard-Smithsonian, CfA*.

205.02 Disks, Winds, and Jets in AGN: The X-ray View

Christopher S. Reynolds[1]
[1]*University of Maryland*.

205.03 Powering Extragalactic Radio Jets in Galaxy Clusters

Brian R. McNamara[1]
[1]*University of Waterloo, Canada*.

205.04 The Role and Power of Jets Across the Black Hole Mass Scale

Sera Markoff[1]
[1]*University of Amsterdam, Netherlands*.

206 Black Holes in Globular Clusters

Tuesday, 4:15 PM - 5:45 PM, De Anza Ballroom II-III

Chair
Stephen E. Zepf[1]
[1]*Michigan State University*

206.01 Black Holes in Globular Clusters: An Overview

Thomas J. Maccarone[1]
[1]*Texas Tech University*.

206.02 Modeling Black Holes in Globular Clusters

Natalia Ivanova[1]
[1]*University of Alberta, Canada*.

206.03 Searching for Black Holes in Milky Way Globular Clusters

Laura Chomiuk[1, 2], J. Strader[1], T.J. Maccarone[3, 4], J. Miler-Jones[5], A. Seth[6]
[1]*Michigan State University,* [2]*National Radio Astronomy Observatory,* [3]*University of Southampton, United Kingdom,* [4]*Texas Tech University,* [5]*International Centre for Radio Astronomy Research, Curtin University, Australia,* [6]*University of Utah*.

206.04 Emission Lines From Tidally Disrupted White Dwarfs and Other Evolved Stars

Drew R. Clausen[1], S. Sigurdsson[1], M. Eracleous[1], J. Irwin[2]
[1]*The Pennsylvania State University,* [2]*University of Alabama*.

206.05 Observations of Black Holes in Extragalactic Globular Clusters

Arunav Kundu[1, 2]
[1]*TIFR, India,* [2]*Eureka 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[1]
[1]*Smithsonian 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**
3. **Andy Ptak, NASA/GSFC: Science of New Worlds, New Horizons, and X-rays**
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[1]
[1]Harvard-Smithsonian, CfA.

300.01 Observing Relativistic Jet Simulations

Roger D. Blandford[1, 2], J. McKinney[3, 2], N.L. Zakamska[4, 2]
[1]Stanford University, [2]KIPAC, [3]University Maryland, [4]Johns Hopkins University.

300.02 The Fermi Bubbles: Possible Nearby Laboratory for AGN Jet Activity

Hsiang-Yi Karen Yang[1], M. Ruszkowski[1], E.G. Zweibel[2], P.M. Ricker[3]
[1]University of Michigan, [2]University of Wisconsin-Madison, [3]University of Illinois.

300.03 Fermi Bubbles and Periodic Past Activity of the Central Galactic Black Hole

Dmitry Chernyshov[1], K. Cheng[2], V. Dogiel[1], C. Ko[3]
[1]Lebedev's Institute of Physics, Russian Federation, [2]University of Hong Kong, Hong Kong, [3]Institute of Astronomy, National Central University, Taiwan.

300.04 The NuSTAR Extragalactic Survey: A First Look at the Distant High-Energy X-ray Background Population

David R. Ballantyne[1], M. Ajello[4], D.M. Alexander[5], R.J. Assef[10], M. Balokovic[2], F.E. Bauer[6], S.E. Boggs[7], K. Boydstun[2], C. Bridge[2], F. Christensen[8], W.W. Craig[7], A. Del Moro[5], P.R. Eisenhardt[10], A.H. Gonzalez[12], C.J. Hailey[9], F. Harrison[2], T. Lu[2, 3], D. Stern[10], W. Zhang[11], NuSTAR Team
[1]Georgia Institute of Technology, [2]Caltech, [3]National Tsing Hua University, Taiwan, [4]KIPAC/SLAC, [5]Durham University, United Kingdom, [6]Pontificia Universidad Católica de Chile, Chile, [7]UC Berkeley, [8]DTU Space, Denmark, [9]Columbia University, [10]JPL/Caltech, [11]NASA/GSFC, [12]University of Florida.

300.05 A Chandra Investigation of Empirical Links Between XRB and AGN Accretion

Paul J. Green[1], M. Trichas[1], A. Constantin[2], T.L. Aldcroft[1], D. Kim[1], A. Hyde[3], D. Haggard[4], B.C. Kelly[6], M. Sobolewska[1], H. Zhoue[5]
[1]Harvard-Smithsonian CfA, [2]James Madison University, [3]Imperial College, United Kingdom, [4]CIERA, [5]USTC, China, [6]University of California.

300.06 Catching Actively Growing Galaxies and SMBHs in a High Redshift (z = 2.23) Protocluster Environment with Herschel and Chandra

Bret Lehmer[1, 2], A.B. Lucy[3], D.M. Alexander[4], P. Best[5], J. Geach[6], C. Harrison[4], A.E. Hornschemeier[1, 2], Y. Matsuda[7], J. Mullaney[4], I. Smail[4], D. Sobral[8], M. Swinbank[4]
[1]Johns Hopkins University, [2]NASA GSFC, [3]University of Oklahoma, [4]Durham University, United Kingdom, [5]Institute for Astronomy, United Kingdom, [6]McGilll University, Canada, [7]National Astronomical Observatory, Japan, [8]Leiden 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 Singal[1], V. Petrosian[1], A. Ko[1]
[1]KIPAC.

