



THE BOSTON UNIVERSITY ASTRONOMY DEPARTMENT ANNUAL REPORT 2004-2005

Harlan Spence, Chairman

Susanna Lamey, Administrator

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DEDICATION

We dedicate this year's annual report to the life of Harry E. Petschek. Dr. Petschek passed away on March 29, 2005, at the age of 74, after a long illness. He was a dedicated part of the CSP and the Department, and we are proud to have been a part of his amazing life.

Dr. Petschek was dubbed "the father of magnetic reconnection" for his seminal contributions to this universal energy conversion process in space plasmas. Harry had a long, varied, and highly successful career in science and engineering. He spent 25 years working at Avco Everett Research Laboratory, a defense and aerospace laboratory, where he worked with heat shielding and contributed to the success of the Apollo moon missions. He later advanced to be the president of Avco, and began research in the medical field. Dr. Petschek used his knowledge of aerodynamics and physics to help invent the intra-aorta balloon, a heart-failure treatment device that has since been used by millions of patients around the world. After leaving Avco and founding two different research companies, Dr. Petschek continued to lead the development of medical innovations.

Although officially in retirement, Dr. Petschek joined the staff of the Center for Space Physics in the mid-1990's, returning to his scientific roots. He was a vigorous part of the space science community for many years thereafter. He worked tirelessly with many of the Department's undergraduate and graduate students on their research projects and taught a graduate course in gas dynamics, his academic specialty. He will be sorely missed by all who had the privilege to know him, a brilliant man of great humility.



EXECUTIVE SUMMARY

The Department of Astronomy teaches science to hundreds of non-science majors from throughout the university, runs the second largest program for undergraduate astronomy majors in the country, has growing graduate program, and is a very active research department by all standard measures.

The Department graduated a class of ten undergraduates, all with a major concentration. Thus, while our program is small by CAS standards, within the discipline it is nationally prominent, second in average class size only to UC Berkeley.

In our graduate program, one student completed a PhD and one received a Master's degree. Our graduate recruiting for next year was very successful: we have an incoming class of twelve new students, bringing our total of new and ongoing astronomy graduate students to 31.

Overall grant revenue won through competitive proposals by Department Faculty and affiliated Research Associates stayed at modern high levels: nearly \$12M, or approximately \$0.8M per teaching faculty on average. Publications in preeminent journals of our discipline remained at high levels as well.

Among other new and ongoing research initiatives in space physics and astrophysics, three new spaceflight hardware projects began this year and a new facility-class instrument was commissioned at the Perkins telescope. PICTURE is a sounding rocket program that will develop the technology needed to image a giant planet around another star. The Loss Cone Imager is an energetic electron instrument that will fly on an Air Force satellite designed to actively modify Earth's radiation belt. CRaTER was selected for flight onboard the Lunar Reconnaissance Orbiter; it will measure and characterize galactic and solar cosmic rays and assess their impact to long-term, human presence in space. Finally, Mimir saw first light in August and is providing new opportunities for wide-field imaging, spectroscopy, and polarimetry at near infrared wavelengths.

We also conducted and successfully concluded the search for a new junior faculty member in space physics. Dr. Nathan Schwadron, currently at the Southwest Research Institute in San Antonio, has accepted our offer of a tenure-track Associate Professor position and will begin teaching this fall. We look forward to Nathan joining our team. He brings a new dimension of research activities to our Department.

Improvements to the Michael D. Papagiannis Astronomy Library were completed this year. New carpets, paint, and a new configuration provide for an improved study space, already making it a favorite location for undergraduate majors and graduate students.

In summary, as this report will show, the Department continues to thrive, serve, lead, and prosper with strong educational programs and an outstanding and agile research enterprise, responsive to shifting national priorities in astronomy and the space sciences. We look forward to working with the College to solve our long-standing space problem, our need for a new observatory complex, and to their support in new, strategic initiatives.

FACULTY AND STAFF

Faculty

The Department of Astronomy currently has twenty-four faculty members: fifteen academic faculty and nine research faculty. The full list of the faculty and staff of the Department is provided in Appendix A. We will be happy to greet a new colleague this coming Fall, tenure-track Associate Professor Nathan Schwadron. The Department looks forward to additional faculty searches in the near future. The astronomy faculty continues to provide outstanding service to the nation and profession by serving on various scientific advisory committees for the federal government and its various agencies, to observatories, to other non-profit research organizations, to learned societies, and to professional journals. This activity feeds back directly to the department as our faculty help direct where national research priorities will be placed and remain in close touch with developments at the national and international level. This high level of external activity shows that the department is contributing and competing well among the first rank of research departments.

New Appointments

Assistant Professor Elizabeth Blanton was appointed to our teaching faculty, the result of a new Faculty Search in astrophysics during AY03-04. She spent her first year teaching a graduate seminar course and an introductory astronomy major course. We have also concluded another faculty search this year, and tenure-track Associate Professor Nathan Schwadron will join our faculty this Fall.

Changes in Status and Awards Received

Assistant Professor Elizabeth Blanton joined the Astronomy Department teaching faculty in Fall 2004. Professor Blanton came to us from the University of Virginia, where she was a Chandra Fellow. Professor Blanton enjoyed a very productive and successful first year in the department, and we look forward to many more such years to come. We are delighted and honored that Professor Blanton was selected to receive a Clare Booth Luce Assistant Professorship.

Research Professor Nancy Crooker began service as President of the Space Physics section of the American Geophysical Union (AGU). The SPA section comprises 3100 space scientists world-wide; the AGU is the premier professional organization for space science. This leadership position represents a significant honor for Professor Crooker and reflects well on the Center for Space Physics, the Department of Astronomy, and Boston University at-large.

Professor Michael Mendillo was elected by the Royal Astronomical Society Council to Associate Membership in the RAS.

Research Professor Jack Quinn was hired this year as the Executive Director of CISM, the Center for Integrated Space Weather Modeling. Jack was formerly employed as a

Research Associate Professor at the Space Science Center in the University of New Hampshire.

Professor Harlan E. Spence stepped down as Chairman at the end of this fiscal year, thus finishing three years in the Chair. He enjoyed his service to the Department, but is now looking forward to a return to his many research projects including CRaTER, CISM, and studies of the magnetosphere, solar wind, energetic particles, and ice cores. In a related change, **Professor James Jackson** became the Department's eleventh Chairman on July 1, 2005. Finally, as he steps down as Director of the IAR, we also welcome his replacement, **Professor Tereasa Brainerd**, as the new IAR Director. We welcome both the new Chairman and IAR Director and wish them well in their leadership positions.

Dr. Esther Zirbel resigned her position as Education Coordinator for the Center for Space Weather Modeling.

Research Associates and Departmental Staff

Through its two affiliated research centers, the CSP and the IAR, the Department of Astronomy currently has 19 Research Associates supporting our collective research mission. Three new research associates joined us this year and two were promoted; we welcome those who arrived and congratulate those who were promoted. A full listing of Research Associates connected with the department and department staff appears in Appendix A.

Changes in Status and Awards Received: Research Associates

Dr. Viacheslav Merkin joined the research staff of the Center for Space Physics in September. He currently works with Professor Goodrich in the Code Coupling thrust of the Center for Integrated Space Weather Modeling.

Dr. Xie Lun joined the Center for Space Physics in the 2005. She currently works for Professor Fritz in the Energetic Particle Group.

Dr. Dilip Ghosh Roy left his research position in the Center for Space Physics where he worked primarily with Professor Chakrabarti.

Dr. Harry Petschek, a Research Fellow in the Center for Space Physics, passed away on March 29th. Harry was a dedicated and active member of the CSP, and his absence will be sorely felt in our department. For more detailed information about Harry, please see the Dedication section at the beginning of this report.

Changes in Status and Awards Received: Department Staff

Kristin Sacca, our former Department Administrator, left her position in April to become the Project Coordinator for the CRaTER contract. Kristin has done an admirable job getting this exciting project on its feet. We thank Kristin for her important service and dedication to the Department.

Susanna Lamey was promoted from the Librarian position to the position of Department Administrator in May. We also thank Susanna for her dutiful service to the Department as Librarian, and look forward to her ongoing contributions as the new Department Administrator.

The Librarian position is currently empty, and we are planning a search for a new Librarian in the near future. Currently, our Librarian remains funded 50% through external grants in addition to departmental library duties, the consequence of earlier budget cuts. As we have learned this year, administration of the library is a full-time job, so we request that the college restore the Astronomy Librarian funding to full-time as soon as possible for the health of the library.

Faculty and Staff Overview

Figure 1 depicts graphically the faculty, staff, research associates, graduate students, and undergraduate concentrators who will comprise the Department of Astronomy in the fall of 2005. Our enterprise includes approximately 150 dedicated people - teaching, learning, researching, or supporting these efforts. Our people remain our greatest asset.

