for the development of geophysics in the Third World and for the advancement of research worldwide in the coming decades.

It is most important that each member of IAGA should think objectively about the principle of commercial funding and notify the national committee and the president of IAGA of his or her opinion, requesting a full debate of the subject at the meeting in Vienna in 1991. Please send any comments to W. F. Stuart, Chairman, IAGA Fund Raising Committee, British Geological Survey, West Mains Rd., Edinburgh, EH9 3LA, Scotland. Those who recognize institutional difficulties in the administration of the proposal should express them so that the process of resolving them can begin.

Book Review: *Physics and Chemistry of the Upper Atmosphere*

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The recently published book, *Physics and Chemistry of the Upper Atmosphere*, by M. H. Rees, is now available through Cambridge University Press, London. Sushil K. Atreya, University of Michigan, Ann Arbor, provides this review.

The Earth's upper atmosphere is a region of immense complexity. The behavior of this region is governed primarily by the energy deposited by solar ultraviolet photons and the energetic charged particles. This book is an excellent attempt at unraveling the mysteries of the upper atmosphere of the Earth. The upper atmosphere in this book refers loosely to the region of the thermosphere and ionosphere, although it is not uncommon to find, throughout the book, occasional references to the mesospheric processes.

The book is divided into eight chapters that deal with the actual process of energy transfer in the low, middle and high latitudes, followed by the manifestation of such energy transfer in terms of compositional changes, thermal structure, spectroscopic emissions and the atmospheric dynamics. All of the chapters contain an in-depth treatment of the physical principles and the chemical processes (when appropriate), as well as a comprehensive discussion of observations from ground-based, orbital and suborbital instruments. At the end of each chapter, most important references are cited for further reading. Each chapter also lists representative problems that will provide graduate students with enough needed exercise to think independently. Students planning to take Ph.D. comprehensive examinations in aeronomy will be well advised to work through all these problems; I found many of these problems quite challenging. The appendices at the end of the book are quite thorough, as they contain most of the aeronomically pertinent information on model atmosphere, solar fluxes, cross sections, chemical kinetics, atomic and molecular physics, and the atmospheric diffusion.

Four chapters are particularly informative and well written and clearly show the author's insight into those areas (other chapters contain mostly standard material and should be an integral part of any monograph on aeronomy). Chapter 3, on charged particle impact, and chapter 6, on energy balance, reflect the author's pioneering work in these areas, although important work of others is cited also. Chapter 7, on spectroscopic emissions, will be very valuable for observational aeronomers and is a much needed update to similar chapters in J. W. Chamberlain's *Aurora and Airglow*, written in the early 1960s. My only complaint for chapter 7 is that little attention is paid here to the high-resolution UV and visible spectroscopic work.

Chapter 8, on thermospheric dynamics, presents a well-balanced discussion of modern observational techniques for measuring thermospheric winds and the ion drifts, such as chemical release, doppler-shifted emissions, incoherent scatter radar, etc., and the theory. Those not closely related to this important area of aeronomy will find this chapter a good tutorial.

In summary, I find this book to be an excellent reference for researchers in the field of aeronomy and graduate students who are planning to study aeronomy.

Meeting Report

Workshop on Solar Flares and Magnetospheric Substorms

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Among many of the fascinating phenomena displayed by nature, there are a number that involve the generation, storage, and subsequent dissipation of electromagnetic energy. Solar flares and magnetospheric substorms are two notable examples that occur in the solar system. A workshop dealing with these two phenomena, "Workshop on Solar Flares and Magnetospheric Substorms," was held March 26–30, 1990, at the East-West Center on the University of Hawaii campus at Manoa—an efficient but delightful setting for scientific interaction. The workshop was unique in that solar physicists and magnetospheric physicists, about 25 from each group, gathered together in a single conference hall to discuss practically all aspects of both solar flares and magnetospheric substorms. Participants came from Australia, Germany, Japan, Scotland, Sweden, Switzerland and the United States.

This conference was conceived by some of the participants in the 1988 Yosemite Conference, "Outstanding Problems in Solar System Plasma Physics," including Syun Akasofu, Richard Canfield, Joe Kan, B. C. Low, and Peter Sturrock. It became clear at that meeting that the apparent similarity between flares and the substorms presented a challenge to both solar physicists and magnetospheric physicists. In addition to this specific challenge, it was thought that it would be profitable to broaden our understanding of the workings of solar system plasma physics regardless of where the plasma is located.

The basic idea behind the workshop was to try to understand whether or not there is a fundamental mode of electromagnetic energy generation and subsequent dissipation that is common to solar flares to magnetospheric substorms, but many important subsidiary questions also presented themselves to participants.

The scope of the workshop can be inferred from the session titles: (1) overview of flares and substorms; (2) flare energy build-up and substorm energy supply; (3) flare energy release and substorm energy dissipation; (4) mass motions: solar and magnetospheric; (5) flare acceleration, double layers, and auroral potential structures; and (6) solar radio emission and auroral kilometric radiation. These are general areas for possible common physics to exist in flares and substorms.

Several areas of possible common physics were discussed during the workshop. Emphases were placed not only on the commonality, but also on the difference between the solar flares and the magnetospheric substorms. A brief summary of possible areas of common physics is given below. (i) A well-recognized area of common physics between flares and substorms is the reconnection process. However, one needs to keep in mind the possible difference between collisionless reconnection in the magnetosphere and collisional reconnection in the solar corona. (ii) The existence of field-aligned potential drop along the auroral field lines have been well established during substorms. The possibility for field-aligned potential drop to exist in the coronal loop associated with solar flares is beginning to receive the attention of solar physicists. (iii) Dynamo process must be responsible for generating the electromagnetic energy consumed in solar flares and magnetospheric substorms. However, the dynamo process for flares is operating under very different conditions compared with the dynamo process for substorms. The dynamo region for flares is located in the partially ionized photosphere and the fully ionized plasma in the convection zone driven by thermal expansion and contraction, while the dynamo region for substorms is in the magnetotail driven by the solar wind. (iv) Similarity between the plasmoid in the magnetotail and the coronal mass ejection is another area of possible common physics. However, plasmoids are observed to occur after the onset of substorms, while coronal mass ejections are believed to occur before the onset of flares. (v) Radio emissions are produced in flares and substorms. The auroral kilometric radiation is produced by the auroral acceleration process in the field-aligned potential drop region along auroral field lines. None of the proposed mechanisms for radio emissions from the Sun depends directly on field-aligned potential drops. However, such drops may occur, and it is therefore possible that the mechanisms responsible for kilometric radio emission from the substorms could contribute to radio emission from flares. The above summary is a partial list of areas that should be of common interest to both solar physicists and space physicists. The uniqueness of flares and substorms should be emphasized before their commonality can be fully appreciated.

Each session was lively from the beginning. Each speaker was interrupted by questions—on the average perhaps more than 10-20 times—to explain jargon and clarify concepts for nonexperts. Given this process, there was no problem for specialists of the two groups in understanding each other.

The final session, chaired by Peter Stur-