300.08 Herschel Observations of Blazars PKS 1510-089 and AO 0235+164

Krzysztof Nalewajko[1], M. Sikora[2], G.M. Madejski[3], K. Exter[4], A. Szostek[3, 5], R. Szczerba[6], M.R. Kidger[7], R. Lorente[7]

[1]University of Colorado, [2]Nicolaus Copernicus Astronomical Center, Poland, [3]KIPAC, [4]KU Leuven, Belgium, [5]Jagiellonian University, Poland, [6]Nicolaus Copernicus Astronomical Center, Poland, [7]Herschel Science Center, Spain.

301 Galaxies & ISM

Wednesday, 10:30 AM - 12:00 PM, De Anza Ballroom II-III

Chair
Randall K. Smith[1]

[1]Smithsonian Astrophysical Observatory.

301.01 The Structure of the Milky Way's Hot Gas Halo

Matthew J. Miller[1], J.N. Bregman[1]

[1]University of Michigan.

301.02 Spatially-resolved Spectral Analysis of the Hot Gaseous Emission in the M31 Bulge

Mihoko Yukita[1], J. Irwin[1], K. Wong[1], E. Million[1]

[1]University of Alabama - Tuscaloosa.

301.03 Unresolved Soft X-Ray Emission from the Galactic Disk

Ikuyuki Mitsuishi[1], T. Sato[1, 2], S. Kimura[2], K. Mitsuda[2], N.Y. Yamasaki[2], Y. Takei[2], T. Ohashi[1], D. McCammon[3]

[1]Tokyo Metropolitan University, Japan, [2]ISAS/JAXA, Japan, [3]University of Wisconsin.

301.04 Exploring the Influence of Metallicity on X-ray Binary Formation in Nearby and Distant UV-selected Galaxies

Antara Basu-Zych[1], B. Lehmer[2, 1], A.E. Hornschemeier[1], A. Ptak[1]

[1]Goddard Space Flight Center, [2]Johns Hopkins University.

301.05 Explore the Origin of Galactic Coronae with a Chandra Survey of Nearby Highly-Inclined Disc Galaxies

Jiang-Tao Li[1, 2], Q.D. Wang[1]

[1]Astronomy Department of University of Massachusetts, [2]CEA Saclay, France.

301.06 X-ray and Ultraviolet Halos Around the Nearby Edge-on Spiral NGC 891

Edmund J. Hodges-Kluck[1], J.N. Bregman[1]

[1]University of Michigan.

301.07 Charge-Exchange in X-ray Spectrum of M82

Shuinai Zhang[1], Q.D. Wang[2], L. Ji[1], R.K. Smith[3], A. Foster[3]

[1]Purple Mountain Observatory, China, [2]Astronomy department, UMASS, [3]Center for Astrophysics.

301.08 The Diffuse X-rays from the Local Galaxy (DXL) Mission

Youaraj Uprety[1], M. Galeazzi[1], M. Collier[3], T. Cravens[5], D. Koutroumpa[3], K.D. Kuntz[6], S.T. Lepri[4], D. McCammon[2], K. Morgan[2], F.S. Porter[3], K. Prasai[1], I. Robertson[5], S. Snowden[3], N.E. Thomas[3]

[1]University of Miami, [2]University of Wisconsin, [3]NASA Goddard Space Flight Center, [4]University of Michigan, [5]University of Kansas, [6]Johns Hopkins University.

302 Gravitational Wave Mission Plans

Wednesday, 1:30 PM - 3:00 PM, De Anza Ballroom II-III

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

302.01 The Proposed Evolved-LISA Mission

Karsten Danzmann[1]
[1]*AEI Hannover, Germany.*

302.02 The LISA Pathfinder Mission

Stefano Vitale[1], LISA Pathfinder Team
[1]*University of Trento, Italy.*

302.03 Astrophysical Information from Massive Black Hole Coalescences

Scott A. Hughes[1]
[1]*MIT.*

303 The Charge Exchange Process in the Solar System and Beyond

Wednesday, 1:30 PM - 3:00 PM, Portola Room

Chair
Damian J. Christian[1]
[1]*California State University.*

303.01 Solar System X-rays from Charge Exchange Processes

Carey M. Lisse[1], D.J. Christian[2], A. Bhardwaj[3], K. Dennerl[4], S.J. Wolk[5], D. Bodewits[6], M.R. Combi[7], T.H. Zurbuchen[7], S.T. Lepri[7]
[1]*Johns Hopkins University Applied Physics Laboratory,* [2]*CSUN Department of Physics and Astronomy,* [3]*Physics Laboratory, Vikram Sarabhai Space Centre, India,* [4]*Max-Planck-Institut für extraterrestrische Physik, Germany,* [5]*Chandra X-ray Center, Harvard-Smithsonian Center for Astrophysics,* [6]*The University of Maryland Department of Astronomy,* [7]*The University of Michigan Department of Space Sciences.*