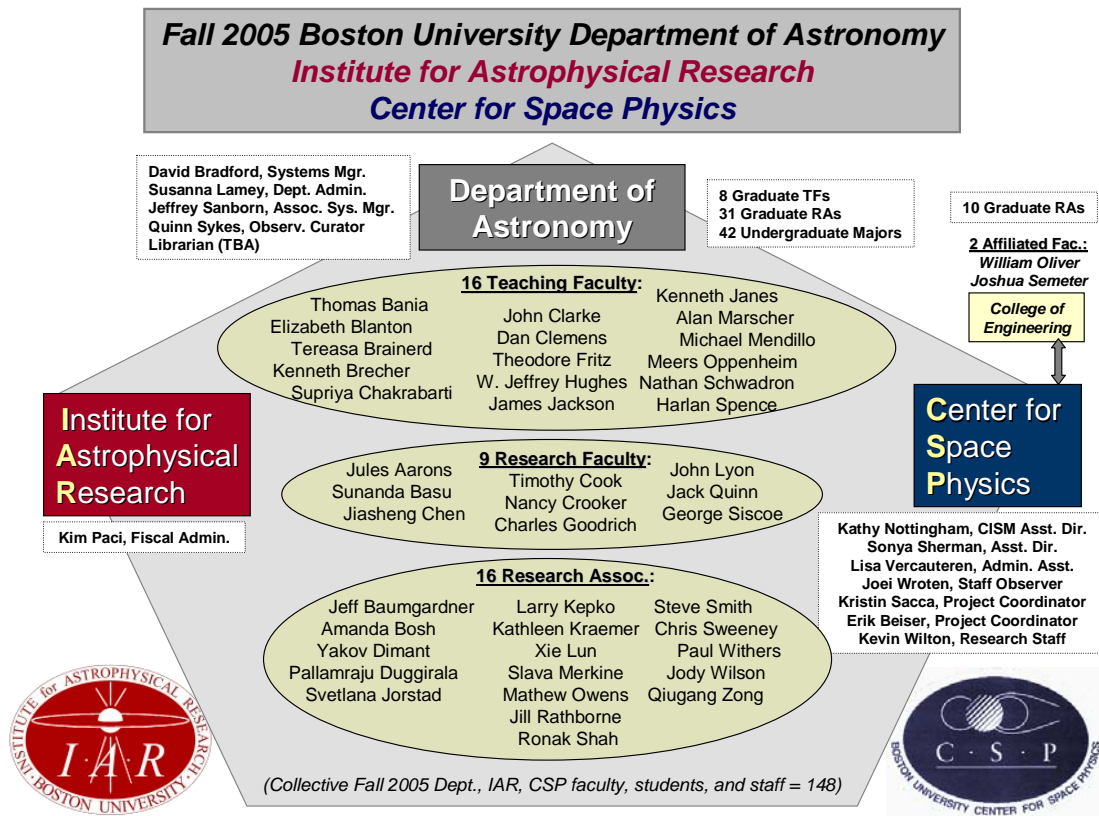


Figure 1: Overview of Department of Astronomy and affiliated personnel as of Fall 2005.

UNDERGRADUATE PROGRAMS

Director of Undergraduate Studies: Professor Kenneth Janes

Divisional Studies Courses

In terms of number of students, the department's largest teaching mission by far is courses designed to satisfy College divisional study requirements and similar requirements within the other undergraduate schools and colleges of the University.

We offer four such 100-level courses. Two of these, AS 101: The Solar System, and AS 102: The Astronomical Universe, provide surveys of solar system astronomy and extra-solar system astronomy and carry laboratory credit. The other two, AS 109 Cosmology and AS 117 Cosmic Evolution, are somewhat more focused and do not carry laboratory credit. This year we offered eight sections of these courses: four sections of AS 101, two of AS 102, and one each of AS 109 and AS 117. In addition, we offered two honors sections, which were run as additions to regular courses.

Table 1 indicates that the total 100-level enrollment was 588 in 2004/2005. The average enrollment in each section this year was 74 students, actual section enrollments varied between 42 and 109. Of the students taking these courses, approximately 70% (408) were CAS students and 30% (180) came from other schools and colleges, principally COM (72), SMG (42) and SED (33). *Table 1* demonstrates also that this relative distribution between CAS and other schools has prevailed for at least the past nine years.

Table 1: 100-Level Astronomy Enrollments

Academic Year	Fall	Spring	CAS	Other Schools	Total
1995/96	442	394	546	290	836
1996/97	407	361	486	282	768
1997/98	416	311	449	278	727
1998/99	420	346	526	240	766
1999/00	437	307	502	242	744
2000/01	421	373	521	273	794
2001/02	322	242	374	190	564
2002/03	389	295	458	226	684
2003/04	372	329	488	213	701
2004/05	319	273	408	180	588

Figure 2 displays the time history of overall 100-level astronomy course enrollments since the 1990-1991 AY. Beginning in 1992 and lasting through 2000, overall enrollments ranged between 700 and 800. Throughout this period, the department introduced and then fine-tuned several important changes to these courses, improving their quality while sustaining healthy enrollments. We attributed the dip in 2001/2002 enrollments to two factors: the introduction of the mandatory Writing Program courses which necessarily reduces the number of freshmen taking divisional courses (principally a one year phenomenon); and, a smaller than usual overall incoming freshman class in 2001 (an effect spread over several subsequent years). As anticipated in earlier annual reports, 100-level enrollments consequently rebounded in academic year 02/03 by ~21%, essentially to pre-Writing Program levels. Last year, this upward trend continued, though last year we saw another dip owing to a smaller incoming class and the growing popularity of the Core curriculum. We expect that 100-level enrollments will remain steady at these or slightly higher values in coming years.

100-Level Astronomy Course Enrollment History

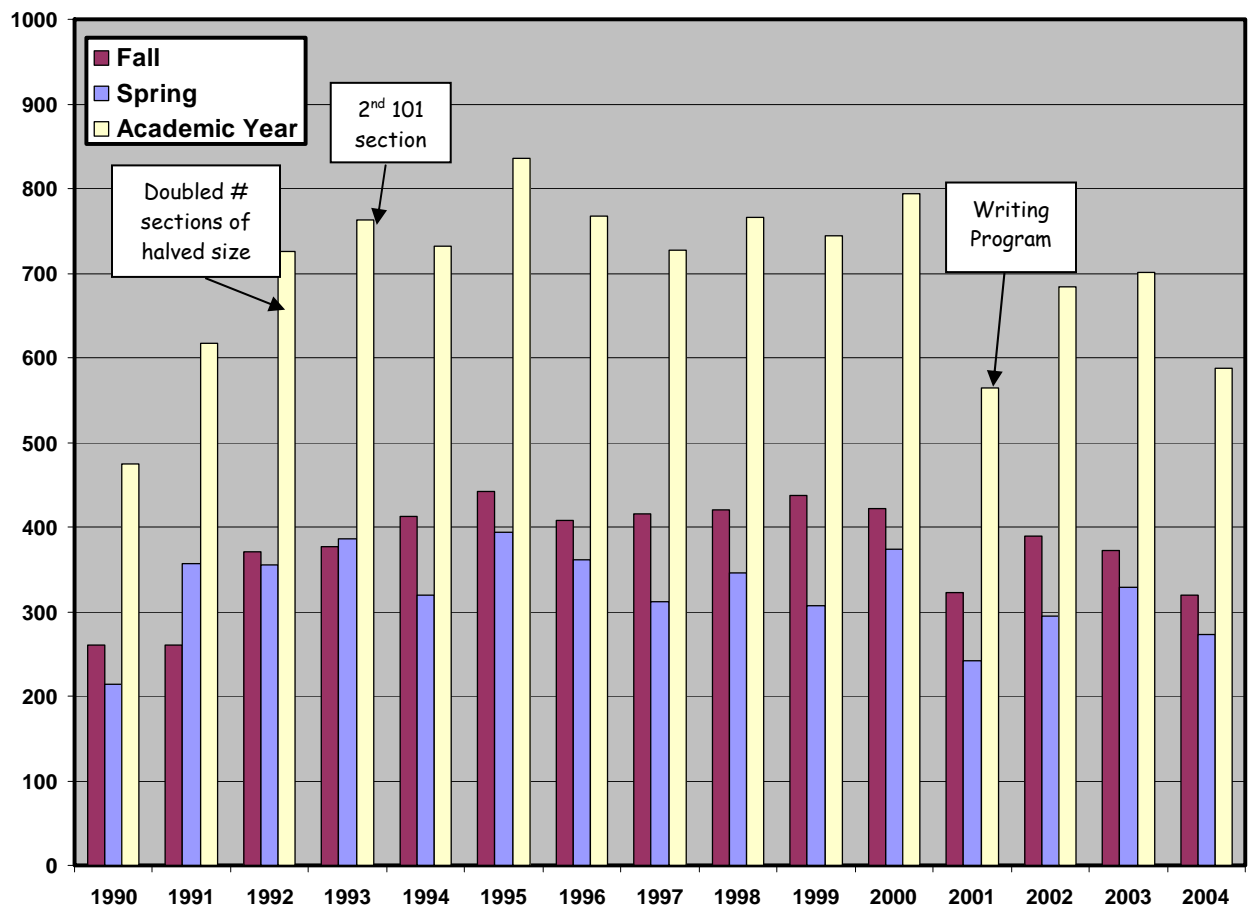


Figure 2: Trends in 100-Level Department of Astronomy course enrollments since 1990.

The Core Curriculum

The department is committed to providing excellent science education to students not concentrating in science, in the spirit of a true liberal arts education. Since an increasing number of CAS students choose to meet this component of their education through the Core, the department is committed to supporting the physical science component of the Core Curriculum, CC105.

One of our own faculty members, Professor Alan Marscher, developed and coordinated CC105 for many years. Professor James Jackson served this past year in the role of overall coordinator, and has continued the strong presence of Department of Astronomy faculty and leadership in this important program. The Astronomy Department provides as many additional faculty members to this course as our other teaching commitments allow. This year, Professors Marscher, Jackson, and Mendillo staffed the Core Curriculum course. We anticipate another strong representation of astronomy faculty and leadership in CC105 next academic year; Professor Jackson will again serve in the leadership role.

