

FOREWORD

Anyone who doubts that astronomy is enjoying a golden age has only to browse the pages of *Organizations and Strategies in Astronomy*, Vol. 5. Our golden age is defined not only by the enormity of new discoveries of dark energy, dark matter, extra-solar planets, and the evolution of Mars, but also by the breadth, diversity, and creativity within our community. This volume records our history, in a period of such rapid change and growth that individual astronomers are hard-pressed to keep abreast of their own fields and neighborhoods, much less of developments world-wide.

Since the 1950's, changes in the landscape of astronomy are manifold. We have witnessed two epochs of big telescope construction, the 4-meter class telescopes of the '60s and '70s and the 8- to 10-meter class telescopes of the '90s, continuing through today. We accomplished the transition from photographic to digital data, and we continue to improve the size and sensitivity of astronomical detectors. We have witnessed the flowering of radio astronomy and the opening of the full electromagnetic spectrum through space astronomy. We have seen the growth of national and international astronomy facilities, and a dramatic broadening of the accessibility of data, both through observing facilities available through open competition based on scientific merit and through deep, rich archives of data. We have seen the establishment of a multitude of new programs at many universities and in many countries, and we have welcomed many new nations to the international community of astronomers. The communication of our research has also seen dramatic changes, as the Internet has enabled rapid electronic access to our journals, and powerful new search capabilities allow us to identify and retrieve relevant literature.

Astronomy has undergone many social transformations as well. While progress is slower than we would like, we have nonetheless opened the field of astronomy to fuller participation by women and other under-represented groups. The statistics on women in the International Astronomical Union (IAU) are carefully documented by Suzanne Débarbat in this volume. It is gratifying to see the participation of women increasing at least steadily,

if not rapidly, in so many countries. The differences among countries in the participation of women are particularly interesting, and it is clear that some of these countries need to pay special attention to the social factors that still seem to discourage women from following careers in science. The IAU has acknowledged the efforts to increase the participation of women by the formation of a new Working Group on Women in Astronomy, and we can hope to see continued progress.

We have welcomed active, new specialties within astronomy that focus on data archiving, data mining, software, instrumentation, technology development, education, public awareness of science, public policy, and so on. These areas have become so well developed that we need experts to keep astronomy moving forward. We've also learned to value teamwork, as the complexity of modern astronomy requires numerous specialists to achieve our research goals.

Increasingly, we are globally connected, and an awareness of the global astronomy landscape is now essential to the conduct of research. Many, if not most new astronomy facilities are collaborative in nature, often with an international component. The scope of astronomical research in Antarctica, documented in this volume by Michael Burton, is an excellent example of international collaboration. Indeed, many proposed new observing facilities are too ambitious for any single nation, and collaboration is essential if we are to build the facilities we need to carry out our research. World-wide, multi-national networks of telescopes enable us to monitor variable phenomena in the Sun and stars around the clock. International collaborations also arise as the instrumentation on telescopes becomes increasingly specialized. We need access to a variety of telescopes and instruments to obtain the observations needed for our research. Rapid global communications have allowed us to collaborate easily with colleagues across national borders. Instantaneous communications are changing how astronomers interact and the rapidity with which new results are known to others working in the same field.

The pace of astronomical discovery is also breathtaking. As Carol Christian reports in this volume, space science alone accounted for nearly 6.5% of all new scientific discoveries world-wide in 2003. The sustained pace of scientific discoveries with the Hubble Space Telescope is documented in the continued high level of media attention afforded to Hubble, and these discoveries are rapidly communicated to the public press.