303.02 Cometary Charge Exchange Emission in Ultraviolet and Soft X-ray Wavelengths

Dennis Bodewits[1]
[1]*University of Maryland.*

303.03 Charge-Exchange Emission and the Soft X-ray Background

K. D. Kuntz[1]
[1]*Johns Hopkins University*

303.04 Laboratory Studies of X-ray Spectra Formed by Charge Exchange

Peter Beiersdorfer[1], R. Ali[2], G.V. Brown[1], D. Koutroumpa[3], R.L. Kelley[3], C. Kilbourne[3], M.A. Leutenegger[3], F. Porter[3]
[1]*LLNL,* [2]*University of Jordan, Jordan,* [3]*Goddard 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[1]

[1]*Columbia Astrophysics Lab*.

304.01 Nuclear Data Needs for Astrophysics

Stan E. Woosley[1], A. Heger[2], R.D. Hoffman[3]
[1]*UC, Santa Cruz,* [2]*Monash University, Australia,* [3]*LLNL*.

304.02 High-Energy-Density Laboratory Astrophysics Experiments on the Omega Laser Facility and the National Ignition Facility

Carolyn C. Kuranz[1]
[1]*University of Michigan*.

304.03 Spectral Modeling of Cosmic Atomic Plasmas

Jelle S. Kaastra[1, 2]
[1]*SRON, Netherlands,* [2]*Utrecht University, Netherlands*.

305 Understanding Gamma-Ray Bursts Emission Mechanism in the Fermi Era

Wednesday, 3:30 PM - 5:00 PM, Portola Room

Chair
Giacomo Vianello[1]
[1]*Stanford University*.

305.01 Spectral and Temporal Properties of Pre-Fermi GRBs

Robert D. Preece[1]
[1]*University of Alabama*.

305.02 Fermi Observations of GRBs

Vlasios Vasileiou[1, 2], Fermi LAT, GBM Collaborations
[1]*CNRS/IN2P3/LUPM Montpellier, France,* [2]*Universite Montpellier II, France*.

305.04 Fermi Observations of the Jet Photosphere in GRBs: Interpretations and Consequences

Felix Ryde[1, 2], Fermi LAT, Fermi GBM
[1]*KTH, Sweden,* [2]*The 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

THURSDAY SESSIONS AND EVENTS

400 SNR/GRB

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

Chair
Stephen P. Reynolds[1]
[1]*North Carolina State University*

400.01 Numerical Simulation-based Jet Model Fits to GRB Light Curves

Binbin Zhang[1], H. Van Eerten[2], D.N. Burrows[1], A. MacFadyen[2]
[1]*The Pennsylvania State University*, [2]*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[1], A. Pe'er[2, 3], C.S. Reynolds[1], R. Haas[4, 5], T. Bode[5], P. Laguna[5]
[1]*University of Maryland*, [2]*Univesity College Cork, Ireland*, [3]*Harvard-Smithsonian Center for Astrophysics*, [4]*California Institute of Technology*, [5]*Georgia Institute of Technology*.

400.03 Searches for Gravitational Waves Associated with Gamma-ray Bursts

Raymond Frey[1], LIGO Scientific Collaboration, Virgo Collaboration
[1]*University of Oregon*.

400.04 NuSTAR Constraints on the Shock Temperature and Velocity in the Luminous Type IIn Supernova 2010jl

Andreas Zoglauer[1], E. Ofek[2], N. Barriere[1], E. Bellm[3], S.E. Boggs[1], F. Christensen[4], W.W. Craig[5], C. Fryer[6], C.J. Hailey[7], F. Harrison[3], S.P. Reynolds[8], D. Stern[9], W. Zhang[10]
[1]*UC Berkeley*, [2]*Weizmann Institute of Science, Israel*, [3]*Caltech*, [4]*DTU Space, Denmark*, [5]*LLNL*, [6]*LANL*, [7]*Columbia*, [8]*North Carolina State University*, [9]*JPL*, [10]*GSFC*.

400.05 NuSTAR First Pulsar-wind Nebulae Results

Kristin Madsen[1], H. An[7], S.E. Boggs[6], W.W. Craig[3], C. Fryer[9], B. Grefenstette[1], C.J. Hailey[4], B. Humensky[4], V.M. Kaspi[7], L.A. Lopez[11], H. Miyasaka[1], K. Mori[4], M. Nynka[4], M. Pivovaroff[3], S.P. Reynolds[8], T. Kitaguchi[12], N.J. Westergaard[2], D.R. Wik[5], A. Zoglauer[6], F. Christensen[2], F. Harrison[1], D. Stern[10], W. Zhang[5]
[1]*Caltech*, [2]*DTU Space, Denmark*, [3]*LLNL*, [4]*Columbia*, [5]*Goddard*, [6]*Berkeley*, [7]*McGill, Canada*, [8]*NCSU*, [9]*LANL*, [10]*JPL*, [11]*MIT*, [12]*Riken, Japan*.

