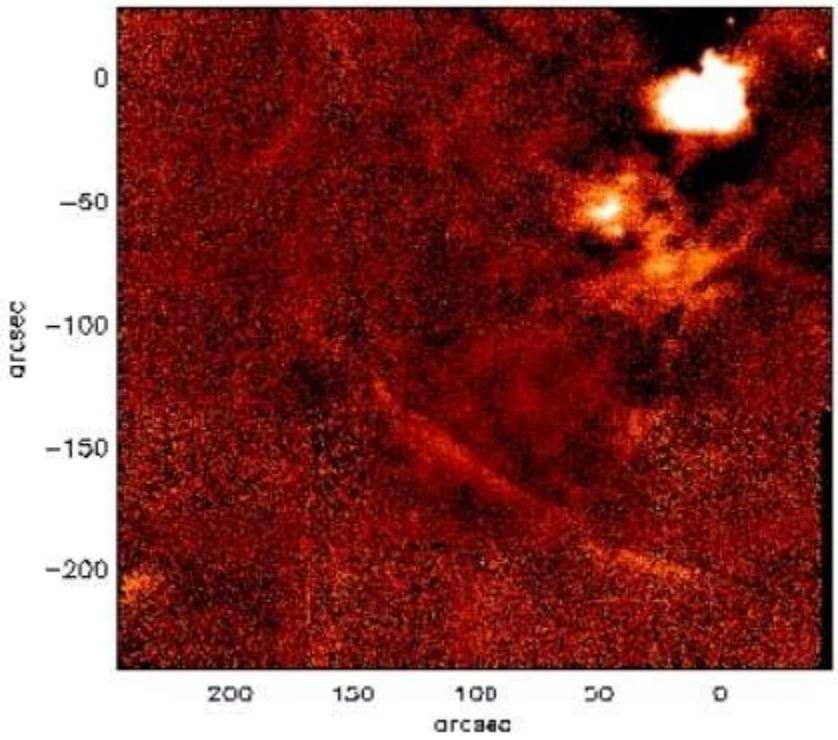
Boston University
Institute for Astrophysical Research
Annual Report
June 2003



Warm dust in the Orion nebula as imaged by the IAR's MIRSI mid-infrared camera

James M. Jackson, Director
Kimberly Paci, Fiscal Administrator

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Summary

The Institute for Astrophysical Research marked a very successful 5th year in its mission to foster research in astrophysics at Boston University. MIRSI (the Mid-InfraRed Spectrometer and Imager) conducted its first scientific observations on NASA's Infrared Telescope Facility. The spectacular images it produced demonstrate that MIRSI is the world's premier mid-infrared camera. Two other IAR instruments, Mimir (named after a Norse god), and PRISM (the Perkins ReImaging SysteM) are near completion and will be deployed to the Perkins telescope at Lowell Observatory in summer 2003. The Galactic Ring Survey celebrated a major milestone when it surpassed one million points on its way to map a major portion of the Milky Way Galaxy.

The IAR continues a vigorous research program. In FY2003, total IAR grant expenditures, including new and continuing grants, was $977,093. IAR members submitted twenty new funding proposals totaling over $16M in requests. The IAR received a total of $831,827 in grant income, including seven new awards totaling $230,274. IAR members published eighteen scientific papers in refereed journals.

Our partnership with Lowell Observatory continues to be successful. The deployment of two new IAR instruments, Mimir and PRISM, to the Perkins 72-inch telescope at Lowell this summer will provide a major upgrade in IAR facilities. Boston University and Lowell Observatory renewed their partnership and will continue to share the use of the 72-inch Perkins telescope in Arizona for at least five more years.

The IAR will host a scientific conference, "Milky Way Surveys: the Structure and Evolution of Our Galaxy," from June 15 to 17, 2003. Over 100 astronomers from around the world will attend.

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 in 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 this past year, the IAR membership consisted of faculty, staff, and students involved in astrophysical research. Faculty members included Professors Thomas Bania, Dan Clemens, James Jackson, Kenneth Janes, and Alan Marscher, Associate Professor Tereasa Brainerd, and Assistant Professor Lynne Deutsch. Research Associates affiliated with the IAR included Senior Research Associates Drs. Svetlana Jorstad and Eric Tollestrup, Research Associates Drs. Joseph Adams, Jill Rathborne, Ronak Shah, and Robert Simon, Research Fellow Dr. Kathleen Kraemer, and Senior Mechanical Engineer Domenic Sarcia. IAR staff members included Senior Research Associate Dr. Amanda Bosh, stationed in Flagstaff, Arizona at the Lowell Observatory site on Mars Hill, Senior Research Technician Alexander Grabau, and IAR Fiscal Administrator Ms. Kimberly Paci.