Astronomy continues to enjoy great popularity with the public. As Christian describes, the Mars Rover websites see millions of hits per week and the Hubble Space Telescope website has recorded hundreds of billions of independent visits. The popularization of astronomy occupies an increasing fraction of the time of professional astronomers, and new career options

have become available within our field to accommodate this need. We are aided in this mission by educators, journalists, and artists (see especially Noël Cramer's article and CD about Ludek Pesek's space art), and the growth in this field is documented by several articles in this volume. Public-outreach efforts in one country, the Netherlands, described by Cornelis de Jager & Mat Drummen, are echoed in many countries around the world. Noreen Grice's work sharing the beauty of astronomical imagery with blind and visually impaired people is particularly inspiring.

As the pace of change and of new technology continues to accelerate, our traditional institutions struggle to respond. Our scientific journals have done well in adapting to new media and new access technologies, and in developing new business models to remain on sound financial footing even as the number of subscriptions drops. (Readers should especially take note of the article by Åge Sandqvist on the high impact factor of the journal *Astronomy and Astrophysics*, based on citations to articles!) Intellectual property rights remain a potential issue for astronomy, but so far we have avoided most of the pitfalls which might have threatened the free flow of information. Procedures for hiring and promotion decisions have been slow to respond to the new norms for publication and collaboration of our field. Some of our institutions have been slow to recognize the essential contributions of instrumentalists in the tenure and promotion process, and new fields of specialization outside of traditional research areas are often unrecognized, as well.

The Web has become the dominant medium for the delivery of information, and the ephemeral nature of web-based material and other electronic communications threatens to make the jobs of future historians of astronomy quite difficult. Our letters, manuscripts, and annual reports of activity in our institutions, now in electronic form, are being lost at an alarming rate. Even worse, many of our institutions, strapped for space as the population of astronomers grows, are forced to dispose of old records and correspondence saved for their potential historical value. The preservation of records of historical value is a difficult challenge because we have few widely accepted or economically feasible methods of archiving a mix of paper and electronic records.

The several contributions in this volume that provide snapshots and histories of astronomical institutions and programs around the world are particularly important in the context of history. While the record of our scientific achievements is increasingly accessible through electronic means, the record of our institutions and programs through time is much more difficult to preserve. *Organizations and Strategies in Astronomy* plays a key role in recording much of the history of our field, particularly the developments of programs and institutions, and it is particularly gratifying to see descrip-

tions of the status of astronomy from so many locations, including South Africa, Ireland, Spain, Austria, and Switzerland, and of the evolution of the Isaac Newton group of Telescopes and of astronomy at the Max-Planck Society. Without these volumes, recording the historical developments of our institutions and national astronomy programs, much of this record would be lost to future historians.

More than anything else, *Organizations and Strategies in Astronomy* is about change, recording where we've been and how we have evolved, and extrapolating to where we will be in the coming decades. From the pages of this volume, it is easy to extrapolate several trends to predict where we will find ourselves in the coming decades. Our institutions will be increasingly interconnected by both research and collaborations on large facilities, and we will live and work in a global, rather than a national world.

Arthur J. Carty, the then President of the National Research Council of Canada, wrote in Vol. 4 of *Organizations and Strategies in Astronomy* of the "Canadian Vision of International Astronomy and Astrophysics", and challenged us to think internationally in the planning and execution of our future. In the United States, the astronomical community undertakes each decade to evaluate the status of our field and to set priorities for facilities and programs for the coming ten years. The last such effort, chaired by Christopher McKee of the University of California at Berkeley and Joseph Taylor of Princeton University, was published as the report *Astronomy and Astrophysics in the New Millennium* by the National Research Council of the United States.

Dr. Carty noted that it might be time for the international astronomical community to consider such a process for establishing the scientific priority of major new projects of international scope and participation. Such a review, with broad international participation and the support of the world-wide astronomical community, might make it possible for many smaller countries to achieve meaningful participation in international projects. The support of the world-wide community in the advocacy of large, international projects could help to convince national governments to participate on behalf of their own astronomy communities. As astronomers around the world become more and more connected, it may well be time to consider such a process.

Caty Pilachowski
catyp@astro.indiana.edu
Indiana University
May 2004.