

ANNUAL REPORT

2005 - 2006

Department of Astronomy

I. INTRODUCTION

2005-2006 was another busy and exciting year for students, staff and faculty in Astronomy! A highlight of the year was the Bethe Centennial Symposium, co-sponsored by Astronomy and Physics on June 2-3, 2006 to pay tribute to Hans Bethe's rich legacy to astrophysics.

Members of the department continue to pursue diverse research topics ranging from the cosmology of the early universe to the characteristics of binary asteroids. Cornell radio astronomers are exploiting several new capabilities of the Arecibo Observatory. For example, Professors **Martha Haynes** and **Riccardo Giovanelli**, assisted by their graduate students, are carrying out a major new survey (ALFALFA) to map the distribution of hydrogen in nearby and distant galaxies. Professors **Jean-Luc Margot** and **Don Campbell** are using Arecibo's radar capabilities to study binary Earth-approaching asteroids and to search for possible deposits of ice at the poles of the Moon, respectively.

Spitzer's Infrared Spectrograph (IRS) group, led by Professor **James Houck** continues to study a broad range of astronomical objects including disks around forming stars, dust in distant galaxies, brown dwarfs, and dying stars in nearby galaxies.

The Mars Rovers continue their spectacular exploration of Mars. Since January 2004, **Opportunity** has been traveling across the dune covered plains of Meridiani investigating outcrops and finding strong evidence that liquid water once covered this portion of Mars. Meanwhile **Spirit** continues to explore Gusev crater and the Columbia Hills. It also has found evidence of ancient water on the surface of Mars. During the past year the bulk of daily science operations for the two rovers has been transferred to Cornell. Daily operations are supervised by Professors **Steven Squyres** and **James Bell**, assisted by graduate and undergraduate students. Professor **Squyres** recently published a most readable account of his personal Mars odyssey called "Roving Mars: Spirit, Opportunity and the Exploration of the Red Planet". The book is published by Hyperion Books.

During the past year **878** students participated in courses offered by the Department **4** undergraduates completed their Astronomy Major and **12** graduate students finished their Ph.D. programs. The Department continues to emphasize the participation of undergraduates in its diverse research programs. Approximately **50** undergraduates were involved, including those who took part in summer programs supported by the National Science Foundation's REU (Research Experience for Undergraduates) program, by the New York State Space Grant Consortium, and by NASA space projects such as Spitzer, Cassini, Deep Impact and MER (Mars Exploration Rovers).

The **Cranson W. and Edna B. Shelley Award for Undergraduate Research in Astronomy** was awarded to **Mark Keremedjiev**. The graduate award of the same name was won by **Amelie Saintonge**. **David Rothstein** was awarded the **Eleanor Norton York Prize in Astronomy**.

With generous support from the **Friends of Astronomy** and help from the College, the Department continued to improve its facilities for undergraduate teaching. The computer facilities in our Clark Hall laboratory used for the teaching of introductory astronomy courses were updated and new video projection equipment was installed. Also during the past year, minor renovations were completed on the 6th floor of the Space Sciences building to provide additional working space for our students.

Significant progress is being made on the Department's major undertaking: the Atacama Project. This project known as the Cornell-Caltech Atacama Telescope (CCAT) project is under the direction of **Professor Riccardo Giovanelli** and involves the building of a 25-meter remotely controlled sub-millimeter telescope at a high altitude site in the Atacama Desert of Chile. A review of the Project by an external committee chaired by Nobel Prize Winner **Robert Wilson** of Harvard was held in January 2006 in Pasadena. The Wilson Committee submitted its findings in a report to the administrations of Cornell and Caltech which is strongly supportive of the project. In part, the conclusions of the Wilson Committee are: "...CCAT will revolutionize Astronomy in the submm/FIR band and enable significant progress in unraveling the cosmic origin of stars, planets, and galaxies. CCAT is very timely and cannot wait." The Department is continuing its efforts to assure funding for Cornell's share of the Project and to find additional partner institutions to join in CCAT. Within the past six months, three institutions have expressed their intent to join Cornell, Caltech and JPL and participate in CCAT.

During the past year a member of the Department, **Paul Goldsmith**, formerly the James Weeks Professor in Physical Sciences left Ithaca and became a Professor Emeritus. He has accepted a research position at Caltech's Jet Propulsion Laboratory.

During the 2005-06 there were approximately **105** individuals associated with the Department (not counting NAIC staff at the Arecibo Observatory in Puerto Rico). They included **25** faculty, **38** research associates, and **41** graduate students. Significant research achievements during the past year are described in the reports of individual faculty members in the main body of this report.

The Department's research was supported by **150** grants and contracts and sub-contracts totaling **\$17.0M**. An additional **\$12.3M** supported operations of the Arecibo Observatory. Most research funds for the Department come from NASA, with a significant contribution from NSF. Operations at Arecibo are supported by NSF.

Members of the Department, their students and associates published some **380** papers during the past year, in addition to presenting numerous colloquia and public lectures.

The Department's Colloquium Series, organized by Professors **Jean-Luc Margot** and **Riccardo Giovanelli** consisted of **29** colloquia including one "named" colloquium endowed by our Friends of Astronomy. This was:

The Charles & Barbara Burger Special Colloquium given by **Jana Levin** from Columbia University: "Black Holes, Chaos, and Gravitational Waves".

The Salpeter Lecturer for 2005-2006 was **Avi Loeb** of Harvard. The **Thomas Gold Lecturer** was Professor **Roger Blandford** of Stanford.

Preparations were underway for two scientific symposia to be held in 2006. The first to be held on July 28-29 is entitled "From Dust to Planets" and will honor Professor **Joseph Burns** on his 65th birthday. The second, "Dark an Dusty Galaxies" will be held on October 13-14 to celebrate the 60th birthday of Professor **Riccardo Giovanelli**.

II. DEPARTMENTAL NEEDS

The Department's most pressing short-term needs are:

- 1) Continued support from the College to maintain and improve the quality of instruction for our undergraduates. There continues to be an urgent need for modest funds (\$10-20K) to update laboratory facilities.

A related perennial request concerns some \$50K to develop detailed plans for the phasing-out and replacement of the Fuertes Observatory.

- 2) A slight increase (by 1 or 2 positions) in the allocation of teaching assistants. We have been forced to limit enrollments in several of our most popular undergraduate courses for lack of sufficient TA support.
- 3) Help in alleviating an increasingly critical shortage of space. In 2005-06 the College provided funds for small alterations to the 6th floor of the Space Sciences Building, alterations which provided some additional, desperately needed space for our students.

A similar request for funds to gain space on the ground floor was unfortunately denied for the coming academic year.

The need to provide the Department with additional space was one of the key items emphasized by the report of the 2004 Visiting Committee.