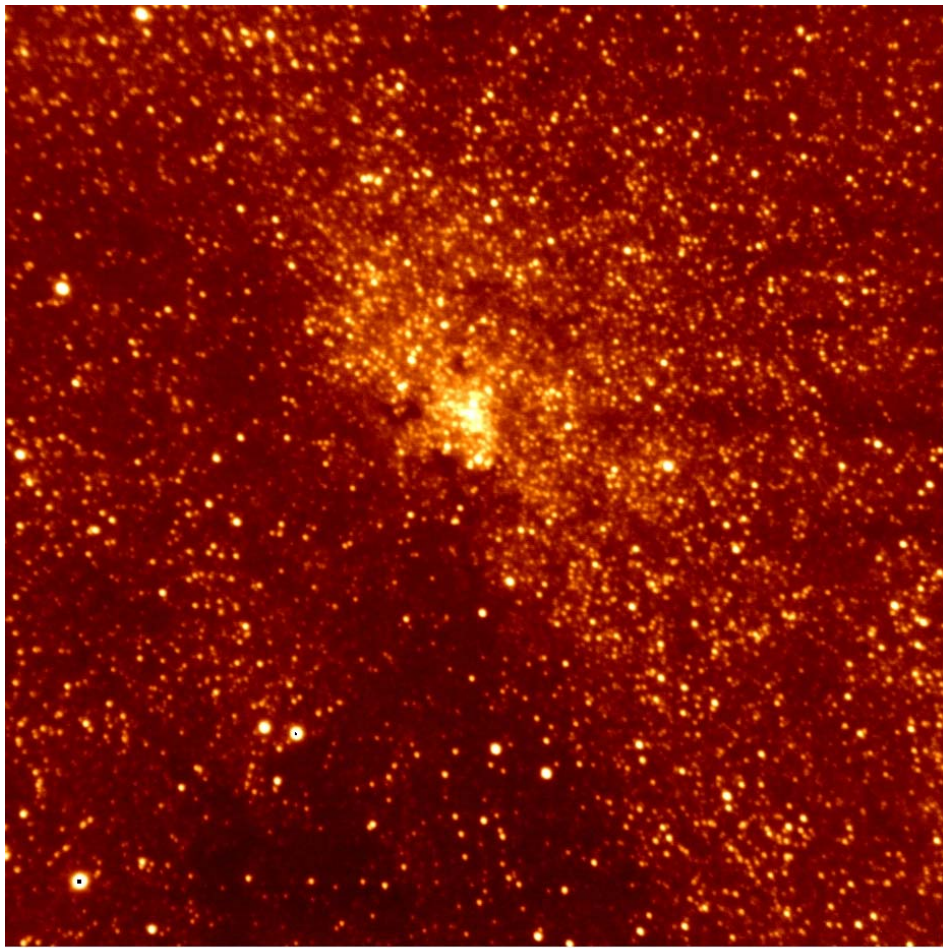




**Boston University  
Institute for Astrophysical Research  
Annual Report  
June 2007**



*Near-infrared image of the center of our Galaxy, obtained with Mimir on the 1.8 Perkins telescope at Lowell Observatory.*

Tereasa Brainerd, Director  
Kimberly Paci, Administrator

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## **Introduction**

### **Summary**

The Institute for Astrophysical Research marked a very successful 9th year in its mission to foster research at Boston University. All three of our state-of-the-art instruments (Mimir and PRISM at Lowell Observatory, and MIRSI at NASA's Infrared Telescope Facility) continue to operate well and are returning exciting science results.

The IAR has maintained its vigorous research program. In the past year, IAR members published twenty four scientific papers in refereed journals. Among our scientific highlights for the year are: (1) the discovery of a Jupiter-like planet orbiting one of the stars in a binar star system, (2) observations for the Galactic Plane Infrared Polarization Survey began in earnest, and (3) the discovery of sound waves in the distant galaxy cluster Abell 2052.

Total IAR grant expenditures in FY2007, including new and continuing grants, was \$X. IAR members submitted fifteen new funding proposals totaling over \$2.8M in requests. The IAR received a total of \$X in grant income, including ten new awards totaling \$X.

### **Institute Mission**

The mission of the IAR is to promote and facilitate research and education in astrophysics at Boston University. The IAR accomplishes this mission by: (1) administering research grants, (2) enhancing the visibility of IAR members with funding agencies and within the astrophysics community, (3) coordinating the use of Boston University astrophysics facilities, and (4) promoting the design, development, and operation of Boston University instruments and telescopes.