Dr. Eric Tollestrup left the IAR in May 2003 become the Assistant Director of NASA's Infrared Telescope Facility in Hawaii.

Dr. Joseph Adams left the IAR in February 2003 to accept a position with the Kodak Corporation.

Dr. Robert Simon left the IAR in January 2003 to accept a research position with the University of Cologne in Germany.

Dr. Jill Rathborne joined the IAR in May 2003 as a Research Associate. Dr. Rathborne received her PhD from the University of New South Wales, Sydney, Australia.

Senior Mechanical Engineer Dominic Sarcia left the IAR in March 2003.

Graduate students conducting astrophysical research with IAR faculty during the past year included Ms. Melissa Hayes-Gehrke, Mr. Marc Kassis, Mr. Andrei Sokolov, Dr. Michal Kolpak, Ms. Alexis Johnson, Ms. Emily Mercer, and Ms. Nina Bonaventura. Undergraduate students working within the IAR included Ms. Emily Flynn, Mr. Todd Veach, Mr. Michael Specian, Mr. Kris Makrides, and Mr. Ori Fox.

Dr. Michal Kolpak defended his PhD dissertation, entitled "The Large Scale Galactic Structure of Star Formation Tracers" and received his degree in May 2003. Dr. Kolpak is the IAR's third PhD recipient.

Ms. Emily Flynn received the IAR Undergraduate Prize for Excellence in Astrophysical Research for her work on the Galactic Ring Survey.

During the past year, Prof. Deutsch has been on leave of absence at the Harvard-Smithsonian Center for Astrophysics working with the team that developed the Infrared Array Camera for NASA's Space InfraRed Telescope Facility mission.

Prof. Bania was on sabbatical during the 2003 spring semester.

Prof. Clemens resigned as IAR Director in December 2002 to concentrate on the Mimir instrument.

Prof. Jackson was appointed IAR Director in January 2003 for a five-year term.

Scientific Highlights

Over the past year IAR members published a number of significant scientific papers, including eighteen papers in refereed journals, one section in a book, twelve abstracts, and thirteen invited talks. A complete list of all of last year's IAR publications is presented in Appendix A.

Two studies led by IAR graduate students are particularly noteworthy. Kassis et al. (2002) studied the mid-infrared emission from the star-forming region M17 using the MIRAC3 instrument on the Infrared Telescope Facility. The IAR team found embedded protostars, young objects that are on their way to becoming stars. From the mid-infrared emission, the team was able to estimate the type of star the objects will become and the amount of material surrounding the young stars. For one object, the team also discovered evidence for a circumstellar disk, the precursor to the formation of planets.

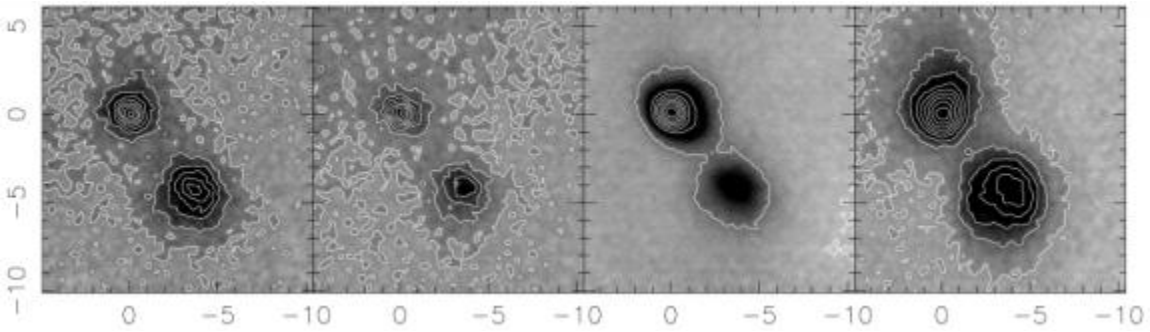


Figure 1. *Images of two embedded protostars (M17-UC1 and IRS 5e) in the M17 region, at wavelengths of 9.8, 10.53, 11.7, and 20.6 mm (from left to right). The angular scale is in arcseconds (Kassis et al. 2002).*

Kolpak et al. (2003) showed that distances to star forming regions in the Milky Way can be accurately found by studying the absorption of intervening hydrogen gas. Although distance measurements in the Milky Way have been hampered by a long-standing problem known as the "near-far kinematic distance ambiguity," Kolpak and his team have resolved the ambiguity using sensitive new measurements with the Very Large Array and find compelling evidence for spiral structure in our home galaxy.

