

ANNUAL REPORT

2002 - 2003

Department of Astronomy

I. INTRODUCTION

Astronomy at Cornell continues its healthy, vigorous growth in teaching and research activities. The past year has been marked by successes as well as by changes and challenges.

Professor **Saul Teukolsky** was elected to the National Academy of Sciences. Dr. **Robert Brown** has been appointed as the new Director of the Arecibo Observatory, succeeding Professor **Paul Goldsmith** who stepped down after serving two five-year terms. The process of promoting **Jim Bell** to Associate Professor with tenure has been initiated. Two new Adjunct Professors were appointed during the past year: **Robert Brown**, the Director of NAIC and **James York**, a world-renowned expert in mathematical general relativity. A search is underway for an outstanding optical/infrared astronomer to fill the position vacated by **Steve Eikenberry** who left Cornell in January.

Several new courses of instruction were introduced during the past year, including Astronomy 310 "Planetary Image Processing" offered by Professor **Jim Bell** exploiting the resources made available by the Department's Hewitt Laboratory for Computing and Visualization in Astronomy. Overall 843 students participated in courses offered by the Department in 2002-2003. Four undergraduates completed their Astronomy Majors and five graduate students completed their Ph.D. programs.

The Department is especially proud of the emphasis that it places on involving Cornell undergraduates directly in many of its research programs. During the past year a total of 50 undergraduates participated in our research projects. Included among these are 20 who participated in summer programs supported by the National Science Foundation's REU (Research Experience for Undergraduates) and by the New York State Space Grant Consortium.

The Cranson W. and Edna B. Shelley Award for Undergraduate Research in Astronomy was awarded to **Jonathan Darvill**. The Cranson W. and Edna B. Shelley Award for Graduate Research in Astronomy was won by **Kristine Spekkens** while the Eleanor Norton York Prize in Astronomy was awarded to graduate student **Lynn Carter**.

The Department has identified as its major educational need the replacement of the Fuertes Observatory and the upgrading of facilities for teaching undergraduate courses in practical observational astronomy and in instrument building. Significant upgrades are needed in the hardware and software required for teaching Astronomy 410 ("Experimental Astronomy") and Astronomy 195 ("Observational Astronomy") as well as for teaching the two courses that make use of the Hewitt Laboratory (Astronomy 234 and 310). The need to replace Fuertes has become acute. The recently completed expansion of the North Campus has produced a serious deterioration in observing conditions at Fuertes. Additionally, the main telescope at Fuertes, while marginally acceptable as a museum piece, is irrelevant to the teaching of modern astronomy.

Significant research achievements during the past year are described in the reports of individual faculty members in the body of this report. Also of importance are developments related to several major space endeavors. Early June 2003 saw the launch of the MER-A spacecraft to Mars carrying the Mars Exploration Rover and the Athena science payload developed by Professor **Steve Squyres** and his associates at Cornell. The companion spacecraft MER-B is scheduled for launch in late June 2003. Both rovers are expected to start exploring the surface of Mars in January 2004.

We are also awaiting the launch in August 2003 of SIRTF (Space Infrared Telescope Facility) the last of NASA's four "Great Observatories". One of the major instruments on SIRTF is the Infrared Spectrometer (IRS) developed by Professor **Jim Houck** and his associates.

The Comet Nucleus Tour (CONTOUR), a NASA Discovery-class mission led by Professor **Joseph Veverka** was launched successfully from Cape Canaveral in early July 2002. CONTOUR was inserted into an elliptical earth-orbit and it was planned to fire a solid rocket motor on August 15, 2002 to inject CONTOUR into a heliocentric orbit which would take the spacecraft to two comets: Comet Encke in 2003 and Comet Schwassman-Wachmann 3 in 2006. Unfortunately, within 90 seconds of the start of the solid rocket burn the spacecraft appears to have broken apart into at least three pieces. At this time, the NAS appointed Mishap Investigation Board (MIB) has not yet released its report on the probably cause of the mishap. Work is underway to re-propose a CONTOUR 2 to carry out the science goals of the original mission. The CONTOUR team at Cornell is also participating in another NASA comet mission, DEEP IMPACT, scheduled to explore the surface and sub-surface of Comet Temple 1 on July 4, 2005.