### **Faculty, Staff and Students**

During the past year, the IAR membership consisted of faculty, staff, and students who were involved in research. Faculty members included Professors Thomas Bania, Dan Clemens, James Jackson, Kenneth Janes, and Alan Marscher, Associate Professor Tereasa Brainerd, and Assistant Professor Elizabeth Blanton. Research Associates affiliated with the IAR included Senior Research Associate Dr. Svetlana Jorstad, Research Associates Drs. Jill Rathborne, Ronak Shah and Irena Stojmirovic, and Research Fellow Dr. Kathleen Kraemer. IAR staff members included Research Associate Brian Taylor, stationed in Flagstaff, Arizona at the Lowell Observatory site on Mars Hill, and IAR Fiscal Administrator Ms Kimberly Paci.

Graduate students conducting astrophysical research with IAR faculty members during the past year included Ingolfur Agustsson, Loren Anderson, Nina Bonaventura, Edward Chambers, Ritaban Chatterjee, Francesca D'Arcangelo, Edmund Douglass, Susanna Finn, Paul Howell, Alexis Johnson, Nicholas Lee, Emily Mercer, Michael Pavel, April Pinnick, Suwicha Wannawichian, Joshua Wing, and Monica Young. Undergraduate

students working within the IAR included Peter Aston, Brett Chizinski, Jessica Donaldson, Katie Jameson, Haruki Oh, Alice Olmstead, Caitlin O'Nan, and Joshua Schiode.

## **Science Highlights (DELETED)**

## Seminar Series

The IAR Astrophysics Seminar Series on Tuesday afternoons brings external astrophysicists from the local area as well as from across the nation to Boston University to present their recent work and to consult with IAR faculty and students. During the past year, the IAR sponsored seminars by twenty-five astrophysicists from across the nation. Students prepare for upcoming seminars through the Astrophysics Journal Club, which meets Friday afternoons. The seminar schedule is shown in Appendix B.

## Accounts, Funding, Expenditures

Accounts supervised by the IAR during the past year include a total of forty-four grants and contracts, the Lowell Operations account (20-341), the IDC return account for the IAR (20-351-1648-9), the IAR MIRSI bridge funding account (20-351), Professor Blanton's startup account (20 201 1383-9) and Professor James Jackson's retention account (20 201 1588-9). Grant and contract accounts supervised by the IAR include ten new sponsored grants and contracts, one existing grant which received no further income, and thirty-three other continuing sponsored grants and contracts within the IAR. A total of four of these sponsored grants and contracts were closed out during the past year. Fifteen new funding proposals were submitted to federal and other agencies, totaling over \$XM.

### *Lowell Operations (20-341)*

The Lowell Operations account is funded through the College of Arts and Sciences and is used to cover the cost of the annual usage fee to Lowell Observatory, the salary for the BU Telescope Support Scientist at Lowell, and auto insurance on the BU vehicle kept in Arizona for use by BU personnel when they go there to observe. Brian Taylor took over the position of Telescope Support Scientist beginning in August 2006. The expenses to be recorded against this account for FY06 are as indicated in the following table.

Category	Cost
Usage fee paid to Lowell Observatory	\$X
Brian Taylor (part time salary)	\$X
Auto Insurance	\$X
Total	\$X

***IAR Dept. Account (020-351)***

This year the College provided the IAR Unrestricted Departmental account funding for 6 months of Research Associate salary to continue working with the IAR's MIRSI instrument. In total \$X was spent on the Research Associate's salary from July '07 – Dec '07.

***IAR IDC Return (20-351-1648-9)***

This account was used to meet IAR expenses throughout the year. Expenditures, as of this report, totaled \$X and income totaled \$X. In managing IAR activities utilizing this account, we internally track expenses in nine categories, some of which have Object Code equivalents, but others of which either combine or split Object Codes. These expense categories are broken down in the following table.

**IAR FY2007 Expenditures**

Category	Cost	Percent of FY07 Expenditures
Basic Operations	\$X	58%
Proposal Development	\$X	2%
Infrastructure	\$X	18%
Seminar Series	\$X	17%
Social	\$X	1%
Cost Sharing	\$X	2%
General Research	\$X	1%
Educational Etc.	\$X	1%
Advisory Council	\$X	0%
Total Expended	\$X	100%

Basic Operations, the largest expense category, covers fixed costs such as Fiscal Administrator Paci's salary, the director's stipend, and benefits for both.

Infrastructure expenses make up the 2nd largest expense category. Included in the infrastructure category are minor costs such as telephone lines and minor computer equipment. Also this year, the IAR contributed \$5k to a security system upgrade for floors 4-7 of CAS, including card swipe access to the labs containing more sensitive equipment.