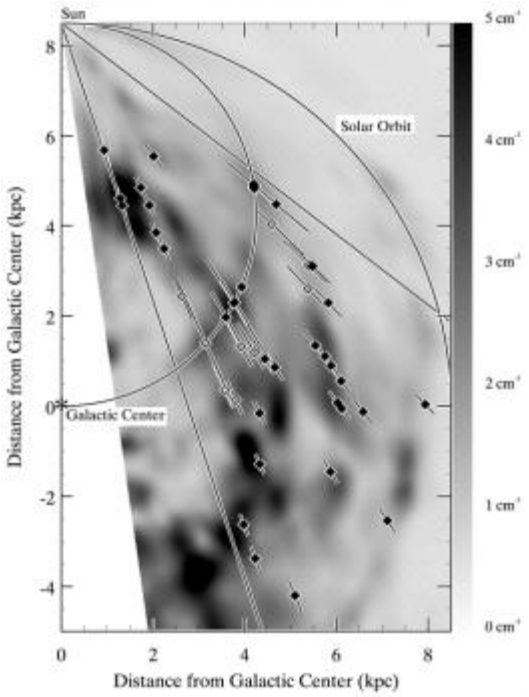


Figure 2. *A face-on map of ionized gas regions in the Milky Way (squares) for which accurate distances have been determined by analyzing sensitive measurements with the Very Large Array radiotelescope. Superposed is an image of the estimated distribution of molecular gas in the Milky Way. Note that the ionized gas regions appear to lie in spiral arms (Kolpak et al. 2003).*

Instruments and Telescopes

IAR members are actively engaged in three major technical programs: (1) the development of new instruments, (2) the Lowell Observatory Partnership, and (3) Antarctic infrared astronomy.

Instrumentation Program

The IAR instrument development program reached new heights in 2002/2003. One instrument (MIRSI) had a spectacular first run on the Infrared Telescope Facility in Mauna Kea. Two new instruments designed for the Perkins telescope at the Lowell Observatory (Mimir and PRISM) are near completion. Mimir and PRISM should achieve first light in summer 2003.

MIRSI

Prof. Lynne Deutsch's instrument MIRSI (Mid-InfraRed Spectrometer and Imager) is a state-of-the-art mid-infrared (8-26 mm wavelength) imager and spectrograph using a 240x320 pixel detector array. MIRSI had its first scientific observations at NASA's Infrared Telescope Facility on Mauna Kea, Hawaii in 2002. MIRSI images and spectroscopy of the Orion star-forming region reveal the warm dust heated by the nascent, embedded young stars. These observations suggest that the transition between the ionized gas in the immediate vicinity of the hot young stars and the more distant neutral gas is extremely sharp, much sharper than theory predicts.

MIRSI will be available to the astronomical community for use on the IRTF in future observing runs. The next is scheduled for July 2003.

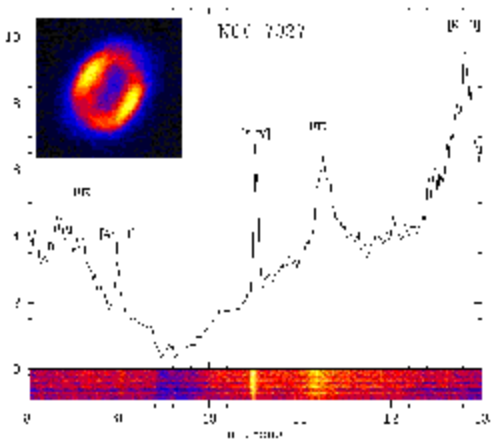


Figure 3. *A mid-infrared MIRSI image (color) and spectrum (plot) of the planetary nebula NGC 7027. Spectral features include ionic lines of argon, sulfur, and neon, and two "UIR" (unidentified infrared) features that arise from small dust grains.*

Mimir

Prof. Clemens leads an IAR team including Dr. Tollestrup, Mr. Sarcia, and Mr. Grabau in designing and fabricating the Mimir near-infrared (1-5 mm wavelength) imaging spectrometer and polarimeter for use on the Perkins 72-inch telescope. During the past year, the IAR team fabricated the instrument and conducted a series of "cold tests" to check system performance at cryogenic temperatures. The 1024x1024 InSb array was purchased and will be shipped to Boston in June 2003. The electronics have been installed and tested. In Summer 2003, Mimir will be integrated, tested, and delivered to Lowell Observatory. Prof. Clemens will accompany Mimir to Arizona and will take part in testing and installation at the Perkins telescope. Once commissioned, Mimir will remain at the Perkins telescope for general use.