Undergraduates Concentrating in Astronomy

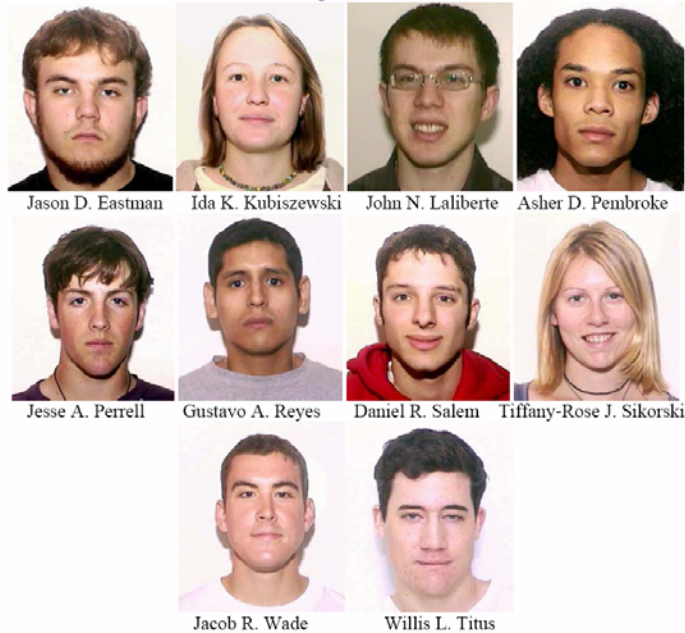
*The Department continues to have one of the largest and strongest undergraduate majors programs in astronomy in the country. Based on the most recent national survey results (The American Institute of Physics “Enrollments and Degrees Report” published in August 2003), we were one of only two institutions granting on average more than ten undergraduate degrees from 1999-2001. **Only UC Berkeley (14 students per year) exceeded our average (12), placing us with the very most elite in this important metric.** Our undergraduates earn degrees by following one of three offered concentrations: Astronomy, Astronomy and Physics (in conjunction with the Physics Department), and Geophysics and Space Science (in conjunction with the Department of Earth Sciences). After graduation, they continue to gain entry into many of the finest graduate astronomy programs, or, find compelling jobs in astronomy and related areas.*

During this academic year, forty-four students (some of whom have declared an additional concentration) were declared in one of the department’s concentrations, and many additional students who expressed a strong interest in astronomy were being advised by an astronomy faculty member. The most popular concentration is Astronomy and Physics (25), followed by Astronomy (14) and Geophysics and Space Science (formerly called Planetary and Space Science) (3). These numbers are distributed fairly evenly over the freshman to senior classes and remain comparable with last year’s distribution.

This year’s graduating class consisted of ten students; eight received BA’s in Astronomy and Physics, one in Astronomy, one in Geophysics and Planetary Science. Several of this year’s graduates will continue studying astrophysics, space physics, or related fields at top graduate schools in the coming year, including Ohio State and Rice University. More anticipate pursuing graduate studies after a year or so of work and public service.

As has been the case now for many years, this class represents a significant fraction of the total number of Bachelor's degrees awarded nationally (the total number nationally in 2003 was 325) at 76 institutions. Current enrollments indicate that we will graduate ten or more students a year for the foreseeable future. A list of our graduating class is provided in Appendix B.

Boston University Department of Astronomy
Graduating Class of 2005



Undergraduate Curriculum

There were no changes to the undergraduate curriculum this academic year.

Undergraduate Advising

Advising of students concentrating, or intending to concentrate, in one of the majors offered by the department is overseen by the Director of Undergraduate Studies, Professor Kenneth Janes.

Since the course schedule for our concentrations is fairly structured, advising must begin with the incoming class sometimes even before they arrive on campus. Thus, freshman advising during the summer is critically important. We also carefully monitor possible freshman concentrators during the first few days of classes in the fall to make sure all are taking the appropriate classes. We also recruit and advise highly-qualified students from our 100-level offerings; we have had growing success in recent years of identifying excellent scholars and introducing them into our program through these courses and advising. Students who decide during their sophomore year to concentrate in astronomy provide us with our biggest advising challenges, but the numbers are small enough that each case can be dealt with carefully on an individual basis.

This year we assigned as many students as possible to their advisor from the previous year. This provides much more continuity for the students, but requires faculty to be more cognizant with the issues at all stages of our program. Every faculty member who was here both semesters acted as an advisor.

OBSERVATORY AND FACILITIES

Observatory Improvements

The disparity between our national departmental prominence and the shamefully poor quality of our observatory continues to be embarrassing, with negative impacts on recruitment efforts.

Due to lack of funding, we were not able to make any significant improvements to our observatory this year.

We are exploring the feasibility of creating an on-campus astronomy museum, for displaying our historic astronomical pieces, as part of a long-desired major development of a new modern observatory complex. We believe that, as one of the oldest Astronomy departments in the country, we could develop such a museum to be an important and unique educational tool.

In this upcoming year, we are planning to make general repairs to the observatory and the domes in order to keep the weather from damaging the equipment and telescopes.

We look forward to establishing such a facility as an integral part of a new observatory complex and seek the College's continued financial assistance in this proposed, major development project.

THE BOSTON UNIVERSITY ASTRONOMICAL SOCIETY

BUAS President: **Jason Eastman**

Faculty Advisors: **Professor Harlan Spence**

The BUAS is the undergraduate society associated with the department. Under the strong leadership of President Jason Eastman, Vice-President Amanda Johnson, Treasurer Michael Gully-Santiago, and Secretary James Kim, with mentoring from their advisor, Professor Harlan Spence, the society had another highly successful year and served the department well. They promoted and organized a robust membership and enjoyed several events on campus as well as at remote sites. Highlights follow below.

This year, the BUAS began the tradition of “BUAS Nights”, open to all BU undergrads rain or shine every Sunday night. When it was actually clear (unfortunately a rarity this past year), the students observed and took pictures on the roof, both with film and with CCDs. During cloudy nights, the BUAS showed interested students how to use the darkroom to develop the pictures they took, showed them how to use MaxIM DL and Photoshop to process their CCD images, or held movie nights in CAS 502. As part of this program, graduate student Paul Howell gave a very popular seminar on astrophotography.

In October, the BUAS co-hosted an “AstroPoetry” night at the John Greenleaf Whittier Homestead in Haverhill, MA.



AstroPoetry


Saturday
October 23rd
6:00-8:00 pm
(rain date Nov 6th)

Join us for an evening of
Stargazing and Poetry
at the John Greenleaf Whittier Birthplace
305 Whittier Rd. Haverhill, MA

The Boston University Astronomical Society
will be on hand with telescopes
and assistance in sky viewing.

Admission by donation to Whittier Birthplace

for more information
visit www.johngreenleafwhittier.com
or call 978-373-3979



Many members of the community gathered to listen to a professional poet, then followed along as the BUAS showed them various celestial objects through their telescopes set up in the Whittier apple orchard.

Later in the year, the BUAS discovered a great new place to observe in western Massachusetts called Arunah Hill and developed an excellent relationship with the society that runs it. Arunah Hill is a wonderful place for the BUAS to get away from the light pollution in Boston and to observe some spectacular faint objects. On their first group trip there, several members managed to do most of the Messier Marathon while others took some of their best astro-pictures of the year.

To help encourage this enthusiastic group, the department collaborated with the Student Activities Organization to fund a laptop computer for the BUAS. This new tool has been heavily used by the members to operate CCDs in remote locations like Arunah Hill.



The BUAS at Arunah Hill.



President Jason Eastman sets up the laptop.



The Meade telescope.



A picture of Saturn taken at Arunah Hill.

GRADUATE PROGRAM

Director of Graduate Studies: **Professor Tereasa Brainerd**

Director of Graduate Admissions: **Professor John Clarke**

Overview

Our graduate program remains a vigorous part of our enterprise, and is where research and education couple most closely. Of the thirty-nine PhD-granting astronomy programs in the country, ours remains mid-sized as measured by number of students or number of PhDs granted. Our graduate students continue to win student awards at national scientific conferences as well as highly-competitive fellowships from federal agencies. A survey of our graduates who earned PhDs in the past decade reveals a remarkable degree of overall professional success, including a significant fraction already holding faculty and leadership positions at major research institutions (see Appendix E).

Last year we had an average-sized incoming graduate class (5 students), bringing the total astronomy graduate population up to 30. Every graduate student is fully supported as either a teaching fellow and/or research assistant for the full 12 months. Teaching Fellows and Research Assistants are listed in Appendix A.

We graduate an average of slightly more than three PhDs each year (41 in the last 13 years). This year, we only had one student graduate with his PhD, Andrei Sokolov, although two of our affiliated Engineering students also graduated (Sophie Laurent and Marlene Colerico). Andrei spent most of his time at BU working with Professor Alan Marscher in his blazar research group, and is now employed as a postdoctoral research associate at the University of Central Lancashire in the UK. Another student, Penny Wu, completed the requirements for her Master's degree and was awarded an MA in May. Penny remains in our program and is pursuing a PhD.

Our students continue to be honored for their efforts, both for teaching and research and by both the College and by external institutions. This year's awardees include:

- April Pinnick, who was awarded the College Prize as Outstanding Teaching Fellow in Astronomy.
- Timothy Guild, Chia-Lin Huang, and Sarah McGregor all received Best Student Paper Awards at recent meetings of the American Geophysical Union. The three graduate students each received an award for posters given at the Spring 2005 AGU meeting in New Orleans; Ms. Huang also won an earlier award for an oral presentation given at the Fall 2004 AGU meeting in San Francisco.

Graduate Student Recruitment

Graduate student recruitment is critical to maintaining a vigorous graduate program. Competition for the best graduate students among the top schools is intense, and we must expend considerable effort in attracting the best students to choose Boston University for their graduate study. Our vigorous recruitment this year was very successful.

Professor John Clarke led our graduate recruitment effort this year with ongoing support from Professor Harlan Spence. Indeed, the entire department (faculty, students, and staff) participate significantly in meeting with visiting graduate students and educating them about the strengths and values of our program. As is increasingly common, the department did a great job of actively recruiting several top applicants and converting them into incoming students. We look forward to greeting twelve new students entering our graduate program in the fall; this incoming group will maintain our graduate population at strong levels. A list of the incoming students is provided in the Appendix.

Graduate Curriculum

There were no changes to our graduate curriculum.

Graduate Advising

Advising of graduate students was overseen by Professor Tereasa Brainerd, Director of Graduate Studies (DGS), now in her second year in that important administrative position. Incoming graduate students are advised by the DGS, who continues to be their primary advisor until they select a research supervisor, usually no later than their first summer of graduate study. After a student has a research supervisor, he/she provides their primary advice. Nevertheless, all graduate student registrations are countersigned by the DGS to ensure that students register for the appropriate courses, especially as they prepare for the written component of the PhD qualifying examination (the “Comps”). The DGS continues to monitor students’ progress throughout their graduate career, ensuring that they present themselves for qualifying and language exams on time.