The seminar series makes up the 3rd largest expense category for the IAR this year. Seminar costs include travel, meals and accommodations for our guest speakers. Eleven seminars were held during the Fall 2006 semester, and fourteen were held during the Spring 2007 semester. The schedules are shown in Appendix B.

***Sponsored Grants and Contracts***

The IAR managed a total of forty-four grants during this fiscal year. There are ten new grants, which have been awarded to the Institute, one existing grant was awarded further funding, and thirty-three other continuing grants. This year, the IAR closed out a total of four awards.

A summary of the FY2007 sponsored grant income and expenditures are contained in the following tables.

**FY2006 Grant Income – Institute for Astrophysical Research (7/2006-6/2007)**

<b>P.I.</b>	<b>Agency</b>	<b>Title</b>	<b>FY2007 Award</b>
*Blanton	9586 NASA	Chandra General Observer Program, Cycle 7 – The Formation of WAT Radio Sources: Interaction Between the Radio Lobes and the Intracluster Medium	\$X
Blanton	8651 Foundations	Clare Boothe Luce Professorship	\$X
*Brainerd	9578 NASA Subcontract	HIPO: High Speed Imaging Photometer for Occultations (Subcontract from Lowell Obs.)	\$X
*Clemens	9378 NSF	The Galactic Plane Infrared Polarization Survey (GPIPS)	\$X
*Jackson	9529 JPL	Protostars in Infrared Dark Clouds (Subcontract via JPL and Caltech)	\$X
*Jackson	9528 JPL	Spitzer Cycle 3 Funding: Active Star Formation in Infrared Dark Clouds	\$X
*Marscher	9437 NASA	Relation Between the X-Ray and Energy Flow in Jets or Radio Galaxies	\$X
*Marscher	9508 NASA	Spitzer Cycle 3 funding: Contribution of Dust Emission to the Spectral Energy Distribution of Gamma-Ray Bright Blazars (Subcontract via JPL)	\$X
*Marscher	9525 NASA	Relation Between High-Energy and Lower-Frequency Emission in Blazars	\$X
*Marscher	9580 NASA	Events in the Central Engine and Energy Flow into Jets of Radio Galaxies	\$X
*Marscher	9926 NSF	Probing Blazars Through Multiwaveband Variability of Flux, Polarization, and Structure	\$X

**\*New Awards**

**Summary of IAR Grant Income**

<b>Origin of Award</b>	<b>Total Current Year Funding (7/06-6/07)</b>
Institute for Astrophysical Research (20-351)	\$X

**FY2007 Grant Expenditures – Institute for Astrophysical Research (7/2006– 6/2007)**

<b>P.I.</b>	<b>Agency</b>	<b>Title</b>	<b>FY2007 Expense</b>
Bania	9116 NASA	Mapping the Distribution of Hot Gas in the Inner Milky Way	\$X
Blanton	9269 NASA	Chandra General Observer Program, Cycle 6-Bubbles and B-Flats: A Deep Observation of Abell 2052	\$X
Blanton	9586 NASA	Chandra General Observer Program, Cycle 7 – The Formation of WAT Radio Sources: Interaction Between the Radio Lobes and the Intracluster Medium	\$X
Bosh	8512 NASA	Planetary Ring Studies Using Stellar Occultation	\$X
Brainerd	8641 NSF	Dynamics of Satellite Galaxies	\$X
Brainerd	9578 NASA	HIPO: High Speed Imaging Photometer for Occultations (Subcontract from Lowell Obs.)	\$X
Clemens	4509 JPL	The SIRTf Galactic Plane Survey	\$X
Clemens	9378 NSF	The Galactic Plane Infrared Polarization Survey (GPIPS)	\$X
Jackson	9078 NSF	Release and Analysis of the Galactic Ring Survey	\$X
Jackson	9720 NASA	The MSX Dark Cloud Catalog	\$X
Jackson	8733 JPL	Spitzer Space Telescope: 24 Micron Survey of the Galactic Plane	\$X
Jackson	8752 JPL	Spitzer Space Telescope: The Small Magellanic Cloud	\$X
Jackson	8753 JPL	Spitzer Space Telescope: The Small Scale Structure of Cluster Forming Infrared Dark Clouds	\$X
Jackson	4623 NASA	Infrared Studies of Star Forming Regions in the Galactic Ring Survey	\$X
Jackson	8862 NASA	The Mid-Course Space Experiment Extended Source Catalog	\$X