400.06 SN 1006 from Chandra: Exquisite Testament to Progress in Fifty Years of X-ray Astronomy

P. F. Winkler[1], S. Katsuda[2], K.S. Long[3], R. Petre[4], S.P. Reynolds[5], B.J. Williams[4]
[1]*Middlebury College*, [2]*RIKEN, Japan*, [3]*STScI*, [4]*NASA-GSFC*, [5]*NCSU*.

400.07 What Would the Remnant of a Gamma-ray Burst Look Like?

Laura A. Lopez[1]
[1]*MIT*.

400.08 Determining Progenitors of Young Supernova Remnants from Their Fe K-Shell Emission

Hiroya Yamaguchi[1], R.K. Smith[1], P.O. Slane[1]
[1]*Harvard-Smithsonian Center for Astrophysics*.

401 Galaxy Clusters

Thursday, 10:30 AM - 12:00 PM, De Anza Ballroom II-III

Chair
Joel N. Bregman[1]
[1]*University of Michigan.*

401.01 Virial Region of Abell 133 Viewed with the 2.4 Msec Chandra Exposure

Alexey Vikhlinin[1]
[1]*Harvard-Smithsonian, CfA.*

401.02 NuSTAR's Hard Look at the Bullet Cluster: First Results

Daniel R. Wik[1], A. Hornstrup[2], S. Molendi[3], F. Harrison[4], S.E. Boggs[5], F. Christensen[2], W.W. Craig[6], D. Ferreira[2], C.J. Hailey[7], T. Kitaguchi[8], G.M. Madejski[9], K. Pedersen[2], D. Stern[10], N.J. Westergaard[2], W. Zhang[1], A. Zoglauer[5], NuSTAR Team
[1]*NASA Goddard Space Flight Center,* [2]*National Space Institute, Technical University of Denmark, Denmark,* [3]*INAF-IASF, Italy,* [4]*Caltech Division of Physics, Mathematics and Astronomy,* [5]*U.C. Berkeley Space Sciences Laboratory,* [6]*Lawrence Livermore National Laboratory,* [7]*Columbia University,* [8]*RIKEN, Japan,* [9]*KIPAC, SLAC National Accelerator Laboratory,* [10]*Jet Propulsion Laboratory.*

401.03 The Evolution of Cool Cores in Galaxy Clusters from z=0 to z=1.2

Michael McDonald[1]
[1]*MIT.*

401.04 How AGN Feedback Evolves in Clusters of Galaxies

Julie Hlavacek-Larrondo[1]
[1]*Stanford 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. Wise[1, 2], D.A. Rafferty[3], J.P. McKean[1]
[1]*ASTRON (Netherlands Institute for Radio Astronomy), Netherlands,* [2]*University of Amsterdam, Netherlands,* [3]*Leiden University, Netherlands.*

401.06 ICM Properties and Gas Mixing in the Stripped Tails of Two Nearby Early-type Cluster Galaxies

Ralph P. Kraft[1], E. Roediger[2, 1], M.E. Machacek[1], W.R. Forman[1], P. Nulsen[1], E. Churazov[3]
[1]*Harvard-Smithsonian, CfA,* [2]*Hamburger Sternwarte, Germany,* [3]*Max-Planck-Institut fuer Astrophysik, Germany.*

401.07 Intragroup and Galaxy-Linked Diffuse X-ray Emission in Compact Groups of Galaxies

Tyler D. Desjardins[1], S. Gallagher[1], P. Tzanavaris[2], J.S. Mulchaey[3], W.N. Brandt[4, 5], J.C. Charlton[4], G. Garmire[4], C. Gronwall[4, 5], A.E. Hornschemeier[3], K.E. Johnson[6], I. Konstantopoulos[7], A.I. Zabludoff[8]
[1]*Department of Physics and Astronomy, University of Western Ontario, Canada,* [2]*Laboratory for X-ray Astrophysics, NASA/Goddard Space Flight Center,* [3]*Carnegie Observatories,* [4]*Department of Astronomy and Astrophysics, The Pennsylvania State University,* [5]*Institute for Gravitation and the Cosmos, The Pennsylvania State University,* [6]*Department of Astronomy, University of Virginia,* [7]*Australian Astronomical Observatory, Australia,* [8]*Steward Observatory, University of Arizona.*

401.08 Probing Non-thermal Emission from Clusters with Gamma-Ray and Radio Observations

Tesla E. Jeltema[1], E. Storm[1], S. Profumo[1], L. Rudnick[2]
[1]*University of California, Santa Cruz,* [2]*University 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[1]
[1]NASA's GSFC.

402.01 NuSTAR's First Results for Cyclotron Lines Sources

Felix Fuerst[1], B. Grefenstette[1], S.E. Boggs[2], F. Christensen[3], W.W. Craig[2, 4], C.J. Hailey[5], F. Harrison[1], K. Pottschmidt[6, 7], R. Staubert[8], D. Stern[9], J. Tomsick[2], J. Wilms[10], W. Zhang[6], NuSTAR Team
[1]SRL, Caltech, [2]UC Berkeley, [3]DTU-Space, Denmark, [4]LLNL, [5]Columbia University, [6]NASA-GSFC, [7]CSST, UMBC, [8]IAAT, Germany, [9]JPL, [10]Remeis-Observatory & ECAP, Germany.