Our graduate program is small enough for the faculty collectively, once a year during a fall faculty meeting, to discuss the progress of each graduate student individually. This process allows us to compare assessments and experiences, and to identify any potential problems and suggest solutions. This advising scheme works well for our graduate program.

Graduate Facility Improvements

By far the largest improvement to our graduate facilities this year was the renovation of our Astronomy Library, a project that was long overdue. Following the renovations of Rooms 502 and 508 last year, the library renovation was the next essential step in the improvement of our educational and research facilities. Coordinated by librarian Susanna Lamey (now our Department Administrator) and curator Quinn Sykes, the entire department participated in the project, which took place in July.

Researchers, students, and professors came together this summer to complete the ambitious department project of renovating the Astronomy Library. Virtually unchanged since the 70's, the library was sorely in need of a facelift and general reorganization. The project was quite ambitious, as it involved everyone's cooperation in moving over 6,000 books and journals, and their shelves, to the sixth-floor hall and back again (at some points workers formed a chain of over 20 people). The project became quite a bonding experience among the various branches of the department, and at the same time educated everyone who participated about the importance of sharing responsibility for our community library.

The main impetus for the library renovation was the installation of a new carpet to replace the original orange one (which was held together, in some places, with duct tape). While the carpet was being installed, Buildings and Grounds painted the walls and ceiling, and an entire set of "new" chairs was obtained from the Law Library, which was also renovating and kindly donated their older furniture to us. We also inherited some tables and cabinets from the Pre-Law Advising Office, and extra wooden bookshelves to replace the older steel shelves from various offices within the department. The layout of the library was rethought, and bookshelves were rearranged to form private study carrolls with an added conference area in the back for group work. All these factors contributed to a beautifully renovated library (see Before and After photos below). It is now a favorite location for studying, used by staff and students alike.



The library temporarily moved to the sixth floor hall.



Before



After

COLLOQUIUM SERIES

Weekly seminar series in both Astrophysics and Space Physics are held throughout the academic year. These are run as graduate seminar courses by members of the department faculty, but organized and financed by the Institute for Astrophysical Research and the Center for Space Physics, respectively. This year Professor Elizabeth Blanton and Alan Marscher ran the Astrophysics Seminar Series and Professors Supriya John Clarke and Michael Mendillo ran the Space Physics Seminar Series. The lists of outstanding speakers in both seminar series are provided in Appendix C.

ALUMNI AFFAIRS AND PUBLIC OUTREACH

Two annual public outreach/alumni highlights are our annual musical events performed by members and friends of the Department: “Astronomy Unplugged”, an informal, intimate concert of popular contemporary music, and our “Musical Soiree”, a formal concert of classical music held each spring in the Tsai Center. These open concerts build esprit de corps within the Department and are enjoyed by many more from within the larger BU community.



Michael Gully-Santiago (center), an Astronomy undergraduate, plays the saxophone at the 15th Annual Musical Soiree, accompanied by staff member David Bradford (left). Professor Jim Jackson (right), of the Fish Worship Trio, plays the electric guitar at the 2005 Astronomy Unplugged.

The Astronomy Department ran a special "Evening With The Stars" on February 2 for the Alumni Associations of the College of Engineering and the School of Management. The 3-hour event included a talk by Professor Mendillo on the recent NASA mission "Cassini" to Saturn, a video presentation of Cassini's landing on Saturn's moon Titan by Dr. Jody Wilson of the Center for Space Physics, and (blessed with clear skies) ample

time to view various celestial objects using our rooftop telescopes. Observatory Curator Quinn Sykes ran the three viewing sessions with volunteer assistance from the undergraduate astronomy club (BUAS). Approximately 90 alumni guests participated in the reception, tour, talks and question and answer sessions.



There are ample opportunities to increase such outreach activities, but the deplorable physical state of the observatory makes this unwise. When our department's desperate need for improvements to our sadly neglected main facility is addressed, we will be able to increase both the quantity and quality of programs such as this one.

Of course, by sheer number of events, our most prominent outreach effort is our Public Open Nights held every clear Wednesday night in the Coit Observatory. This program is run by our department curator, typically supported by members of the BUAS, and draws hundreds of visitors annually from the Greater Boston area. We stress that the quality of this popular program and other special events are limited by and indeed ever threatened by the poor physical state of the Coit Observatory. The attraction of our special events to the general public stands in contrast to our inability to deliver quality programs due to the limitations of our facility, demonstrating the urgent need for a new observatory complex.

RESEARCH

The Department of Astronomy, through its affiliated research units, the Center for Space Physics(CSP), Center for Integrated Space Weather Modeling (CISM), and the Institute for Astrophysical Research (IAR), has a robust and thriving research program. Every member of the faculty maintains a research program through external sponsored funding. Publication of scientific results continued at a brisk pace in the top journals of our fields.

Overall Summary

It is impossible to even briefly summarize all the new research results generated in the past year in a report of such limited size, nor do we wish to repeat that which has been reported elsewhere. Research done through the auspices of CISM, CSP, and IAR is described in more detail in their annual reports. The reader is therefore strongly commended to these three annual reports for a comprehensive description.

Research Funding

One measure of the health of our research is the funding our research proposals generate. While this is certainly not an end in itself, funding is absolutely required to maintain our research program and support our researchers. Every member of the faculty is funded as a PI on at least one grant. In several cases, two or more faculty members collaborate on a project (but only one is listed as PI in the summary in Appendix D).

Table 2: Astronomy Research Funding 2000-2005

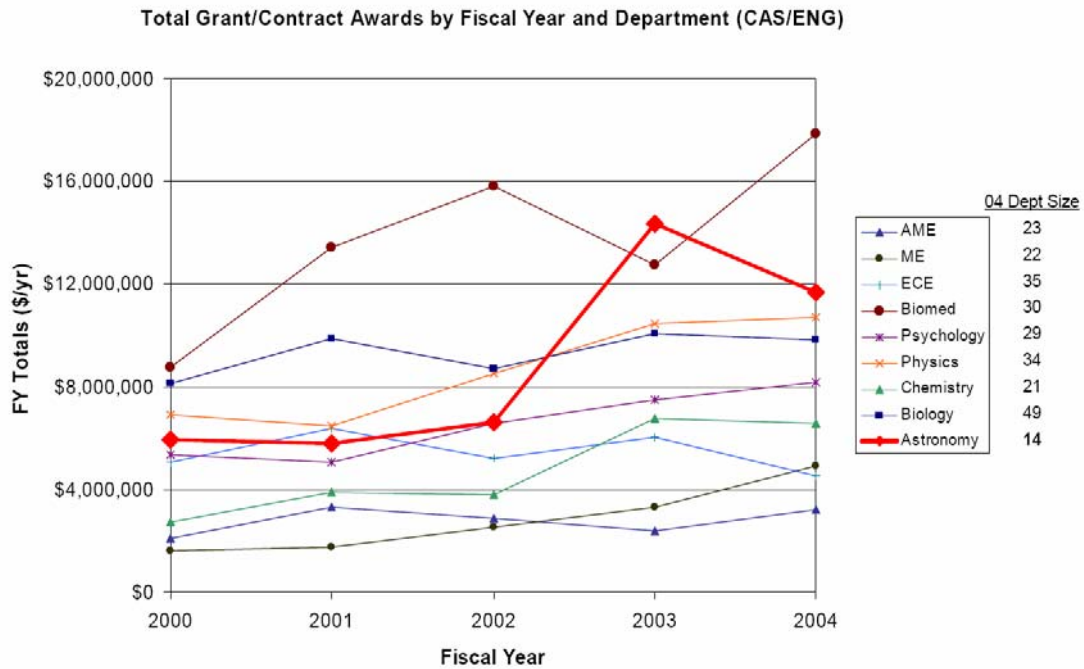
Fiscal Year	2000	2001	2002	2003	2004	2005 (partial)
Astrophysics	\$1,133,790	\$1,565,628	\$ 830,146	\$ 831,827	\$ 743,404	\$1,473,917
Space Physics	\$4,779,935	\$4,218,828	\$5,722,910	\$ 13,445,670	\$10,920,249	\$10,490,169
Total	\$5,913,725	\$5,754,456	\$6,553,056	\$ 14,277,497	\$11,663,653	\$11,964,086

Table 2 shows the research funding brought into the university by members of the department over the last five years. The funding is split into astrophysics (administered by IAR) and space physics (administered by CISM and CSP). Our total funding varies considerably from year to year. This is in part due to variations in funding of a few large projects, and in part due to vagaries of the sponsoring agencies and the differing university and federal fiscal year boundaries.