Jackson	9078 NSF	Release and Analysis of The Galactic Ring Survey	\$X
Jackson	9528 JPL	Spitzer Cycle 3 Funding: Active Star Formation in Infrared Dark Clouds	\$X
Jackson	9529 NASA	Protostars in Infrared Dark Clouds (Subcontract via JPL and Caltech)	\$X
Janes	8773 NSF	Collaborative Research: Boston University/Lowell Obs. Partnership	\$X
Janes	9251 NSF	REU Supplement: Collaborative Research: BU/Lowell Observatory Partnership-Bringing the Perkins Telescope into the 21ST Century	\$X
Janes	9080 NSF	Old Star Clusters: Stellar Activity and Galactic Structure	\$X
Jorstad	9022 NASA	Spitzer Space Telescope: Deep Imaging of Quasar Jets with IRAC	\$X
Marscher	8514 NSF	Multifrequency Probes of Blazar Jets	\$X
Marscher	9007 NASA	Positrons in AGN Jets: Search for Annihilation Line Radiation	\$X
Marscher	9021 JPL	Spitzer Space Telescope: Comparison of Time-Variable IR and X-Ray Continuum Spectra in Four Blazars	\$X
Marscher	9237 NASA	NGC1052: The Key to Explore the Disk-Jet Connection in AGN	\$X
Marscher	9437 NASA	Relation Between the X-Ray and Energy Flow in Jets or Radio Galaxies	\$X
Marscher	9508 JPL	Spitzer Cycle 3 funding: Contribution of Dust Emission to the Spectral Energy Distribution of Gamma-Ray Bright Blazars (Subcontract via JPL)	\$X
Marscher	9525 NASA	Relation Between High-Energy and Lower-Frequency Emission in Blazars	\$X
Marscher	9580 NASA	Events in the Central Engine and Energy Flow into Jets of Radio Galaxies	\$X

**Summary of IAR Sponsored Funding Expenditures**

<b>Origin of Award</b>	<b>Total Current Year Expenditures (7/06-6/07)</b>
Institute for Astrophysical Research (20-351)	\$X

## Appendix A: Publications and Presentations

### Articles in Referred Journals

- Agudo I., Gomez J.L., Gabuzda D.C.; Marscher A.; Jorstad S.G.; & Alberdi A. "The Milliarcsecond-Scale Jet of PKS 0735+178 During Quiescence", 2006, *A&A*, 453, 477-486
- Agustsson, I. & Brainerd, T. G.; "The Orientation of Satellite Galaxies: Evidence of Elongation in the Direction of the Host", 2006, *ApJ*, 644, L25-L28
- Agustsson, I. & Brainerd, T. G.; "The Locations of Satellite Galaxies in a LCDM Universe", 2006, *ApJ*, 650, pg. 550-559
- Bach, U.; Villata, M.; Raiteri, C.M.; Agudo, I.; Aller, H.D.; Aller, M.F.; Denn, G.; Gomez, J.L.; Jorstad, S.; Marscher, A.; Mutel, R.L.; & Terasranta, H.; "Structure and flux variability in the VLBI jet of BL Lacertae during the WEBT campaigns (1995-2004)", 2006, *A&A*, 456, 105-115
- Bania, T.M.; Balser, D.S.; Rood, R.T.; Wilson, T.L.; & LaRocque, J.M.; "He3 in the Milky Way Interstellar Medium: Ionization Structure", 2007, *ApJ*, in press
- Bolatto, A.D.; Simon, J. D.; Stanimirovic, S.; van Loon, J. T.; Shah, R. Y.; Venn, K.; Leroy, A. K.; Sandstrom, K.; Jackson, J. M.; Israel, F. P.; Li, A.; Stavelly-Smith, L.; Bot, C.; Boulanger, F.; & Rubio, M.; "The Spitzer Survey of the Small Magellanic Cloud: S<sup>3</sup> MC Imaging and Photometry in the Mid- and Far-Infrared Wave Bands," 2007, *ApJ*, 655, 212-232
- Carraro, G.; Subramanian, A. & Janes, K.A.; "Fundamental parameters of six neglected old open clusters," 2006, *MNRAS*, 371, 1301
- Churchwell, E.; Povich, M. S.; Allen, D.; Taylor, M.G.; Meade, M.R.; Babler, B.L.; Indebetouw, R.; Watson, C.; Whitney, B.A.; Wolfire, M.G.; Bania, T.M.; Benjamin, R.A.; Clemens, D.P.; Cohen, M.; Cyganowski, C.J.; Jackson, J.M.; Kobulnicky, H.A.; Mathis, J.S.; Mercer, E.P.; Stolovy, S.R.; Uzpen, B.; Watson, D.F.; & Wolff, M.J.; "The Bubbling Galactic Disk", 2006, *ApJ*, 649, 759-778
- Currie, T.; Balog, Z.; Kenyon, S.J.; Rieke, G.; Prato, L.; Young, E.T.; Muzerolle, J.; Clemens, D.P.; Buie, M.; Sarcia, D.; Grabau, A.; Tollestrup, E.V.; Taylor, B.; Dunham, E.; & Mace, G.; "Spitzer IRAC and JHK<sub>s</sub> Observations of  $\eta$  and  $\chi$  Persei: Constraints on Protoplanetary Disk and Massive Cluster Evolution at 10<sup>7</sup> Years", 2007, *ApJ*, 659, 599-615
- D'Arcangelo, F.D.; Marscher, A.P.; Jorstad, S.G.; Smith, P.S.; Larionov, V.M.; Hagen-Thorn, V.A.; Kopatskaya, N.; Williams, G.G.; & Gear, W.K. "Rapid Multiwaveband Polarization Variability in the Quasar PKS 0420-014:

Optical Emission from the Compact Radio Jet”, 2007, ApJ, 659, L107-L110

Jorstad, S.G.; Marscher, A.P.; Stevens, J.A.; Smith, P.S.; Forster, J.R.; Gear, W.K.; Cawthorne, T.V.; Lister, M.L.; Stirling, A.M.; Gomez, J.L.; Greaves, J.S. & Robson, E.I. “Multiwaveband Polarimetric Observations of 15 Active Galactic Nuclei at High Frequencies: Correlated Polarization Behavior”, 2007, AJ, 134, in press

Marscher, A.P.; Jorstad, S.G.; Gomez, J.L.; McHardy, I.M.; Krichbaum, T.P. & Agudo, I. “Search for Electron-Positron Annihilation Radiation from the Jet in 3C 120”, 2007, ApJ, 665, in press

McCullough, P.R.; Stys, J.E.; Valenti, J.A.; Johns-Krull, C.M.; Janes, K.A.; Heasley, J.N.; Bye, B.A.; Dodd, C.; Fleming, S.W.; Pinnick, A.; Bissinger, R.; Gar, B.L.; Howell, P.J.; & Vanmunster, T.; “A Transiting Planet of a Sun-like Star,” 2006, ApJ, 648, 1228-1238

McHardy, I.M.; Lawson, A.; Newsam, A.; Marscher, A.; Sokolov, A.; Urry, C.M.; & Wehrle, A. “Simultaneous X-ray and Infrared Variability in the Quasar 3C273 - II. Confirmation of the Correlation and X-ray Lag”, 2007, MNRAS, 375, 1521-1527

Mercer, E. P.; Clemens, D. P.; Rathborne, J. M.; Meade, M. R.; Babler, B. L.; Indebetouw, R.; Whitney, B.A.; Watson, C.; Wolfire, M.G.; Wolff, M.J.; Bania, T.M.; Benjamin, R.A.; Cohen, M.; Dickey, J.M.; Jackson, J.M.; Kobulnicky, H.A.; Mathis, J.S.; Stolovy, S.R.; Uzpen, B.; & Churchwell, E.B.; "A GLIMPSE of the Southern Jellyfish Nebula and Its Massive YSO", 2007, ApJ, 656, 242-247

Pyatunina, T.B.; Kudryavtseva, N.A.; Gabuzda, D.C.; Jorstad, S.G.; Aller, M.F.; Aller, H.D.; & Terasranta, H. “Frequency-Dependent Time-Delays for Strong Outbursts in Selected Blazars from the Metsahovi and the University of Michigan Radio Astronomy Observatory Monitoring Databases - I”, 2006, MNRAS, 373, 1470-1482

Quierza, C.; Rood, R.T.; Bania, T.M.; Balser, D.S.; & Maciel, W.J.; “The Galactic Electron Temperature Gradient” 2006, ApJ, 653, 1226-1240

Quierza, C.; Rood, R.T.; Balser, D.S.; & Bania, T.M.; “Radio Recombination Lines in Galactic H II Regions”, 2006, ApJS, 338-359

Rathborne, J. M.; Simon, R.; & Jackson, J. M.; "The Detection of Protostellar Condensations in Infrared Dark Cloud Cores," 2007, ApJ, 662, 1082-1092

Rogers, A.E.; Dudevoir, K.A.; & Bania, T.M.; “Observations of the 327 MHz Deuterium Hyperfine Transition”, 2007, AJ, 133, 1625-1632

Simon, R.; Rathborne, J.M.; Shah, R.Y.; Jackson, J.M.; & Chambers, E.T.; "The Characterization and Galactic Distribution of Infrared Dark Clouds," 2006, ApJ, 653, 1325-1335