Figure 4. *The Mimir instrument in the IAR infrared lab.*

PRISM

Prof. Ken Janes, along with Sarcia and graduate student Melissa Hayes-Gehrke, has designed and fabricated the PRISM (Perkins ReImaging SysteM) wide-field optical (0.3-1 mm wavelength) imaging spectrograph for use on the Perkins telescope. The PRISM cryostat has been assembled, and vacuum tests are underway. Final fabrication and testing should be complete in summer 2003, when it will be shipped to Lowell Observatory. PRISM will join Mimir as an IAR instrument available for routine use by all Lowell Observatory, Boston University, and outside collaborative scientists.

Figure 5. *The PRISM instrument.*

Lowell Observatory Partnership

Boston University and Lowell Observatory are partners in the operation of the 72-inch Perkins telescope on the Andersen Mesa, near Flagstaff, Arizona. Boston University scientists and students regularly used the telescope in the past year. The Boston University and Lowell Observatory have agreed to a new five-year term for joint use of the Perkins telescope. This new agreement is vital to reap the scientific benefits of the Mimir and PRISM instruments.

The Antarctic Infrared Observatory (AIRO)

Prof. James Jackson is leading a team that is proposing to the NSF Office of Polar Programs to build AIRO (the Antarctic InfraRed Observatory). A 2-m class infrared telescope, AIRO will initially be equipped with a 2-color (K and L band) camera. AIRO would be deployed to Antarctica after a five-year construction and testing period in Boston and at Lowell Observatory. It would be optimized for an efficient, relentless wide-field imaging survey in the thermal infrared. These wavelengths, from 2.4 to 5 mm wavelength, provide a unique window on very low-mass stars (brown dwarfs), protoplanetary disks, very old stars, and the star-forming Universe. The AIRO team includes members from both Boston University and Lowell Observatory.

Significant NSF support ($121,600) for the AIRO design was awarded to Boston University from the NSF Office of Polar Programs.

Profs. Jackson and Clemens briefed the NSF Office of Polar Programs on the AIRO project in Washington on May 23, 2003.

The IAR supports AIRO as its top priority among potential new projects.

Scientific Programs

In addition to instrument development, the IAR hosts a number of scientific programs. The blazar research group, consisting of Prof. Alan Marscher,
Senior Research Associate Svetlana Jorstad, and graduate student Andrei Sokolov, continued their work on the high-energy plasma jets of quasars and other active nuclei of galaxies. Their studies included monitoring of the brightness changes near the base of the jets in a number of objects at X-ray (NASA's RXTE satellite), optical and near-infrared (Lowell Observatory), and radio (U. of Michigan and Finland's Metsahovi radio observatories) wavelengths. A unique facet of their program is monthly imaging of the changing appearance of the jets at extraordinarily fine resolution (0.0001 arcseconds, or 1000 times better than the Hubble Space Telescope) achieved with the ten radio antennas of the Very Long Baseline Array, one of which is located at Boston University's Sargent Camp. Mr. Sokolov is developing new theoretical models for explaining the characteristics of the flares in brightness that these observations reveal. A new component of the program is imaging of the extended jets of quasars at X-ray wavelengths with NASA's Chandra satellite.

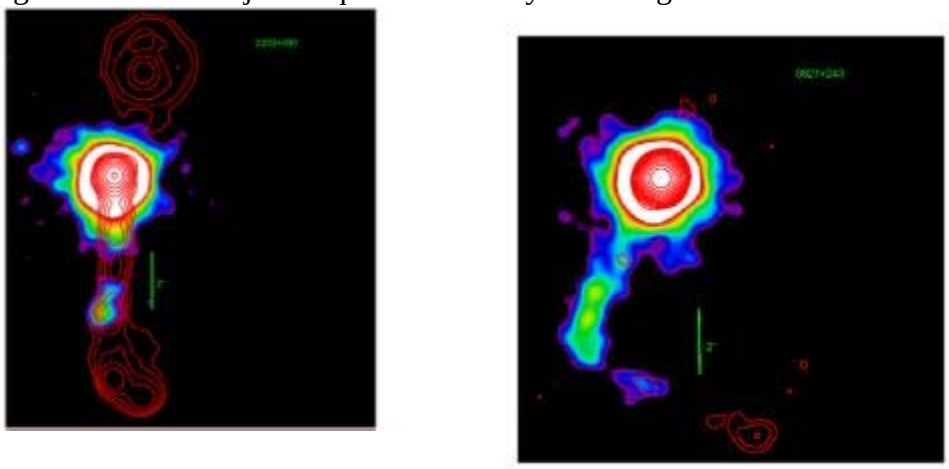


Figure 6. *False-color images of the X-ray emission from the jets of two quasars, obtained with NASA's Chandra satellite. The jets extend more than 1 million light-years from the nuclei of the galaxies from which they emanate. The red contours map out the radio-wave emission. Noteworthy are the sharp bend and absence of radio emission in the brightest part of the X-ray jet in 0827+243 (left) and the offset of the X-ray and radio emission from the bright spot in 2209+080 (right). (Note that the nucleus is overexposed in each image.)*

Prof. Bania, along with collaborators Prof. Rood at Virginia and Dr. Balser at NRAO (and formerly of Boston University), are engaged in a long-term project to measure the abundance of the rare 3-helium isotope via observations of its radio spin-flip transition. Because 3-helium was produced in the very early Universe, its abundance provides key cosmological constraints.