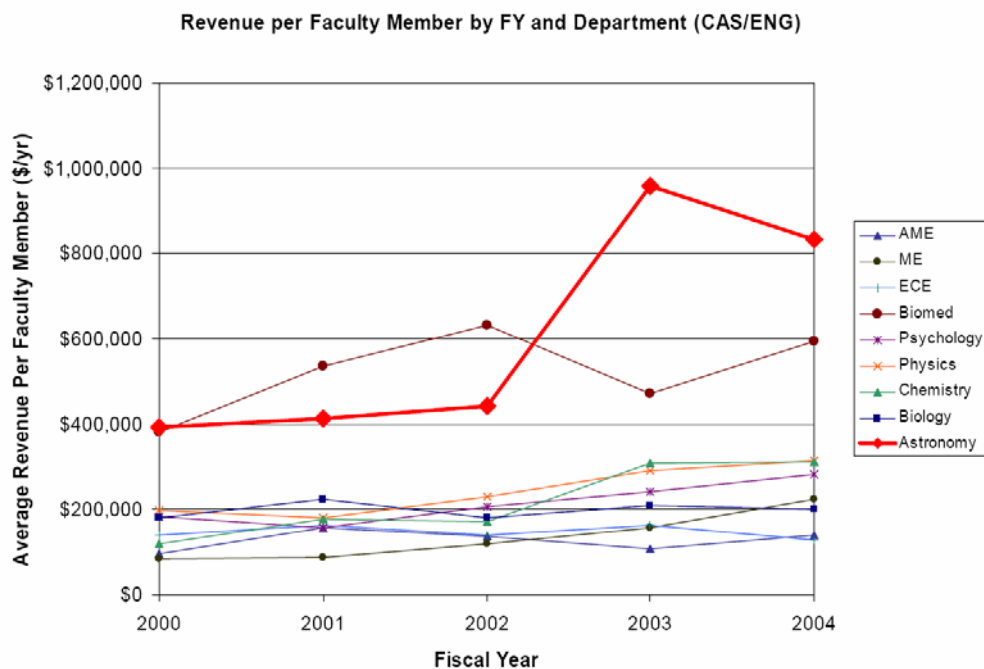
Through May 2005, our total departmental research funding was nearly \$12M, or put another way, ~\$0.8M per astronomy teaching faculty member who submitted their grants through either the CSP or the IAR. We anticipate that these numbers will increase substantially when the final month of the FY is included. This remains an astounding record of accomplishment. Through May, there were a total of 59 new or continuing grants awarded funding during the last fiscal year (20 to IAR members and 39 to CSP members). Even without our largest single grant (CISM, \$4M/year), the average grant revenue per faculty member last year was ~\$0.5M, a very healthy metric. We are confident that we will compete for and continue to win both the large grants similar to PICTURE, LCI, CRaTER, and CISM as well as the smaller “bread-and-butter” grants that sustain our base program.

As has been the case in past years, our research was supported by grants and contracts from three major federal agencies National Science Foundation, NASA, and the Office of Naval Research. We continue to stress the importance of this diversity as a hedge against the shifting sands of highly competitive federal and private research funds. A full listing of funding received this year as reported monthly by the OSP is provided in Appendix D.

The aggregate level of research activity within the Department is large compared to both College and University standards. Our unit continues to win substantial research grant money to support our graduate program and research enterprise. A summary of total grant revenue from 2000-2004 by top research units from within the University is shown below.



Despite our comparatively small size, we generate significant resources for conducting nationally-important research in space physics and astrophysics. All members of the Department generally have at least one active grant; many have ongoing, multiple grants. When viewed as per capita grant revenue, this metric is even more impressive. In 2004, the average per capita grant revenue per Astronomy faculty member was over \$0.8M, exceeding even the significant per capita grant revenue generated by faculty members of the Biomedical Engineering department.



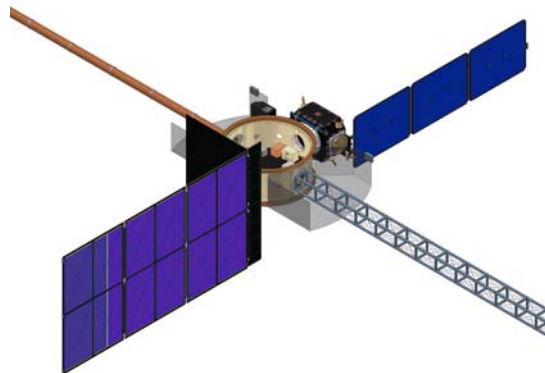
Peer-Reviewed Publications

The Department's faculty, research associates, and students continue to publish in the leading journals of our disciplines and to present their results at national and international meetings. This activity not only disseminates major new research results, but also helps to keep the department's research prominent within our research communities. Eighty-seven articles in refereed journals went to press in the reporting period, nearly six per teaching faculty. A full accounting of these publications is in the CSP, CISM, and IAR annual reports.

Selected Highlights – PICTURE, LCI, CRaTER, and Mimir

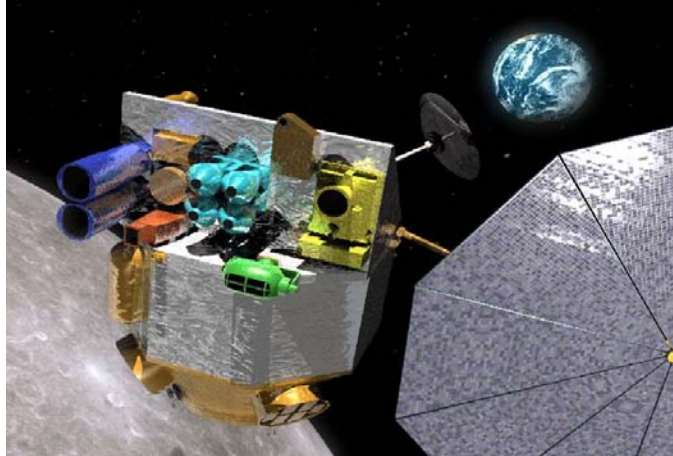
This year included the start of three significant new spaceflight hardware projects and the first scientific use of a ground-based instrument designed, developed, and built at Boston University.

- The Planet Imaging Concept Testbed Using a Rocket Experiment (**PICTURE**) is a NASA sounding rocket program to obtain a direct image of an extrasolar giant planet. PICTURE is a collaboration between Boston University, Jet Propulsion Laboratory, Massachusetts Institute of Technology and NASA Goddard Space Flight Center. Professor Chakrabarti is the PI. Most extrasolar planets have been discovered using the radial velocity technique. However, to obtain fundamental physical parameters of these planets (for example, mass and orbital inclination), we need additional measurements. PICTURE will use a nulling interferometer developed at JPL for the Terrestrial Planet Finder mission along with other enabling technologies to demonstrate their flight worthiness. PICTURE is scheduled for launch in 2007.
- The Loss Cone Imager (**LCI**) is an instrument selected for flight on the US Air Force DSX mission. Professor Fritz is the PI. LCI will measure energetic particle distributions in Earth's radiation belts, with emphasis on the measurement of the fluxes of energetic electrons along the direction parallel and anti-parallel to the local geomagnetic field vector. These measurements will help to achieve DSX mission goals by demonstrating that radiation belt electrons can be modified through the active injection of very low frequency electromagnetic waves into the magnetosphere. LCI is planned to be launched on the DSX satellite in late 2009.



A rendering of the DSX spacecraft that will carry LCI into Earth's radiation belt to test theories of wave-particle interactions. It is expected to launch in 2009.

- The Cosmic Ray Telescope for the Effects of Radiation (**CRaTER**) is an instrument selected for the first spacecraft of NASA's Robotic Lunar Exploration Program, the Lunar Reconnaissance Orbiter (LRO). CRaTER is a collaboration between BU, MIT, The Aerospace Corporation, the Univ. of Tennessee, the Air Force Research Laboratory, and NOAA. Professor Spence is the PI. CRaTER has three scientific goals: to characterize the lunar radiation environment most harmful to humans; to quantify the effects of exposure to this variable radiation on humans in space; and, to provide measurements of the nuclear interaction of these energetic particles with material as a baseline for radiation model validation. CRaTER will accomplish these goals by measuring the LET spectrum of cosmic ray ions in the lunar environment under different depths of tissue equivalent plastic. CRaTER will be launched on the LRO satellite in late 2008.



A schematic of the LRO spacecraft in orbit around the Moon. CRaTER is the brown instrument at the top of LRO's instrument deck. It is slated for launch in 2008.

- The **Mimir** near-infrared instrument for the Perkins telescope at the Lowell Observatory was commissioned and saw first light in August 2004. Mimir is a new facility-class infrared instrument. Mimir was designed, fabricated, and tested by teams at Boston University and Lowell Observatory with support provided by NASA, NSF, and the W.M. Keck Foundation. Professor Clemens is the PI. Mimir is a multi-function instrument covering a broad wavelength range. It allows users to make complex observations with a single instrument. Mimir performs wide-field imaging, long-slit spectroscopy, and imaging polarimetry.



Professor Clemens and Dr. Marc Buie (Lowell Observatory) during commissioning of the Mimir instrument on the Perkins telescope in August 2004.

Use of IDC Return

The Department of Astronomy no longer receives any IDC return. Instead, IDC is returned to IAR and CSP who administer all sponsored research funding.

FUTURE PLANS & DEPARTMENTAL NEEDS

One of the most pressing departmental needs continuing this year is space: renovations to existing space - teaching, meeting, office, laboratory, and observatory space – as well as development of new space to accommodate our growing missions. Our highest priority is to build a major, new observatory complex.

A New Observatory Complex

As was highlighted last year, the physical condition and limitations of our current observatory are shamefully poor and inconsistent with the high national stature and quality of our educational and research programs. It continues to be an eyesore that we either avoid showing or apologize for when prospective students and their parents, professional colleagues, and local citizens come to visit. What should and could be a crowning gem for the astronomy department, the CAS building, and the College and University, is instead an ongoing embarrassment. The last two year's annual reports graphically detailed this perennial issue; the reader is referred to those reports for illustrative photographs – a few lowlights are included below to remind everyone of how badly the facility has decayed.



In sum, the observatory is the most public part of the department's facilities yet it is our very poorest face. The Coit Observatory on the roof of the CAS building is arguably the department's most important teaching facility, severing nearly a thousand student visits each year. On Wednesday evenings we have for many years opened the observatory to the public and they return with great regularity in large number. The observatory is necessarily a focal point of any tour of the department by prospective students or others. However, several local area high schools have significantly better observatories than ours.

If we are to teach astronomy divisional courses with a laboratory component, and if that is to include access to the night sky and if we are to teach our majors and graduate students modern observational astronomy then we must build a new observatory. As noted earlier, this observatory should include a museum to house our antique astronomical collections. We envision also a planetarium/theatre and teaching labs in addition to modern telescopic facilities. This new multi-million dollar facility would be a resource not only for the department, but also for the entire BU community.