Uzpen, B.; Kobulnicky, H.A.; Monson, A.J.; Pierce, M.J.; Clemens, D.P.; Backman, D.E.; Meade, M.R.; Babler, B.L.; Indebetouw, R.; Whitney, B.A.; Watson, C.; Wolfire, M.G.; Benjamin, R.A.; Bracker, S.; Bania, T.M.; Cohen, M.; Cyganowski, C.J.; Devine, K.E.; Heitsch, F.; Jackson, J.M.; Mathis, J.S.; Mercer, E.P.; Povich, M.S.; Rho, J.; Robitaille, T.P.; Sewilo, M.; Stolovy, S.R.; Watson, D.F.; Wolff, M.J.; & Churchwell, E.; "The Frequency of Mid-Infrared Excess Sources in Galactic Surveys", 2007, ApJ, 658, 1264-1288

Villata, M.; Jorstad, S.G.; & Marscher, A.P.; et al. (88 authors) "The Unprecedented Optical Outburst of the Quasar 3C 454.3. The WEBT Campaign of 2004-2005", 2006, A&A, 453, 817-822

Wang, Y.; Zhang, Q.; Rathborne, J. M.; Jackson, J.; & Wu, Y.; "Water Masers Associated with Infrared Dark Clouds," 2006, ApJ, 651, L125-L128

### **Seminars, Colloquia and Conference Talks**

Bania, T.; invited talk, *The Milky Way 3-Helium Abundance*, at the Symposium on the Composition of Matter: Honoring Johanness Geiss on the Occasion of His 80th Birthday, Grindelwald, Switzerland, 11-15 September 2006

Bania, T.; Astrophysics Colloquium, *The Cosmic Abundance of 3-Helium*, Boston University, 28 November 2006

Brainerd, T.; Astrophysics Colloquium, *Satellite Galaxies and CDM Halos*, Michigan State University, 18 January 2006

Brainerd, T.; Astrophysics Colloquium, *New Constraints on CDM Halos from Satellite Galaxies and Weak Lensing: the View from CAS 514B*, Boston University, 7 February 2006

Brainerd, T.; invited talk, *Satellite Galaxies & CDM Halos*, American Association of Physics Teachers Annual Meeting, Boston, MA, 31 March 2006

Brainerd, T.; Physics Colloquium, *Constraints on Dark Matter Halos from Satellite Galaxies*, UMass Lowell, 20 September 2006

Brainerd, T.; two invited lectures, *Galaxy-Galaxy Lensing: History, Theoretical Expectations & Simulations* and *Galaxy-Galaxy Lensing: Observational Constraints on Dark Matter Halos*, INAF/COSMOCT International School on Gravitational Lensing, 30 October 2006

Jorstad S.; invited talk, *Successes and Problems of VLBI Observations of Blazars*, at conference “VLBI-2012 for Astrometry, Geodynamics, and Astrophysics”, Institute of Applied Astronomy, St. Petersburg, Russia, 11-15 September 2006

Jorstad S.; contributed talk, *The Kiloparsec Scale Jet of the Quasar 1317+520*, American Astronomical Society Meeting 209, 5-10 January 2007

Jorstad S.; invited talk, *VLBA mm-monitoring*, at conference “VLBI in the GLAST Era”, NASA-Goddard Space Flight Center, 23-24 April 2007

Jorstad, S.; contributed talk, *The Quasar 1317+520: A Laboratory for Particle Acceleration*, at conference “Extragalactic Jets: Theory and Observation from Radio to Gamma Ray”, Girdwood, Alaska, 21-24 May 2007

Jorstad, S.; contributed talk, *Long-term mm-wave Monitoring of the Quasar 3C 279 with the VLBA*, at the 17th New England AGN Workshop (NERQUAM), Haystack Observatory, 5 June 2007

Marscher, A.; invited talk, *View of Active Galactic Nuclei from the Past and Present*, at conference “Astronomy 2006: Tradition, Present, and Future”, St. Petersburg, Russia, 22-27 June 2006

Marscher A.; invited lecture, *Progress in Our Understanding of Blazars*, at the 8th ENIGMA meeting, Helsinki, Finland, 9 September 2006

Marscher A.; invited talk, *Relativistic Jets in AGN and their Relationship to the Central Engine*, at conference “Microquasar Workshop IV: Microquasars and Beyond”, Como, Italy, 21 September 2006

Marscher, A.; contributed talk, *Limit to the Positron Content of the Jet in 3C 120 from INTEGRAL and mm-Wave VLBI Observations*, at the American Astronomical Society Meeting 209, 5-10 January 2007