In order to infer the mass and the shape of “dark matter” haloes that surround all galaxies, Prof. Brainerd studies gravitational lensing that arises from the deflection of light from distant galaxies by nearer, foreground galaxies. Because these haloes are composed not of stars, but of some non-luminous material, gravitational lensing offers the most powerful known technique for their study.

The Galactic Ring Survey (GRS) is a multi-year effort to map the distribution of the ^{13}CO molecular line in the inner part of the Milky Way galaxy. Prof. Jackson leads the GRS in collaboration with Profs. Bania and Clemens, Research Associates Dr. Rathborne and Dr. Shah, graduate students Johnson and Kolpak, undergraduates Fox, Veach, Flynn, and Nero, and collaborator Dr. Mark Heyer at the Five College Radio Astronomy Observatory. Last year, the GRS covered over 16 square degrees, bringing the total area mapped up to 50 square degrees. In December 2002, the GRS passed a significant milestone in mapping its millionth point. This noteworthy event was celebrated with a Megapixel Party on May 2, 2003.

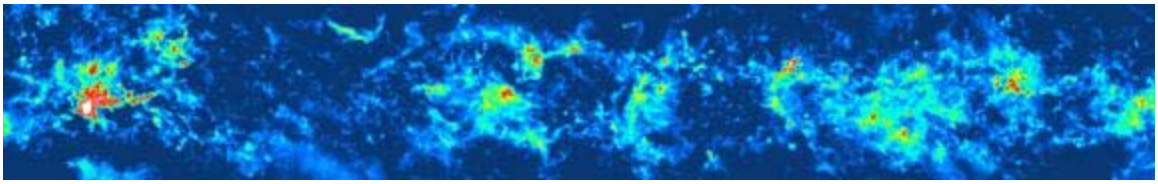
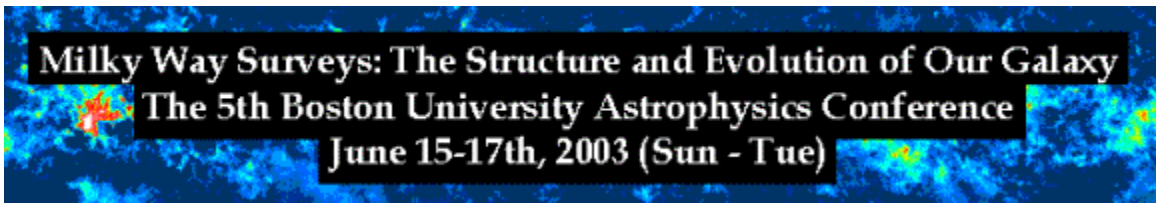


Figure 7*. An image of* ^{13}*CO emission along the Galactic plane from the BU-FCRAO Galactic Ring Survey reveals star-forming molecular clouds in the inner Milky Way galaxy. The image covers ~16 square degrees of the Galactic Plane from 40 to 51 degrees in galactic longitude and -1 to 0.5 degrees in latitude.*

"Milky Way Surveys: The Structure and Evolution of Our Galaxy" Conference

From June 15 to 17, 2003, the IAR will host Boston University's fifth international conference, "Milky Way Surveys: The Structure and Evolution of Our Galaxy." With over 100 astronomers from 6 continents in attendance, this conference will bring together the leading theorists with observers conducting the most modern surveys of the Milky Way. With its participation in the Galactic Ring Survey, the GLIMPSE infrared survey, and AIRO, the IAR is an important contributor to Galactic astronomy.



Seminar Series

The IAR Astrophysics Seminar Series on Monday 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 nineteen 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.

Future Activities

During the upcoming year, we will continue the Perkins telescope partnership with Lowell Observatory. MIRSI will be deployed to the Infrared Telescope Facility, and Mimir and PRISM to the Perkins telescope. These instruments will greatly improve the quantity, quality, and stature of our scientific publications in the upcoming next few years.

We will continue to promote the Antarctic Infrared Observatory project as our first priority for a new telescope facility.