402.02 Long-term Monitoring of Supergiant Fast X-ray Transients with Swift: From Hours to Years

Patrizia Romano[1], J.A. Kennea[2], S. Vercellone[1], D.N. Burrows[2], L. Ducci[3], P. Esposito[4], H.A. Krimm[5], V. Mangano[1], N. Gehrels[5]
[1]INAF-IASF Palermo, Italy, [2]Pennsylvania State University, [3]Universitat Tuebingen, Germany, [4]INAF-IASF Milano, Italy, [5]NASA/GSFC.

402.03 Interactions of X-ray Binaries with Their Surrounding Material

Mathieu Servillat[1, 2], S. Chaty[1], A. Coleiro[1], S. Tang[3, 2], J.E. Grindlay[2], E. Los[2]
[1]CEA Saclay, France, [2]Harvard-Smithsonian Center for Astrophysics, [3]UC Santa Barbara.

402.04 The First Dynamical Mass Measuement for an Ultraluminous X-ray Source

Jifeng Liu[1], J.N. Bregman[2], Y. Bai[3]
[1]National Astronomical Observatory of China, China, [2]university of Michigan, [3]Beijing 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 Pasham[1, 2], T.E. Strohmayer[2]
[1]University of Maryland College Park, [2]NASA/GSFC.

402.06 A State Transition of the Luminous X-ray Binary in the Low-Metallicity Blue Compact Dwarf Galaxy I Zw 18

Philip Kaaret[1], H. Feng[2]
[1]University of Iowa, [2]Tsinghua University, China.

402.07 First Models of Neutron Star X-ray Bursts with too Short Recurrence Times

Laurens Keek[1], A. Heger[2]
[1]Michigan State University, [2]Monash University, Australia.

402.08 Determining Neutron Star Masses and Radii using Energy-resolved Waveforms of X-ray Burst Oscillations

Frederick K. Lamb[1], K. Lo[1], M.C. Miller[2], S. Bhattacharyya[3]
[1]University of Illinois, [2]University of Maryland, [3]Tata 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 Bodaghee[1], J. Tomsick[1], J. Rodriguez[2], K. Pottschmidt[3], J. Wilms[4], G.G. Pooley[5]
[1]University of California, Berkeley, [2]CEA Saclay, France, [3]CRESST/UMBC - NASA-GSFC, [4]Sternwarte-University Erlangen, Germany, [5]University 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[1]
[1]*UC, Berkeley.*

403.01 The Swift Monitoring Campaign of Sagittarius A*

Nathalie Degenaar[1], J.M. Miller[1], J.A. Kennea[3], R. Wijnands[2], N. Gehrels[4]
[1]*University of Michigan,* [2]*University of Amsterdam, Netherlands,* [3]*Penn State University,* [4]*NASA Goddard Space Flight Center.*

403.02 NuSTAR Detection of High-energy Emission and Fast Variability from a Sagittarius A* X-ray Flare

Nicolas Barriere[1], J. Tomsick[1], F.K. Baganoff[2], S.E. Boggs[1], F. Christensen[3], W.W. Craig[4, 1], B. Grefenstette[5], C.J. Hailey[6], F. Harrison[5], K. Madsen[5], K. Mori[6], K. Perez[6], D. Stern[7], S. Zhang[6], W. Zhang[8], A. Zoglauer[1], NuSTAR Team
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403.03 A 200-Second Quasi-Periodicity After the Tidal Disruption of a Star by a Dormant Black Hole

Ruben C. Reis[1], J.M. Miller[1], M. Reynolds[1], K. Gultekin[1], D. Maitra[1], A.L. King[1], T.E. Strohmayer[2]
[1]*University of Michigan,* [2]*NASA Goddard Space Flight Center.*

403.04 Late-time Observations of the New Class of Relativistic Tidal Disruption Flares

Stephen B. Cenko[1]
[1]*University of California, Berkeley.*

403.05 PS1-10jh: The Partial Disruption of a Main-Sequence Star of Near-Solar Composition

James Guillochon[1], E. Ramirez-Ruiz[1]
[1]*UC 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 Irwin[1], K. Wong[1], R.V. Shcherbakov[2], M. Yukita[1], W.G. Mathews[3]
[1]*University of Alabama - Tuscaloosa,* [2]*University of Maryland,* [3]*University of California, Santa Cruz.*

403.07 Modeling the Accretion Flow Onset in the Low-Luminosity Active Galactic Nucleus of NGC3115

Roman V. Shcherbakov[1], K. Wong[2], J. Irwin[2], C.S. Reynolds[1]
[1]*University of Maryland,* [2]*University of Alabama.*

403.08 Probing the Origin of the Intermediate Mass Black Hole ESO 243-49 HLX-1

Sean Farrell[1], M. Servillat[2, 4], N. Webb[3], D. Barret[3], O. Godet[3]
[1]*The University of Sydney, Australia,* [2]*CEA-Saclay, France,* [3]*IRAP, France,* [4]*Harvard-Smithsonian Center for Astrophysics.*