Other highlights of the Department's activities include:

- Professor **Joseph Burns** testified to the House Science Committee on the future Large Synoptic Survey Telescope (LSST) intended to contribute to the detection of potentially dangerous asteroids.
- Professor **Yervant Terzian** testified to Congress on the future of the NASA Space Grant Program.
- The Dynamical Astronomy Division of the American Astronomical Society (AAS) held its annual meeting at Cornell in May.
- Professor **Saul Teukolsky** was elected to the National Academy of Sciences.
- Professor **Don Campbell** and collaborators obtained tantalizing radar evidence that bodies of liquid hydrocarbons (ethane?) may occur on the surface of Saturn's satellite Titan.
- Professor **Terzian** was elected to a 3-year term as Chair of the US Consortium for the SKA. The SKA, or Square Kilometer Array, is a concept to build a radio telescope with 20 times the collecting area of Arecibo. Professor **Jim Cordes** received significant funding from the National Science Foundation to lead a study of the feasibility of this project.

Work continues on the definition of Cornell's Atacama Telescope project, the goal of which

is the construction of a 15-meter telescope in the Atacama desert of Chile. The study has benefitted considerably from a generous gift from Mr. Fred Young, one of our devoted Friends of Astronomy. Additional support has been provided by the Provost's Office and by the National Science Foundation. The current objective is to finalize a Memorandum of Understanding (MOU) between Cornell and the University of Chicago to initiate the formal Study Phase of this project. The Department is also in contact with several other potential participants.

While working on plans for the Atacama Project, the Department is continuing its partnership with CalTech for the use of the Palomar 5-meter telescope. The current agreement between Cornell and CalTech runs out in 2004. Preliminary negotiations to extend the agreement for another five years are underway.

This year's Colloquium Series, organized by Professors **Jim Bell** and **Jim Cordes** consisted of 44 colloquia including three special "named" colloquia endowed by our Friends of Astronomy. These were:

- The Charles & Barbara Burger Special Colloquium by Professor Jeff Hester of Arizona State University on "The Crab Pulsar: The Gift That Keeps on Giving".
- The Maryanne Shelley Jessup MacConochie Astronomy Colloquium by Professor Imke de Pater, University of California-Berkeley on "Studies at Near and Mid-Infrared Wavelengths with the Keck Telescope of 1) Volcanism on Io and 2 Titan's Atmosphere and Surface".
- The Josephine Lawrence Hopkins Foundation Colloquium by Professor Peter Goldreich, California Institute of Technology on "Formation of Kuiper Belt Binaries".

The Salpeter Lecturer for 2002-2003 was Professor **Shri Kulkarni** of the California Institute of Technology. The Thomas Gold Lecturer was Dr. **Vera Rubin** of the Carnegie Institution of Washington. A Special Symposium was held in September to honor Professor **Don Campbell** on the occasion of his 60th birthday and to recognize his many contributions to radar astronomy.

During 2002-2003 there were approximately **114** individuals associated with the department (not counting NAIC staff at the Arecibo Observatory in Puerto Rico). These included **22** faculty, **23** research associates and **36** graduate students.

The Department's research was supported by **85** grants and contracts totaling **\$11.7M**. An additional **\$11.4M** supported operations of the Arecibo Observatory. The bulk of the Arecibo support came from NSF. Most of the research funds for the Department came from NASA, with a significant contribution from NSF.

Members of the Department, their students and collaborators published approximately **235** scientific papers in addition to presenting numerous colloquia and public lectures.

The Department's activities continue to receive enthusiastic support from our Friends of Astronomy. In Fall 2002, the group celebrated its 10th anniversary under the mentorship of Professor **Yervant Terzian**.

Section II of the Annual Report summarizes the department's most pressing needs. Most pressing among these are:

- Support for our new endeavor to enhance the undergraduate teaching of Astronomy at Cornell by replacing the Fuertes Observatory and upgrading the facilities for teaching practical (i.e. observational and instrumental) astronomy
- Additional support for the Atacama Project, including the appointment of additional faculty in areas essential to the success of this endeavor.
- Support for the appointment of Visiting Professors to the Department.
- Additional support student for education related computer facilities such as the Hewitt Laboratory.