Preface

IAU Symposium 196 addressed the problems of light pollution, radio interference and space debris that hinder astronomers' ability to study the Universe at the exquisitely sensitive levels necessary for current research. The Symposium was a follow up to the very successful 1988 IAU Colloquium 112 in Washington, DC ("Light Pollution, Radio Interference, and Space Debris", ed. D. L. Crawford) and the 1992 Paris workshop sponsored by UNESCO, ICSU, IAU and COSPAR ("The Vanishing Universe: Adverse Environmental Impacts on Astronomy", ed. D. McNally). The Symposium was organized by IAU Commission 50 (Protection of Existing and Potential Observatory Sites), with the support of Commissions 9 (Instrumentation and Techniques), 21 (Light of the Night Sky), 25 (Stellar Photometry and Polarimetry), 40 (Radio Astronomy), 46 (Astronomy Education and Development) and 51 (Bioastronomy: Search for Extraterrestrial Life) .

Increasing levels of "technological fog" are threatening not only the work of professional astronomers but also the ability of the general public to study and appreciate the wonders of the sky. The threats are global in scale and the effects are long-term in nature. The meeting had two primary purposes: to share information on the status of the environment and adverse effects on observations, and (2) to develop technical and political action plans to preserve the astronomical sky. The meeting was held at the United Nations centre in Vienna, as part of the "Technical Forum" of UNISPACE III, the third United Nations conference on the Exploration and Peaceful Uses of Outer Space.

The meeting had 70 participants from 25 nations and 3 Press Officers who helped to get the word out. After three days of talks and a delightful banquet at the old Vienna Observatory, the fourth day was devoted to workshop sessions for brainstorming effective strategies for dealing with the issues. On the final day, the workshop results were debated in plenary and polished further, before being approved by the entire Symposium. Primarily, a statement was prepared which was presented to the national delegations to UNISPACE III, with the intention that this will provide a basis for future UN discussions and international action. The statement was approved at UNISPACE III and published in their Report: it is included as Appendix 1 to these proceedings.

On the optical front, the most interesting new results for light pollution were based on quantitative calibrations newly available from the US Defense Meteorological Satellite Program (DMSP). Qualitative images of the night-time earth showing the glow from urban areas have been available for twenty years, but now one can do proper quantitative measurements. Based on these images, S. Isobe (Japan) presented estimates of the money wasted annually by major cities from street lighting scatterred upwards: e.g., US$3M for London and US$14M for New York City. P. Cinzano (Italy) presented a marvellous new night-time image of Europe based on DMSP data combined with a light-scattering model

to show estimated sky brightness (limiting magnitude) at any given location. Back on Earth, M. Smith, Director of Cerro Tololo Inter-American Observatory, Chile, emphasized the challenges and successes which that observatory has had in dealing with local authorities to preserve their telescopes' capabilities.

Radio astronomers were preparing for the next major meeting of the International Telecommunication Union to allocate radio frequences, in May/June 2000. The millimetre-wavebands, little used until now by industry, will be a major focus for radio astronomy in the 21st century, with the development of powerful new facilities such as ALMA. H. Butcher (The Netherlands) told of the strong recommendation of the Working Group on Radio Astronomy of the Megascience Forum of the Organization for Economic Cooperation and Development (OECD) to seek protection for the new major radio observatories in the mm- and cm-bands, now in various stages of technical development and implementation. As a result, in June 1999 the science ministers of the OECD recommended the formation of a high-level task force to develop long-term solutions (such as radio-quiet zones) that may safeguard our radio windows on the Universe while allowing efficient development of commercial telecommunications. The Terms of Reference of this group are given in Appendix 2. R. Ekers (Australia) and R. Fisher (USA) emphasized that radio astronomers need to become better in rejecting radio interference, using techniques that are quite feasible and known in military circles but not yet developed at observatories. Furthermore, radio (and optical) observatories have been remiss in quantitatively documenting the interference they encounter over time.

W. Flury (Germany) reported on the space debris problem. Already, some 100,000 objects larger than 1 cm circle the Earth and menace operations of all spacecraft, including scientific missions. While this is a serious problem, our meeting did not focus specially on it because it featured prominently elsewhere on the UNISPACE agenda and the major space agencies are themselves giving the problem high priority.

In summary, we achieved our goal not only to exchange information among ourselves and develop new strategies, but also to bring the issues of radio interference and light pollution to an entirely new forum, the United Nations. The 'Vienna Declaration' and Final Report of UNISPACE III (now available from bookshops and at http://www.un.or.at/OOSA/) show that our recommendations were heard and, to a gratifying extent, accepted by the ~100 UN Member States attending UNISPACE III. This forms an excellent basis for the further work, through the UN Committee on the Peaceful Uses of Outer Space, UN-COPUOS, to improve international protection of the astronomical sky as the cultural heritage of all humankind and to protect everyone's access to pristine and uncluttered skies.

In conclusion we would like to thank all members of the Scientific Organizing Committee and the Local Organizing Committee for their help in organizing and running the meeting. We also gratefully thank our sponsors the IAU, COSPAR, the UN Office of Outer Space Affairs, the CIE, IUCAF, URSI and the International Dark-Sky Association, without whose financial support the meeting would not have been possible.

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