As our new instruments and telescopes (MIRSI, Mimir, PRISM, and AIRO) come on-line in the next few years, we need to position ourselves to make the new discoveries that these unique capabilities will make possible. However, as many of our faculty have made the transition from observational to instrumental programs, we have fewer faculty devoted to observing and analysis. The IAR needs a new, young astrophysics faculty member who will utilize our instruments and telescopes to conduct front-line research and to secure our rise in scientific stature. That person should be sought and hired within the next 3 years.

When AIRO comes on line, we will be poised to build new infrared instruments, and to seek out even larger, more sophisticated telescope and instrument opportunities. Several initiatives, such as the Lowell Next Generation Telescope and the Cornell large infrared telescope, are actively under consideration.

Appendix A: Publications

Articles in Refereed Journals

Adams, Joseph D., Stauffer, John R.; Skrutskie, Michael F.; Monet, David G.; Portegies Zwart, Simon F.; Janes, Kenneth A.; Beichman, Charles A., "Structure of the Praesepe Star Cluster," 2002, AJ, 124, 1570

Bania, T.M., Rood, R.T., & Balser, D.S., "The cosmological density of baryons from observations of 3-He^+ in the Milky Way", 2002, Nature, 415, 54

Bradford, C. M., Nikola, T., Stacey, G. J., Bolatto, A. D., Jackson, J. M., Savage, M. L., Davidson, J. A., Higdon, S. J. CO (J=7-->6) Observations of NGC 253: Cosmic-Ray-heated Warm Molecular Gas", 2003, ApJ, 586, 891

Fong, D., Meixner, M., & Shah, R.Y., "Discovery of Multiple Molecular Shells in the Outer Envelope of IRC +10216", 2003, ApJ, 582L, 39F

Friel, Eileen D., Janes, Kenneth A., Tavarez, Maritza, Scott, Jennifer; Katsanis, Rocio, Lotz, Jennifer, Hong, Linh, & Miller, Nathan, "Metallicities of Old Open Clusters", 2002, AJ, 124, 2693

Hagen-Thorn, V.A., Larionov, V.M., Jorstad, S.G., and Larionova, E.G., "Periodic component in variations of brightness and polarization of BL Lacertae", 2002, AJ, 124, 3031, 3034

Ingalls, J.G., Reach, W.T., & Bania, T.M., "Photoelectric Heating and [C II] Cooling of High Galactic Latitude Translucent Clouds", 2002, ApJ, 579, 289, 303

Jackson, J.M., Bania, T.M., Simon, R., Kolpak, M., Clemens, D.P., & Heyer, "H I Self-Absorption and the Kinematic Distance Ambiguity: The Case of the Molecular Cloud GRSMC 45.6+0.3", 2002, ApJ, 566L, 81

Kolpak, M.A., Jackson, J.M., Bania, T.M., Clemens, D.P., & Dickey, J.M., "Resolving the Kinematic Distance Ambiguity toward Galactic HII Regions", 2003, ApJ, 582, 756, 769

Kolpak, M.A., Jackson, J.M., Bania, T.M., & Dickey, J.M., "The Radial Distribution of Cold Atomic Hydrogen in the Galaxy", 2002, ApJ, 578, 868, 876

Kraemer, K. E., Jackson, J. M., Kassis, M., Deutsch, L. K., Hora, J. L., Simon, R., Hoffmann, W. F., Fazio, G. G., Dayal, A., Bania, T. M., and 2 coauthors, "Five star-forming cores in the galactic ring survey: a mid-infrared study", 2003, ApJ, 588, 918

Marscher, A.P., Jorstad, S.G., G'omez, J-L., Mattox, J.R., Wehrle, A.E., "High-Frequency VLBA Total and Polarized Intensity Images of Gamma-Ray Blazars", 2002, ApJ, 577, 85, 97

McQuinn, Kristen B. W., Simon, Robert, Law, Casey J., Jackson, James M., Bania, T. M., Clemens, Dan P., Heyer, Mark H., "A Comparison of 13CO and CS Emission in the Inner Galaxy", 2002, ApJ, 576, 274

Rood, R. T., Bania, T. M., & Balser, D.S., Perspectives Article: "The 3He Saga", 2002, Science, 295, 804, 806

Savolainen, T., Wiik, K., Valtaoja, E., Jorstad, S.G., Marscher, A.P., "Connections between millimetre continuum variations and VLBI structure in 27 AGN," 2002, AstrAp, 394, 851, 861