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NASA PCOS X-ray SAG Meeting
9:00am-5:30pm
Cottonwood Room
Host: Jay Bookbinder

Friday, 12 April 2013	
Session: Technology Development Plans	
9:00am	Tech Development Plans - Near Term Technologies, 9:00am-9:45am, Rob Petre, NASA/Goddard Space Flight Center
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10:45am	Break, 10:45am-11:00am
Session: Optics	
11:00am	Future Optics, 11:00am-11:20am, Martin Weisskopf, NASA/Marshall Space Flight Center
11:20am	Silicon Optics, 11:20am-11:40am, Will Zhang, NASA/Goddard Space Flight Center
11:40am	Adjustable Optics, 11:40am-12:00pm, Paul Reid, SAO
12:00pm	Off Plane Grating Developments, 12:00pm-12:15pm, Randy McEntaffer, University of Iowa
12:15pm	CAT Grating Developments, 12:15pm-12:30pm, Ralf Heilmann, MIT/Kavli
12:30pm	Multilayer Optics Development, 12:30pm-12:45pm, Suzanne Romaine, SAO
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Session: Detectors	
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1:50pm	Large Format Silicon Detectors, 1:50pm-2:10pm, Abe Falcone, Pennsylvania State University
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2:50pm	Break, 2:50pm-3:00pm
3:00pm	Cryogenic Detectors, 3:00pm-4:00pm, Simon Bandler, CRESST/NASA/Goddard Space Flight Center
4:00pm	Multiplex Readouts for Large-Format Microcalorimeters, 4:00pm-4:30pm, Kent Irwin, NIST/Boulder
4:30pm	Open Discussion, 4:30pm-5:30pm

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)

"Testing General Relativity in the Strong-Field Regime with Observations of Black Holes in the Electromagnetic Spectrum"

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

Universitá 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

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5) Dormody et al. 2011, ApJ 742, 126D

6) Ray et al. 2011, ApJS 194, 17R

7) Belfiore 2011, III Fermi Symposium, Rome

8) Belfiore 2012, XXVII IAU GA, S291, Beijing

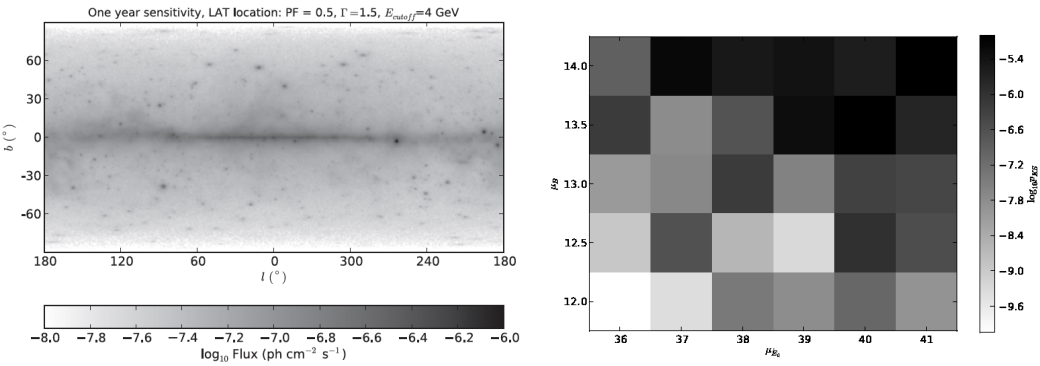

Fig. 1.— Left. Sensitivity map, showing the flux required for a gamma-ray pulsar to be detected with 50% probability in one year of LAT data, assuming a standard set of pulsar parameters. Right. Sample of outcomes from the pulsar population study. Given the central values of the distribution in surface 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.

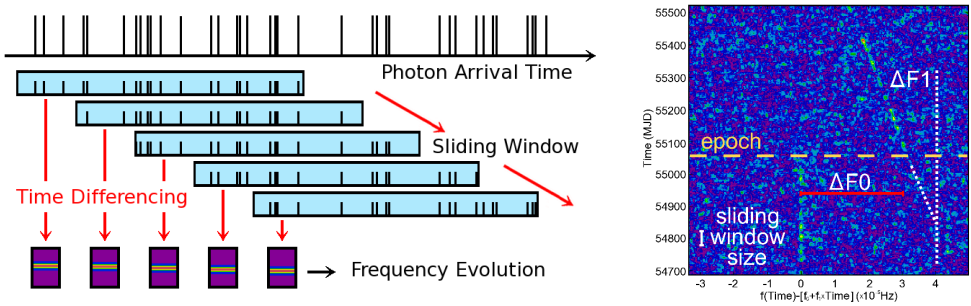

Fig. 2.— Left. Diagram showing the algorithm used to find pulsar glitches directly in gamma rays. Right. Output of the algorithm applied to a glitch observed in the radio-quiet gamma ray pulsar J1023-5746, highlighting some of the glitch parameters. The x axis reports the offset in frequency from the 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.