Marscher A.; invited talk, *Radio and Gamma-ray Emission from Extragalactic Jets and VLBI-EGRET Results*, at conference “VLBI in the GLAST Era”, NASA-Goddard Space Flight Center, 23-24 April 2007

Marscher, A.P.; invited talk, *GLAST and Multiwaveband Monitoring as Probes of Bright Blazars*, at workshop “Getting Involved with GLAST”, Harvard Univ.; Cambridge, MA, 21 June 2007

Marscher, A.; contributed talk, *The Core of a Blazar Jet*, at conference “Extragalactic Jets: Theory and Observation from Radio to Gamma Ray”, Girdwood, Alaska, 21-24 May 2007

Marscher, A.; contributed talk, *X-ray Dips and Superluminal Ejections in the Radio Galaxies 3C 120 and 3C 111*, at the 17th New England AGN workshop (NERQUAM), Haystack Observatory, 5 June 2007

### Conference Proceedings and Abstracts

Bania, T. M.; “The Saga of 3-Helium,” in “But it Was Fun: the First Forty Years of Radio Astronomy at Green Bank”, 2007, eds. F. J. Lockman; F. D. Ghigo; & D. S. Balser (Green Bank: NRAO), 384-395

Bania, T.M.; Rood, R.T.; & Balser, D.S.; “The Milky Way 3-Helium Abundance”, Space Sciences Series of ISSI, 2007, 27, G. Gloeckler; G. Mason; & R. von Steiger; eds. (Springer: Berlin), 87-97

Chambers, E.T.; Jackson, J. M.; Rathborne, J. M.; & Simon, R.; “A Water and Methanol Maser Survey of Infrared Dark Clouds,” 2007, BAAS, 210.87.02

Chambers, E.T.; Jackson, J. M.; Rathborne, J. M.; & Simon, R.; “Characterizing Star Formation Activity in Infrared Dark Cloud Cores,” 2006, BAAS, 209.105.01

Clarke, T.; Blanton, E.; Sarazin, C.; Kassim, N.; Anderson, L.; Schmitt, H.; Gopal-Krishna; & Neumann, D.; “Tracing Ghost Cavities with Low Frequency Radio Observations”, 2006, to appear in the proceedings of "Heating vs. Cooling in Galaxies and Clusters of Galaxies", eds. H. Boehringer, P. Schuecker, G. W. Pratt & A. Finoguenov (ESO Astrophysics Symposia, Springer-Verlag), Garching (Germany)

Clarke, T.; Blanton, E.; Sarazin, C.; Kassim, N.; & Anderson, L.; “Tracing AGN Outbursts in Clusters Cores using X-ray and Low Frequency Radio Observations”, 2006, American Astronomical Society, HEAD meeting #9, #13.31

Clemens, D.P.; Pinnick, A.; Pavel, M.; Taylor, B.; & Jameson, K.; ”GPIPS: Season One”, 2006, BAAS, 209.172.23

Douglass, E.; Blanton, E.; Clarke, T.; Sarazin, C.; & Wise, M.; “Chandra Observation of the Cluster Environment of a WAT Radio Source in Abell 1446”, 2007 AAS/AAPT Joint Meeting, American Astronomical Society Meeting 209, #77.19

Jackson, James M.; Rathborne, J.; Chambers, E.; & Simon, R.; “Cluster Formation in Infrared Dark Clouds,” 2007, BAAS, 210.87.01

Jackson, J.M.; Rathborne, J.; Chambers, E.; Zhang, Q.; & Simon, R.; “SMA Observations of IRDC Cores: An Active Hot Core and a Quiescent Cold Core,” 2006, BAAS, 209.133.02

Jorstad, S.G.; Marscher, A.P.; Lister, M.L.; Stirling, A.M.; Cawthorne, T.V.; Gomez, J.L.; Gear, W.K.; Stevens, J.L.; Robson, E.I.; Smith, P.S.; & Forster, J.R.; “Jet Kinematics of AGNs at High Radio Frequencies”, in “Blazar Variability Workshop II: Entering the GLAST Era”, eds. H. R. Miller, K. Marshall, J. R. Webb, and M. F. Aller, 2007, ASP Conference Series, 350, 149

Jorstad, S.G.; & Marscher, A.P.; “Kinematics of Jets in Gamma-ray blazars”, Proceedings of the First International GLAST Symposium (American Institute of Physics Conference Series), eds. S. Ritz, P.F. Michelson, & C. Meegan, 2007, in press