Stirling, A.M., Cawthorne, T.V., Stevens, J.A., Jorstad, S.G., Marscher, A.P., Lister, M.L., G'omez, J.L., Smith, P.S., Agudo, I., Gabuzda D.C., Robson, E.I., Gear, W.K., “Discovery of a precessing jet nozzle in BL Lacertae," 2003, MNRAS, 341, 405, 422

Väisänen, P., Morel, T., Rowan-Robinson, M., Serjeant, S., Oliver, S., Sumner, T., Crockett, H., Gruppioni, C., Tollestrup, E. V., “Near- and mid-infrared colours of star-forming galaxies in European Large Area ISO Survey fields”, 2002 MNRAS.337.1043V

Villata, M., Jorstad, S.G., et al. ``The WEBT BL Lacertae Campaign 2000," 2002, AstrAp , 390, 407, 421

Books

Brainerd, T. G. & Blandford, R. D., “Gravitational Optics Studies of Dark Matter Halos”, book chapter in Gravitational Lensing: An Astrophysical Tool, eds. F. Courbin & D. Minniti (Springer-Verlag Lecture Notes in Physics vol. 608), pgs. 96-123 (2002)

Conference Proceedings and Abstracts

Bradford, C. M., Nikola, T., Stacey, G. J., Bolatto, A. D., Jackson, J. M., Savage, M. L., Davidson, J. A., Higdon, S. J., “Cosmic-Ray Heated Molecular Gas in NGC 253”, 2002, AAS, 201.2607

Brainerd, T. G., “Weak Lensing Constraints on Dark Matter Halos”, invited review in “New Cosmological Data and the Values of the Fundamental Parameters”, proceedings of IAU Symposium 201 (ASP S201), eds. A. Lasenby, A. W. Jones & A. Wilkinson, pp. 28-37 (2002)

Brainerd, T.G. & Wright, C.O., ”Constraining Halo Shapes with Weak Lensing”, in proceedings of A New Era in Cosmology, ASP conf. series 283, eds. N. Sharpe and T. Shanks, pgs. 177-180 (2002)

Brainerd, T.G. “Multiple Deflections in the HDF-North”, in proceedings of the Hubble's Science Legacy: Future Optical-UV Astronomy from Space, ASP conf. series 291, eds. K. R. Sembach, C. J. Blades, G. D. Illingworth, and R. C. Kennicutt, pgs. 347-350 (2003)

Flynn, E., Jackson, J.M., Simon, R., Shah, R.Y., Bania, T.M., & Wolfire, M. 2002, American Astronomical Society Meeting, 201, “H I Self-Absorption Toward Molecular Clouds: Theoretical Models”, 2002, AAS, 20111220

Johnson, A., Jackson, J.M., Shah, R.Y., Simon, R., Bolatto, A., & Di Francesco, J. 2002, American Astronomical Society Meeting, 201, The Structure of GRSMC045.46+0.05”, 2002, AAS, 20111219

Jorstad, S.G., Marscher, A.P., Lister, M.L., Stirling, A.M., “Measurements of the VLBI core proper motion of OJ 287 at 43 GHz”, 2002, AAS, 201, 4803

Marscher, A.P., Jorstad, S.G., McHardy, I.M., Aller, M.F., Balonek, T.J., Sokolov, A.S.,”Where the action in blazar jets: Multifrequency monitoring and VLBA imaging of 3C 273, 3C 279, PKS 1510-089, and BL Lac”, 2002, AAS, 201, 8608

Paglione, T. A. D., Jackson, J. M., Bergin, E. A., “CN/HCN: A Global Indicator of Star Formation?”, 2002,

AAS, 201.7707

Shah, R. Y., Simon, R., Flynn, E., Jackson, J. M., Bania, T. M., Clemens, D. P., Heyer, M. H., Johnson, A., Kolpak, M., McQuinn, K., and 5 coauthors, “The BU-FCRAO Milky Way Galactic Ring Survey”, 2002, AAS, 20111222

Shah, R.Y. & Wootten, A., “Identifying cold clumps in star forming regions with deuterated molecules”, 2002, P&SS, 50.1155S

Simon, R., Jackson, J.M., Bania, T.M., Clemens, D.P., & Heyer, M.H. 2002, American Astronomical Society Meeting, 201, “MSX Infrared Dark Clouds in the BU-FCRAO Galactic Ring Survey: A Galactic Ring Population”, 2002, AAS, 20111221

Invited Talks and Colloquia

Bania, T.M. "Parameters of Galactic Plane HI Survey with GALFA", Arecibo, Puerto Rico, GALFA workshop, Oct. 2002

Bania, T.M., "Resolving the Kinematic Distance Ambiguity with GALFA", Arecibo, Puerto Rico, GALFA workshop, March 2003