We look forward to working with Administration and Development to resolve the long-outstanding and ever-worsening problem of our presently inadequate observatory. We are eager to work to identify funds and/or donors to make our vision for a new observatory complex a reality. We hope that this visionary project will become a primary need presented to potential donors and a priority for BU capital investments.

Our Physical Space Crisis

As the Department and her affiliated research units have grown to national prominence over the years, our physical space has not grown commensurately. As a consequence, during this fiscal year, we have exceeded full capacity. The arrival of three large hardware projects, a return of our graduate program to larger levels, and the conversion of 500 into an Access Grid room and 502 into a classroom/seminar room has created an office crisis. By the end of this FY, several hires are being held up, pending discussions with the Dean and Provost regarding the identification of additional space to house our teaching and research programs. We are especially hopeful that space can be found in the College of Engineering to house Professor Fritz's finite-duration LCI project. There are many excellent reasons for relocating this project from CAS to ENG: coordinated labs are now spread across two buildings (Photonics and CAS), Fritz has a joint appointment in ENG, this project supports a significant number of ENG undergraduate and graduate students as well as three ENG faculty (Ruane, Hubbard, and Sullivan). Identification of space in Photonics to relocate Fritz's project would solve our current space crisis in a logical and collegial way. We look forward to help from the University in meeting this pressing need.

APPENDIX A: Faculty, Staff, and Graduate Students

Chairman:	Professor Harlan E. Spence
Associate Chairman:	Professor Kenneth Janes
Director of Graduate Studies:	Professor Tereasa Brainerd
Director of Undergraduate Studies:	Professor Kenneth Janes
Department Administrator:	Ms. Susanna Lamey (since April 1) Ms. Kristin Sacca (before April 1)

Faculty

Jules Aarons, Research Professor of Astronomy and Space Science. BA, City College of New York; MA, Boston University; PhD, University of Paris

Thomas Bania, Professor of Astronomy. AB, Brown University; MS, PhD, University of Virginia

Sunanda Basu, Research Professor of Astronomy and Space Physics. BSc, Calcutta University (India); AM, Boston University; PhD, Calcutta University (India)

Elizabeth Blanton, Assistant Professor of Astronomy. AB, Vassar College; MA, MPhil, PhD, Columbia University

Tereasa Brainerd, Associate Professor of Astronomy. BSc, University of Alberta; PhD, The Ohio State University

Kenneth Brecher, Professor of Astronomy. BS, PhD, Massachusetts Institute of Technology

Supriya Chakrabarti, Professor of Astronomy. BE, University of Calcutta; MS, PhD, University of California, Berkeley

Jiasheng Chen, Assistant Research Professor of Astronomy. BS, Peking University; MS, Chinese Academy of Sciences; PhD University of Delaware

John Clarke, Professor of Astronomy. BS, Denison University; MA, PhD, Johns Hopkins University

Dan Clemens, Professor of Astronomy. BS, BS, University of California; MS, MS, PhD, University of Massachusetts

Timothy Cook, Associate Research Professor of Astronomy and Space Physics. BA, Johns Hopkins University, PhD, University of Colorado

Nancy Crooker, Research Professor of Astronomy and Space Physics. BA, Knox College; MS, PhD, University of California, Los Angeles

Theodore Fritz, Professor of Astronomy and Space Physics, Professor of Electrical and Computer Engineering, Professor of Aerospace and Mechanical Engineering. BS, Virginia Polytechnic Institute; MS, PhD, University of Iowa

Charles Goodrich, Research Professor of Astronomy and Space Physics. BS, PhD, Massachusetts Institute of Technology

W. Jeffrey Hughes, Professor of Astronomy. BSc, PhD, University of London

James Jackson, Professor of Astronomy. BS, Pennsylvania State University; PhD, Massachusetts Institute of Technology

Kenneth Janes, Professor of Astronomy. AB, Harvard College; MS, San Diego State University; MA, MPhil, PhD, Yale University

John Lyon, Research Professor of Astronomy and Space Physics. ScB, Brown University; PhD, University of Maryland
 Alan Marscher, Professor of Astronomy, Associate Dean. BS, Cornell University; PhD, University of Virginia
 Michael Mendillo, Professor of Astronomy, Professor of Electrical and Computer Engineering. BS, Providence College; MA, PhD, Boston University
 Meers Oppenheim, Associate Professor of Astronomy. BS, PhD, Cornell University
 Jack Quinn, Research Professor of Astronomy and Space Physics. BA, University of Colorado; MS, PhD, University of California, San Diego
 George Siscoe, Research Professor of Astronomy and Space Physics. BS, PhD, Massachusetts Institute of Technology
 Harlan Spence, Professor of Astronomy. BA, Boston University; MS, PhD, University of California, Los Angeles

Astrophysics Research Associates (Institute for Astrophysical Research)

Amanda Bosh, SB, MSS, PhD, Massachusetts Institute of Technology
 Svetlana Jorstad, BS, PhD, St. Petersburg State University
 Kathleen Kraemer, BS, California Institute of Technology; PhD, Boston University
 Jill Rathborne, PhD, University of New South Wales, Sydney, Australia
 Ronak Shah, BA, Boston University, MA, PhD, University of Virginia

Space Physics Research Associates (Center for Space Physics and CISM)

Jeffrey Baumgardner, BA, MA, Boston University
 Andrew Clark, B.S.E.E, Duke University, Cornell
 Yakov Dimant, MS, Novosibirsk State University, Siberia; PhD, Lebedev Institute of Physics, Moscow
 Pallamraju Duggirala, MS, Osmania University; PhD, Physical Research Laboratory, Ahmedabad, India
 Lars Dyrud, BA, Augsburg College; MA, PhD, Boston University
 Marina Galand, BA, DEA, University of Strasbourg; PhD, University of Grenoble
 Larry Kepko, BA, MS, PhD, University of California, Los Angeles
 Xie Lun, BE, MS, Changchun Institute of Optics and Fine Mechanics; PhD, Peking University
 Viacheslav Merline, BS, MA, Moscow Institute of Physics and Technology; PhD, University of Maryland
 Ingo Muller-Wodarg, MSc, PhD, University of London
 Mathew Owens, MS, University College London; Ph.D., Imperial College London
 Christina Pagel, BA, University of Oxford, MSc, MA, Ph.D. University of London
 Henry Rishbeth, BA, MA, PhD, ScD, University of Cambridge, England
 Steven Smith, BS, MS, PhD, University of Canterbury, New Zealand
 Chris Sweeney, BS, Miami University (Ohio); MS, PhD, University of Michigan
 Jody Wilson, BS, Ohio State University; MS, PhD, University of Colorado, Boulder
 Paul Withers, B.A., M.S., Cambridge University, PhD, University of Arizona
 Qiugang Zong, BS, Sichuan University; PhD, University of Braunschweig, Germany

Department Staff

David Bradford, Systems Manager, BS, Indiana University

Susanna Lamey, Department Administrator, BA, Susquehanna University; MA, Boston University (Department Librarian prior to April 1, 2005)

(Kristin Sacca, Department Administrator prior to April 1, 2005)

Jeffrey Sanborn, Associate Systems Manager, BS, Boston University

Quinn Sykes, Observatory Curator, BS, MS, University of North Carolina, Charlotte

Astronomy Graduate Students During 2004-2005

Teaching Fellows	Research Assistants		
Loren Anderson†	Ingolfur Agustsson*	Tengfei Lin*	Raid Suleiman*
Tyler Chapman	Nina Bonaventura†	Sarah McGregor*	Suwicha Wannawichian*
Ritaban Chatterjee	Edward Chambers†	Carlos Martinis*	Erin WeeksΦ
Edmund Douglass†	Katie Garcia*	Emily Mercer†	Penny Wu*
Alexis Johnson†	Timothy Guild*	Luke Moore*	Hui Zhang*
April Pinnick	Brian Hicks*	Jon Niehof*	
Monica Brucker	Paul Howell†	Christina Prested*	
Nicki Viall* (fall) Frannie D'Arcangelo† (spring)	Chia-Lin Huang*	Andrei Sokolov†	
* in Center for Space Physics			
† in Institute for Astrophysical Research			
Φ SMEC			

Incoming Graduate Students

Graduate Student	Undergraduate Institution	Graduate Student	Undergraduate Institution
Elizabeth Bass	Cornell University	Tony Case	University of Oregon
Susanna Finn	Brown University	Susan Grunwald	New York University
Andrew Jordan	Calvin College	Amber Kendall	N. Carolina State University
Michael Klida	University of Michigan	Nicholas Lee	Brandeis University
Christopher Mendillo	Brown University	Kate Whittaker	U. Mass., Amherst
Joshua Wing	Wesleyan College		

Photo Gallery of Current and Incoming Astronomy Graduate Students Summer 2005

CURRENT GRADUATE STUDENTS



Carlos Martinis



Tim Goff



Elly Huang



Alexis Johnson



Paul Howell



Sarah McSpiegel



Jon Nishaj



Erin Weeks



Emily Mercer



Luke Moore



Nina Benavides



Sandra Benavides



Pinyi Wu



Monica Becker



Tingfei Lin



Hui Zhang



Doug Agostini



Loren Anderson



Brian Hicks



Christina Prasad



Nicki Wall



Eli Chambers



Rishan Chatterjee



Fannie D'Amico



Ned Dringus



April Pivnick



Katie Goria

INCOMING GRADUATE STUDENTS



Elizabeth Bass



Terry Case



Susanna Finn



Susan Gromoll



Andrew Jordan



Zeke Kauffman



Amber Kendall



Mike Klein



Nicholas Lee



Chris Mendillo



Kate Whitaker



Josh Wong

APPENDIX B: 2005 Astronomy Graduates

DOCTOR OF PHILOSOPHY

Name	Advisor	Thesis Title
Andrei Sokolov	Alan Marscher	“Theoretical Study of Multifrequency Emission Variability in Blazars”