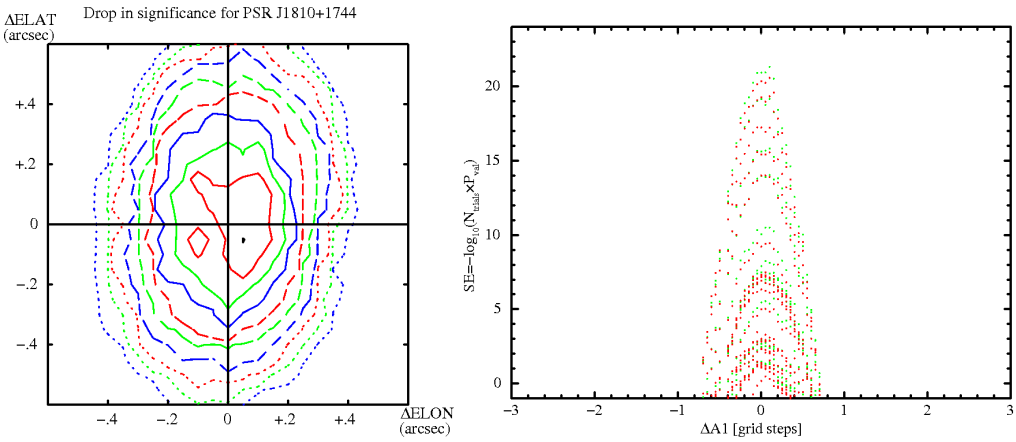

Fig. 3.— Plots obtained as part of the validation study of the blind search technique on black-widow pulsars, for the particular case of J1810+1744. We measure the drop in significance by introducing an estimator, defined as $\mathrm{SE} = -\log_{10}(N_{trials} \times P_{val})$, where the number of trials N_{trials} is fixed and the probability P_{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 A1. 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).

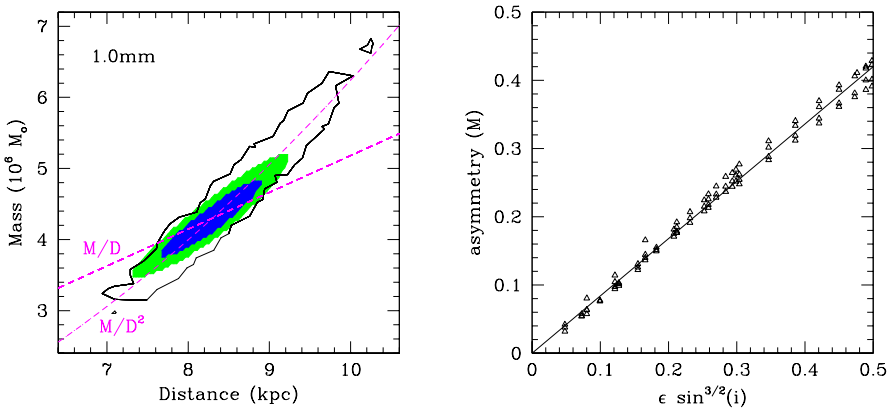

Figure 1. Left: 68% and 95% confidence contours of the mass M and distance D of Sgr A* obtained from the combination of dynamical measurement (Gillessen et al. 2009) and simulated data for VLBI observations of the shadow of this black hole. Compared to (solid line) the 95% confidence contour of dynamical 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 $\epsilon \sin^{3/2} i$, where ϵ 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

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).

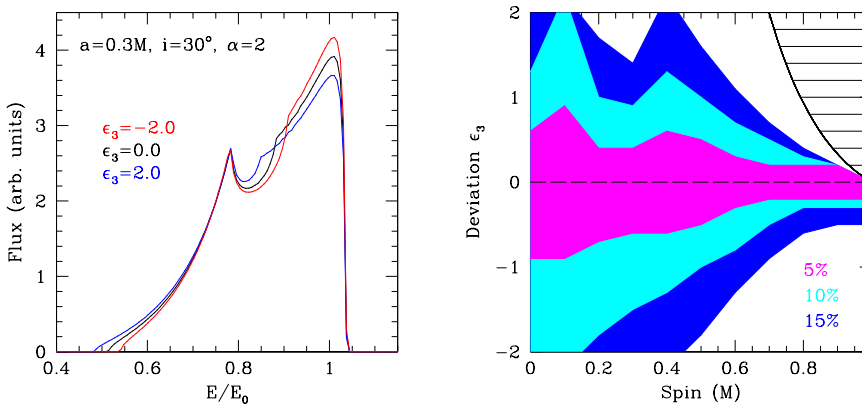

Figure 2. Left: Profiles of relativistically broadened iron lines for several values of the deviation parameter. Increasing values of the deviation parameter lead to an extended tail at low energies and a smaller intensity ratio of the two peaks. Right: Contours of the precision required in future observations 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 $|\epsilon| \sim 1$ can be obtained at a precision level of $\sim 5\%$ 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 μm (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 μm. 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.