Jorstad, S.G.; Marscher, A.P.; Aller, M.F.; & Balonek, T.J.; “X-ray, Optical, and Radio Monitoring of Gamma-Ray Blazars”, in “AGN Variability from X-Rays to Radio Waves”, eds. C. Martin Gaskell, Ian M. McHardy, Bradley M. Peterson and Sergey G. Sergeev. 2007, ASP Conference Series, 360, 153

Jorstad, S.G.; “Successes and Problems of VLBI Observations of Blazars”, in “VLBI-2012 for Astrometry, Geodynamics, and Astrophysics”, 2006, Institute of Applied Astronomy of Russian Academy of Sciences, St. Petersburg, Russia, 70-75

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## Appendix B: Seminar Series Schedules

### Institute for Astrophysical Research Seminar Series Fall 2006

Sept. 1 – Paul Vanden Bout, National Radio Astronomy Observatory, *Studies of Dense, Star-forming Gas in High-Z Galaxies: Star Formation at Cosmic Dawn*

Sept. 26 - Svetlana Jorstad, IAR/BU , *Polarimetric Studies of AGNs at High Frequencies*

Oct. 3 - Riccardo Giovanelli, Cornell University, *ALFALFA: the Extragalactic HI Arcibo Legacy Survey*

Oct. 17 - Mark Reid, Harvard-Smithsonian CfA, *Mapping the Milky Way: Parallax and Proper Motions with the VLBA*

Oct. 24 - Jeffrey McClintock, Harvard-Smithsonian CfA, *The Spin of the Near-Extreme Kerr Black Hole GRS 1915+105*

Oct. 31 - Erik Rosolowsky, Harvard-Smithsonian CfA, *Connecting Local and Global Star Formation*

Nov. 6 - Tracy Clarke, Naval Research Laboratory, *Cavities and Relics: Low Frequency Observations of Galaxy Clusters*

Nov. 7 - Margaret Hanson, University of Cincinnati, *Revealing our Galaxy's Massive Star Clusters*

Nov. 14 - Paul Schechter, MIT, *Gravitational Micro-Lensing of Quasars at Unit Optical Depth*

Nov. 28 - Thomas Bania, IAR/BU, *The Cosmic Abundance of 3-Helium*

Dec. 5 - Alyssa Goodman, Harvard University, *Tasting the COMPLETE Survey of Star-Forming Regions*

**Institute for Astrophysical Research Seminar Series**  
**Spring 2007**

Jan. 23 - Justin Kasper, MIT, *Breaking the Ionospheric Barrier: The Mileura Wide-field Array and the Return of Low Frequency Radio Astronomy*

Jan. 30 - Elizabeth Blanton, IAR/BU, *Radio Sources in Clusters of Galaxies: Impact on the ICM and Probes of High- $z$  Systems*

Feb. 6 - Karl Gordon, University of Arizona, *Spitzer Observations of the Aromatic Features: New Insights from Spectroscopy and Imaging*

Feb. 27 - Bob Rood, University of Virginia, *The Nature of Technological Civilizations: How to Search for Unicorns*

Mar. 6 - Bob Benjamin, University of Wisconsin at Whitewater, *Infrared Galactic Cartography: Constraints on the Stellar Disk, Bar, and Spiral Arms*

Mar. 13 - No Seminar (Spring Break)

Mar. 20 - Geoffrey Landis, NASA Glenn Research Center, *Three Years on Mars: the Mars Exploration Rovers Mission*

Mar. 27 - David Helfand, Columbia University, *MAGPIS: Finding Magnetars, Dark Accelerators, and Other Shiny Trinkets in a Galactic Plane Radio Survey*

Apr. 3 - Brian Chaboyer, Dartmouth College, *Ages of Old Star Clusters in the Milky Way*

Apr. 10 - Kevin Marvel, Executive Officer, American Astronomical Society, *Astronomy Policy and the FY 2008 Budget*

Apr. 11 - Lord Martin J. Rees, Cambridge University, *Scanning Cosmological Horizons*

Apr. 17 - David Charbonneau, Center for Astrophysics, *The Era of Comparative Exoplanetology*

Apr. 23 - Jim Heasley, Institute for Astronomy University of Hawaii, *The Pan-STARRS Project*

Apr. 24 - Steven Snowden, NASA Goddard Space Flight Center, *The Diffuse X-ray Background, from Earth's Exosphere to the Edge of the Universe OR One Astronomer's Signal is Another Astronomer's Contamination*

May 1 - Maxim Markevitch, Harvard-Smithsonian CfA, *Novel Methods of Measuring Some Interesting Properties of Intergalactic Gas in Clusters*