MASTER OF ARTS

Name	Thesis Title or Examination
Pin (Penny) Wu	Comprehensive Exam

BACHELOR OF ARTS

Name	Concentration
Jason Eastman	Astronomy and Physics, <i>cum laude</i>
Ida Kubiszewski	Astronomy and Physics
John Laliberte	Astronomy and Physics
Asher Pembroke	Astronomy and Physics, <i>cum laude</i>
Jesse Perrell	Astronomy
Gustavo Reyes	Geophysics and Planetary Science
Daniel Salem	Astronomy and Physics
Tiffany-Rose Sikorski	Astronomy and Physics, <i>cum laude</i>
Willis Titus	Astronomy and Physics
Jacob Wade	Astronomy and Physics, <i>cum laude</i>

APPENDIX C: Colloquium Series 2004/2005

Astrophysics Colloquia, Fall 2004

September 7	David Goldberg (Drexel University) Galaxy Flexion: Gravitational Lensing to Second Order
September 14	Christine Jones (Harvard/CfA) The Impact of AGN Outbursts on Hot Gas in Elliptical Galaxies
September 21	Robert Kirshner (Harvard/CfA) The Accelerating Universe: Exploding Stars and Dark Energy
September 28	Bob Millis and Tom Sebring (Lowell Observatory) The Discovery Channel Telescope
October 5	Dan Clemens (IAR) Mimir -- Our Near-Infrared Imager, Spectrometer and Polarimeter on the Perkins Telescope
October 12	Oleg Gnedin (Ohio State) Formation of Globular Clusters in Hierarchical Cosmology
October 26	Svetlana Jorstad (IAR) Highly Variable Apparent Speed of the Quasar 3C 279
November 2	Alexey Vikhlinin (Harvard/CfA) Cosmology with Chandra Cluster Data
November 16	Dawn Peterson (UVA) The Pre--Main Sequence and Brown Dwarf Populations of OMC 2/3: A Multiwavelength Study
November 30	Ben Oppenheimer (American Museum of Natural History) The Lyot Project: Toward Exoplanet Imaging and Spectroscopy
December 7	Kris Sellgren (Ohio State) Spitzer Space Telescope Observations of the Reflection Nebula NGC 7023

Spring 2005

January 28	Dan Harris (CfA) The Jets of the Radio Galaxies M87 and 3C 120
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February 1	Phil Uttley (NASA/GSFC) Variability of Radio-Quiet AGNs and the AGN/X-Ray Binary Connection
February 15	Anil Bhardwaj (NASA/MSFC) X-Rays from Solar System Bodies
February 25	Luis Ho (Carnegie Observatory) Black Hole Demographics in the Local Universe
March 1	Martin Elvis (CfA) Quasar Winds
March 15	Glenn Ciolek (RPI) MHD Shocks & Waves in Dusty Clouds
March 22	Randy Phelps (NSF) Newborn Stars, Old Open Clusters and the Evolving Scientific Workforce
April 5	Bruck Carney (U. North Carolina) TBA
April 12	Tim Slater (U. Arizona) Are You Teaching if No One Is Learning? Impact of Astronomy Education Research on ASTRO 101
April 26	Pavel Denisenko (Dartmouth Col.) Nucleosynthesis in Low-Mass Red Giants

Space Physics Colloquia, Fall 2004

September 9	Dr. Janet Kozyra-University of Michigan SAR Arcs During Geomagnetic Storms
September 16	Dr. Leonid Matveenko Radio Astronomy
September 23	Dr. Jeffrey Hughes-Boston University Status of CISM
September 30	Dr. Dave Mitchell-University of California, Berkeley Mars Magnetic Field and Plasma

October 7	Dr. Jonathan Friedman-Arecibo Earth Ionosphere
October 14	Dr. Eric Quemerais-CNRS Mars Atmosphere from SPICAM
October 21	Professor Jack McConnell-York University Mars Atmospheric Chemistry
October 28	Jack Quinn, University of New Hampshire Cluster Measurements of Magnetospheric Plasma Convection
November 4	Dr. Tom Krimigis-Applied Physics Lab Cassini at Saturn at High Energies
November 19	Dr. Bruce Jakosky-LASP Water on Mars and Habitability
December 2	George Siscoe-Boston University Sun-Solar System Science, A Biography of a Field
December 9	AGU Practice Talks
Spring 2005	
January 27	Dr. Jack Connerney-NASA Goddard Space Flight Center Tectonic Implications of Mars Crustal Magnetism
February 3	Dr. John Sigwarth-NASA Goddard Space Flight Center Global Auroral Imaging: Dynamic Pressure Induced Auroral Brightenings and Conjugate Auroral Observations
February 10	Dr. William Burke-Air Force Research Lab., Hanscom AFB Electromagnetic Heating of the Ionosphere/Thermosphere during Severe Geomagnetic Storms
*February 15	Dr. Anil Bhardwaj-NASA Marshall Space Flight Center X-rays from the Solar System Bodies
February 17	Professor Margaret Kivelson-UCLA Interpreting the differences between auroral forms at Earth and Jupiter: What happens when rotational stress becomes dominant?
February 24	Jadwiga Beres-NCAR/High Altitude Observatory Lower and Upper Atmospheric Coupling: Role of Gravity Waves

March 3	Michael Shay-University of Maryland Magnetic Reconnection: Magnetic Explosions in Space Plasmas.
March 17	Mark Linton-Naval Research Laboratory Coronal Mass Ejections: Magnetic Reconnection and Flare Loop Formation
March 24	Jie Zhang-George Mason University Understanding Solar Eruptions in the Integrated Sun-Earth Connection System
March 29	Nathan Schwadron-Southwest Research Institute From the Sun to Solar Wind and the Interstellar Boundaries
March 31	Bodo Reinisch-UMASS, Lowell Remote Sensing of Geospace Plasmas with Radiowaves: From Earth's Ionosphere and Magnetosphere to Jupiter's Icy Moons
April 4	Stanislav Sazykin-Rice University Electrodynamic coupling in the inner magnetosphere of the Earth
April 14	Dr. Chris Parkinson-Caltech, JPL 1) Enhanced Transport in the Polar Mesosphere of Jupiter: Evidence from Cassini UVIS Helium 584 Å Airglow. 2) Hydrodynamic Escape from Planetary Atmospheres
April 28	Dr. Anthea Coster-MIT Haystack Observatory Monitoring Space Weather with GPS Mapping Techniques

APPENDIX D: Sponsored Project Funding

Funding Received on New or Continuing Grants by Astronomy Faculty and Senior Research Associates in FY05

PI	Agency	Title	FY 2005 Amount
Basu	DOD	Multi-Technique Studies of Ionospheric Plasma Structuring	\$ 59,241
Basu	NASA	Studies of Ionospheric Plasma Structuring at Low Latitudes from Space and Ground	\$ 47,454
Basu	DOD	Multi-Technique Studies of Ionospheric Plasma Structuring	\$ 86,440
Basu	NSF	International Coordination Center for the SCOSTEP-CAWSES Program	\$ 86,472
Baumgardner	NASA	High Definition Imaging of Mercury's Atmosphere and Surface	\$ 75,000
Blanton	Luce	Clare Booth Luce Professorship	\$ 105,504
Blanton	NASA	The Formation of Wide-Angle Tailed Radio Sources	\$ 37,417
Bosh	NASA	Spitzer Space Telescope: Changing Seasons on Pluto - A Stellar Occultation Opportunity	\$ 10,300
Brainerd	NSF	Dynamics of Satellite Galaxies	\$ 121,331
Brecher	NASA	Development of a Spectroscopic Learning-Tool Network (GSRP)	\$ 24,000
Chakrabarti	NASA	Planet Imaging Concept Testbed Using a Rocket Experiment	\$ 545,000
Chakrabarti	NASA	High Throughput, High Resolution, Ultraviolet Imaging Spectrograph for Studies of Diffuse Emissions	\$ 80,000
Clarke	NASA	HST UV Images of Saturn's Aurora Coordinated with Cassini Solar Wind Measurements	\$ 46,872
Clarke	NASA	Identification of a Magnetic Anomaly at Jupiter from Satellite Footprints	\$ 28,542
Clarke	NASA	Saturn's Auroral Energy Deposition Coordinated with Cassini UVIS	\$ 27,820
Clemens	NASA	The SIRTf Galactic Plane Survey	\$ 20,000
Clemens	NASA	The SIRTf Galactic Plane Survey Mod. 16	\$ 60,000
Cook	DOD	Designing UV Focal Plane	\$ 9,998
Cook	STSci	The Baryonic Structure Probe	\$ 13,172
Crooker	NASA	Heliospheric Sector Boundary	\$ 30,000

		Outflows		
Dimant	NSF	Plasma Instabilities and Turbulent Heating in Lower Ionosphere: Theory and Simulations	\$	95,061
Duggirala	SRI	Critical Investigations of Dayside Reconnection Arcs and the Cusp Boundary with Coordinated ISR and HIRISE Diagnostics	\$	142,845
Fritz	NASA	The POLAR CAMMICE Effort at Boston University	\$	100,000
Fritz	NASA	The POLAR CAMMICE Effort at Boston University	\$	194,000
Fritz	NASA	The Cluster RAPID On-Orbit Operations and Data Verification	\$	500,000
Fritz	DOD	The Loss Cone Imager	\$	383,000
Galand	NASA	Satellite and Ground Based Studies of Proton Aurora	\$	75,721
Goodrich	NASA	Integrated Numerical Simulation of the Solar-Terrestrial Environment for the LWS Program	\$	277,801
Hughes	NSF	STC: Center for Integrated Space Weather Modeling	\$	4,000,000
	NSF	MACCS	\$	74,000
Jackson	NASA	Spitzer Space Telescope: 24 Micron Pilot Survey of the Galactic Plane	\$	88,300
Jackson	NASA	Spitzer Space Telescope: The Small Magellanic Cloud - A Template for the Primitive Interstellar Medium	\$	88,500
Jackson	NASA	Spitzer Space Telescope: The Small Scale Structure of Cluster Forming Infrared Dark Clouds	\$	65,600
Jackson	NASA	The Mid-Course Space Experiment Extended Source Catalog	\$	75,942
Jackson	NASA	Infrared Studies of Star-Forming Regions in the Galactic Ring Survey	\$	127,434
Janes	NSF	REU: Development of the Perkins Re-imaging System at Boston University	\$	5,388
Janes	NSF	Collaborative Research: The BU/Lowell Observatory Partnership	\$	185,880
Janes	NSF	Development of the Perkins Re-Imaging System	\$	5,087
Kepko	NSF	Highly Periodic Solar Wind Density Structures: Characteristics and Magnetospheric Coupling	\$	119,600
Marscher	NSF	Multifrequency Probes of Blazar Jets	\$	201,504