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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 ($M_\bullet$–σ), as well as with the bulge luminosity ($M_\bullet$–L_{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 $\gtrsim$ *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 to 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 $M_* \sim 1$ $M_\odot$ main-sequence star and a non-spinning MBH, $M_\bullet \lesssim 10^8$ $M_\odot$.

The rate at which these events occur (γ) 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 γ and TDF observational characteristics.

A major uncertainty in γ 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 γ 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 $t^{-5/3}$ 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 $\sim$ 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 γ. Galaxy clusters also (as per Wang & Merritt 2004) present an unusual galaxy population by which to search for environmental effects on γ.

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 $M_\bullet$ as inferred from $M_\bullet$–L_{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 ~ 7 years of *Chandra* observations, γ 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 γ 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 ~ 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 100μm and ~ 1700Å 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 ~ 28 *Chandra* and *XMM-Newton* pointings over ~ 13 years (Fig. 3; owing to the fact that A1795 is a *Chandra* callibration 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 (~ 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.

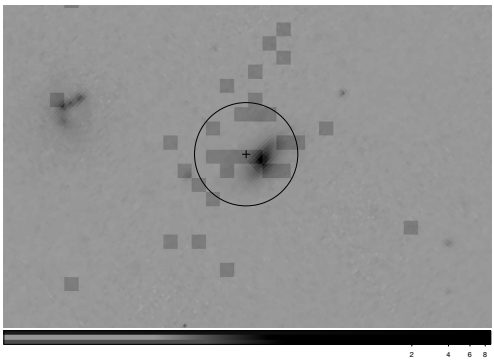

Figure 1: Pre-flare HST WFPC2 image of SDSS J131122.15-012345.6 taken using the *HST/WFPC2* F606W filter. The larger overlaid pixels are singly binned X-ray events from the flare at its peak at epoch 2004.16. The circle indicates centroid error at $r \sim 1''8$ and the cross is the middle of the centroid.

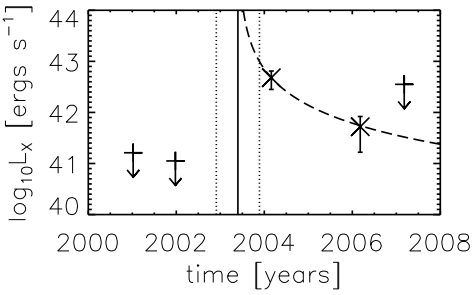

Figure 2: Light curve for SDSS J1311 with error bars. Arrows indicate upper bounds. $L_X(0.3\text{–}3)$ corrected for galactic extinction are indicated by ×. The dashed line is a $t^{-5/3}$ light curve which assumes pericenter passage time t_D at the expected value for a solar-type star, indicated by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

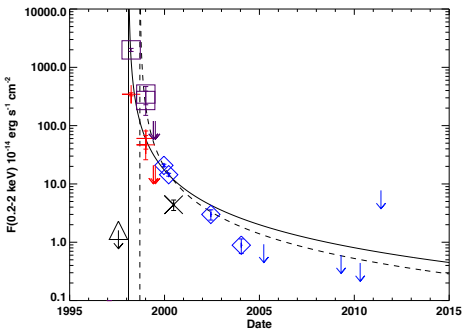

Figure 3: Model-dependent X-ray evolution for WINGS J1348: At the distance of A1795 ($z \sim 0.062$), 10^{-14} erg cm^{-2}s^{-2} $\sim 10^{41}$ erg s^{-1}. *Chandra* (blue), *XMM-Newton* (black ×) *EUVE* (red/purple). The *ROSAT* upper limit is 1.6×10^{-14} erg cm^{-2} s^{-1} at Date = 1997.57.

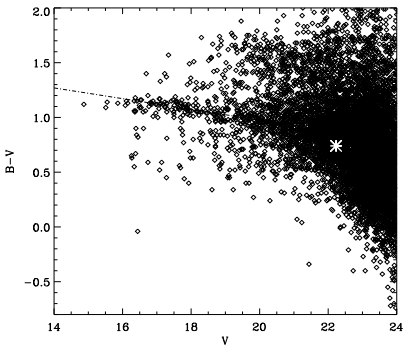

Figure 4: Color-magnitude diagram of A1795 galaxies, with ridge line (dashed) and WINGS J1348 (asterisk). WINGS J1348 position is consistent with the ridge line. Correlation of Magellan echellette spectra with templates supports this analysis.

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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 broadband 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 $N_{\rm H}$ of 8.4 $\times 10^{22}\,{\rm cm}^{-2}$. 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 $n_{\rm H}$ = 1.8–3.0 $\times 10^{7}\,{\rm cm}^{-3}$, 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 2.5×10^{20} 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 ($v_{\rm FWHM} < 7100$ 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 $v_{\rm FWHM}$ I have calculated a minimum inner radius of $\gtrsim 1200\ R_{\rm S}$. 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 (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 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 PEXRAV . I attempted to apply the 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 Γ 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 Γ and L for the Seyferts in the full sample, however a positive correlation between Γ 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 Γ 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 Γ 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 $\gtrsim$225 keV in 20 out of 23 sources, corresponding to an electron temperature of $k_B T_e \gtrsim 75$ 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 ~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.

References

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