Brainerd, T.G, “Multiple Deflections in the HDF North”, Jan. 16, 2003 Invited Colloquium at The Ohio State University

Jackson, J.M., “The Antarctic Infrared Observatory (AIRO)”, 21 June 2002, Lowell Observatory, Flagstaff, AZ, Weekly Seminar Series

Jackson, J.M., “The Antarctic Infrared Observatory (AIRO)”, 15 July 2003, Shanghai Exhibition Center, Shanghai, China, Scientific Committee for Antarctic Research Conference

Jackson, J.M., “The Antarctic Infrared Observatory (AIRO)”, 29 April 2003, Capri, Italy, "Astrophysics at Concordia Station" workshop

Jackson, J.M., “The Galactic Ring Survey”, 14 November 2002, University of Massachusetts, Amherst, MA, Astrophysics Colloquium

Jackson, J.M., “The Galactic Ring Survey”, 9 May 2003, Center for Astrophysics, Cambridge, MA, Radio Group Lunch Talk

Jackson, J.M., “The Antarctic Infrared Observatory (AIRO)”, 23 May 2003, National Science Foundation, Office of Polar Programs, Washington, DC

Jorstad, S.G., “VLBI properties of Gamma-Ray Blazars”, Green Bank, West Virginia, “Radio Astronomy at the Fringe” workshop, October 11, 2002.

Marscher, A.M., "Relativistic Jets in Blazars: Where the Action Is," Green Bank, West Virginia, “Radio Astronomy at the Fringe” workshop, October 11, 2002.

Marscher, A.M., "Blazar Variability: Multiwaveband Correlations," Mayschloss, Germany, ENIGMA

Meeting, May 14, 2003

Marscher, A.M., "The Impact of Recent Monitoring Studies on the Theory of Multiwaveband Variability of Blazars," Nashville, Tennessee, American Astronomical Society meeting, May 26, 2003

Appendix B: Seminar Series Schedules

Institute for Astrophysical Research Seminar Series
Fall 2002

Sept. 16 Eric Tollestrup (BU/IAR)
SIRTF/GOODS

Sept. 26 Supriya Chakrabarti (BU/CSP)
SPIDR

Sept. 30 Chris Kochanek (Harvard-Smithsonian Center for Astrophysics)
Detection of CDM Substructure

Oct. 7 Di Li (Harvard-Smithsonian Center for Astrophysics)
HI Narrow Line Absorption – An Atomic Probe of Molecular Clouds

Oct. 23 Jay Lockman (NRAO)
The Vertical Structure of Neutral Hydrogen in the Galaxy

Oct. 28 Bob Reasenberg (Harvard-Smithsonian Center for Astrophysics)
Checking the Equivalence Principle While Riding on a Pogo Stick

Nov. 18 Scott Burles (MIT)
Deuterium and Big Bang Nucleosynthesis

Nov. 25 Markos Georganopoulos (NASA/Goddard Space Flight Center)
Relativistic and Slowing Down: The Plasma Flow in the Hotspots of Powerful Radio Galaxies

Dec. 9 Kyzysztof Stanek (Harvard-Smithsonian Center for Astrophysics)
Gamma-ray Bursts – Is the Mystery Solved?

Institute for Astrophysical Research Seminar Series
Spring 2003

Feb. 3 James Jackson (BU/IAR)
The BU FCRAO Galactic Ring Survey

Feb. 10 Tom Megeath (Harvard-Smithsonian Center for Astrophysics)
The Role of Massive Stars in the Formation of Young Stellar Clusters

Feb. 18 Matt Beasley (Univ. of Colorado)
A High Spatial Resolution Imaging Spectrograph for Far Ultraviolet

Feb. 24 Giovanni Fazio (Harvard-Smithsonian Center for Astrophysics)
SIRTF A New View of the Infrared

March 17 Dan Watson (Univ. of Rochester)
High-Resolution Infrared Imaging and Spectroscopy of Young Stellar Objects and Protoplanetary Disks

March 24 Andrew Harris (Univ. of Maryland)
Galactic and Extragalactic Radio Astronomy Over Very Wide Bandwidths

March 31 Emma Bakes (NASA Ames Research Center)
Finding the Answer to the 35 Year Problem of the Unidentified Infrared Emission Features

April 7 Sydney Barnes (Yale Univ.)
A New Paradigm for the Rotational Evolution of Solar and Late-type Stars

April 23 Johannes Staguhn (Goddard Space Flight Center)
Astronomical Observations with New Instruments for Far-Infrared and Submillimeter Imaging and Spectroscopy

April 28 Niel Brandt (Penn State Univ.)
The Cosmic X-ray Background and Results from the 2 Ms Chandra Deep Field – North Survey