Marscher	NSF	Multifrequency Probes of Blazar Jets	\$	202,537
Marscher	NASA	Connection Between X-Ray Emission and Relativistic Jets in the Radio Galaxies 3C 111 and 3C 120	\$	14,451
Marscher	NASA	High Energy Variable and Particle Acceleration in the Quasar 3C 273	\$	16,741
Marscher	NASA	Long-Term Monitoring of Blazars	\$	18,001
Mendillo	NASA	Mars and the Solar Wind	\$	80,000
Mendillo	NASA	Saturn's Ionosphere and Plasmasphere (GSRP)	\$	24,000
Mendillo	NASA	Development of a General Circulation Model of Saturn's Coupled Thermosphere-Ionosphere	\$	77,100
Mendillo	DOD	Disturbances of the Low Latitude Ionosphere During Extremes of Geomagnetic Activity	\$	180,000
Mendillo	NSF	CEDAR Post Doc: Photochemistry and Neutral-Plasma Coupling at Earth and Mars	\$	80,298
Oppenheim	NSF	CEDAR Post Doc: Modeling Radar Observations of Meteor Trails	\$	80,299
Oppenheim	NSF	Simulations and Theory of Small Scale E-Region Turbulence	\$	96,000
Oppenheim	NSF	CEDAR: The Aeronomy of Meteor Trails - Observations, Simulations, and Theory	\$	86,146
Siscoe	NSF	Solar Wind-Magnetosphere- Ionosphere Coupling	\$	130,271
Spence	NSF	SGER: Paleo-Solar Activity Recorded in Arctic Ice Cores	\$	87,135
Spence	NASA	Energetic Particle Instrument Interface and Support of UNH Bench-Model Satellite Development	\$	15,501
Spence	NASA	Cosmic Ray Telescope for the Effects of Radiation	\$	2,223,936
Spence	NASA	Integrated Sun-Earth System Studies using Magnetospheric Energetic Particles	\$	133,157
Wilson	NASA	The Escape of Oxygen from Mars	\$	32,998
Wilson	NASA	A Groundbased Study of Mass Input into Jupiter's Magnetosphere from Io's Volcanoes	\$	65,289
Total			\$	11,964,086

APPENDIX E: Department of Astronomy PhD Recipients: 1995 – 2005

YR	PhD Recipient	Dissertation Title	Research Supervisor	Last Confirmed Location
1995	Dana Balser	The Abundance of ^3He in the Milky Way Galaxy	Prof. Thomas Bania	Associate Scientist National Radio Astronomy Observatory
	Xiang Qun He	Hydrogen Escape from the Earth's Atmosphere	Prof. Robert Kerr	Staff Scientist Harvard-Smithsonian Center for Astrophysics
	Xiaoqing Pi	Dynamical Effects of Substorms in the Middle and Lower Latitude Ionosphere	Prof. Michael Mendillo	Staff Scientist Jet Propulsion Laboratory, Cal Tech
	Yun Fei Zhang	Time Variable Extragalactic Radio Sources with Peaked Spectra	Prof. Alan Marscher	Staff Scientist Harvard-Smithsonian Center for Astrophysics
1996	Brian Kane	The Structures, Kinematics, and Magnetic Natures of Starless Bok Globules	Prof. Dan Clemens	Education Software Developer Northeast Consortium for Engineering Education
	Kent Montgomery	Old Stellar Systems: A Study in Stellar and Galactic Evolution	Prof. Kenneth A. Janes	Professor Astronomy Department, Young Harris College
1997	Redgie S. Lancaster	Upper Atmospheric Oxygen Density Determined from Combined Optical and Incoherent Scatter Radar Measurements	Prof. Robert Kerr	Staff Scientist NASA Goddard Earth Sciences and Technology (GEST) Center
	Timothy A. Paglione	The Properties of the Dense Gas in the Nuclei of Spiral Galaxies	Prof. James Jackson	Assistant Professor of Astronomy York College, CUNY
	Eftyhia Zesta	Traveling Convection Vortices at Cusp Latitudes Observed by MAACS	Prof. W. Jeffrey Hughes	Assistant Researcher Dept. of Atmospheric Sci., UCLA

1998	Anders Jørgensen	Global Dynamics of the Hot Plasma in the Inner Magnetosphere: Energetic Neutral Atom (ENA) and In-situ Measurements	Prof. Harlan E. Spence	Staff Scientist Space Instrum. and System Eng. Los Alamos National Laboratory
	Kathleen Kraemer	The Effects of Massive Star Formation on the Interstellar Medium: Photodissociated and Molecular Gas in NGC 6334	Prof. James Jackson	Astrophysicist , Air Force Research Lab, Hanscom AFB, MA Research Fellow IAR, Boston University
	John Noto	The Velocity Distributions of Hydrogen and Helium in the Earth's Exosphere	Prof. Robert Kerr	President & co-Founder Scientific Solutions
	Sheelah Shodhan-Shah	Properties of the Plasma Mantle in the Earth's Magnetotail	Prof. George Siscoe	(Stay-at-home mother – a very important job!)
1999	Markos Georganopoulos	Models of Blazars	Prof. Alan Marscher	NAS/NRC Postdoctoral Res. Assoc. , Laboratory for High Energy Astrophysics, NASA/GSFC
	James G. Ingalls	Carbon Gas in High Galactic Latitude Molecular Clouds	Professor Thomas Bania	Staff Scientist Jet Propulsion Laboratory, Cal Tech
	Matthew Lister	The Influence of Special Relativistic Effects on the Observed Properties of Jets in Active Galactic Nuclei	Prof. Alan Marscher	Jansky Postdoct. Fellow , NRAO Asst. Professor (starting 9/2003) Purdue University
2000	Mohamed J. Alothman	Modeling the Trapping Boundary of the Radiation Belts	Prof. Theodore Fritz	Professor University of Bahrain
	Yan Bétremieux	A New Look at the Jovian Atmosphere with a Raman Scattering Model	Prof. Roger Yelle	Postdoctoral Researcher Dept. of Physics and Astronomy, Northern Arizona University
	Alberto D. Bolatto	The Interstellar	Prof. James	Postdoctoral Scholar

		Medium in Low Metallicity Environments	Jackson	Radio Astronomy Lab Astronomy Dept., U.C. Berkeley
	Karen L. Hirsch	Assessing Plasma Sheet Convection Models Using Off-Equatorial Plasma Sheet Observations	Prof. Harlan E. Spence	Research Associate Space and Remote Sensing Sciences Los Alamos National Laboratory
2001	Athanasios Boudouridis	Two-Point Studies of the Spatial and Temporal Aspects of High-Latitude Particle Precipitation: A Remote Diagnostic of Magnetospheric Regions and Processes	Prof. Harlan E. Spence	Postdoctoral Researcher Department of Atmospheric Sciences University of California, Los Angeles
	Maohai Huang	Interstellar Carbon Under Influence of HII Regions	Prof. Thomas Bania	Postdoctoral Researcher Trieste Observatory, Italy
	Andrew W. Stephan	EUV/FUV Remote Sensing of the Low-Latitude Ionosphere and Thermosphere	Prof. Supriya Chakrabarti	Research Associate Naval Research Laboratory
	Sherri G. Stephan	High Resolution Study of the Heliospheric Interface Region Using SCARI	Prof. Supriya Chakrabarti	Member of the Senate Staff Washington, DC
2002	Candace Oaxaca Wright	Applications of Weak Gravitational Lensing: Constraining the Dark Matter in Clusters and Galaxies	Prof. f Tereasa Brainerd	Staff Scientist Air Force Research Laboratory Hanscom AFB, MA
2003	David Murr	Magnetosphere-Ionosphere Coupling on Meso- and Macro-scales	Prof. W. Jeffrey Hughes	NSF GEM Postdoctoral Fellow Dartmouth College
	Michal Kolpak	The Large Scale Galactic Structure of Star Formation Tracers	Prof. James Jackson	Mathematics Teacher China
2004	Sigrid Close	“Theory and Analysis of Meteoroids Using High-Resolution Multi-	Prof. Meers Oppenheim	Staff Scientist MIT Lincoln Laboratory

2005		Frequency Radar Data”		
	Lars Dyrud	“Simulations and Analysis of the Effects of Small Scale Turbulence on Macro Scale Plasma”	Prof. Meers Oppenheim	CEDAR Postdoctoral Fellow Boston University
	Melissa Hayes-Gehrke	“Ultra-High Precision Photometry of Open Clusters: A Study of Stellar Activity in Old Stars”	Prof. Kenneth Janes	Astronomy Lecturer The University of Maryland
	Marc Kassis	“Mid-Infrared Observations of Photodissociation Regions and MIRSI: A Mid-Infrared Spectrometer and Image Developed for Ground Based Observing”	Prof. James Jackson (Prof. Lynne Deutsch)	Support Astronomer W. M. Keck Observatory Kamuela, HI
	Lara Waldrop	“Probing the Structure, Composition, and Dynamics of the Jovian Plasma Sheet with Energetic Particles”	Prof. Theodore Fritz	CEDAR Postdoctoral Fellow University of Illinois
	Andrei Sokolov	“Theoretical Study of Multifrequency Emission Variability in Blazars”	Prof. Alan Marscher	Postdoctoral Research Associate University of Lancashire, UK