

## Preface

The polar wind is an outflow of plasma along the open magnetic field lines of the Earth. It plays an important role in the coupling between the polar ionosphere and the magnetosphere. Since the proposal of its existence about 40 years ago, the polar wind has constantly been a topic of interest for theoreticians and experimentalists in space science research. Numerous models representing various theories have been developed to describe the polar outflow. Early theoretical studies focused on the classical polar wind, where the outflow was in steady state and the plasma was assumed to be cold, quasi-neutral and current free. More recent models examined various non-classical effects, such as those due to wave–particle interactions, warm plasmas, photoelectrons, hot magnetospheric particle populations, convection, and time dependence of the ionospheric conditions. Overall, a variety of modeling approaches and techniques have been used to consider the various physical effects. With regard to experimental research, the Dynamic Explorer (DE) satellites and the Akebono satellite have made important observations that have significantly updated our knowledge of the polar wind. Such novel experimental findings have also led researchers to develop new theories that may better explain the observations, further enhancing our understanding of the physics in the polar wind. More recently, the Polar spacecraft has extended the domain of observations for the polar outflow to an altitude of 8 times the Earth's radii, providing physical constraints for researchers to study the processes that couple the polar wind with other regions in the magnetosphere.

Although numerous studies on the polar outflow have been reported in the literature, there has never been a journal issue that concentrates primarily on the polar wind. Because of the lack of such a collection, it would be difficult for those who want to study the polar wind to catch up on its four decades of research history. In an effort to remedy

this situation for the general space science community, this special issue of the Journal of Atmospheric and Solar-Terrestrial Physics presents a collection of articles on the polar wind from international experts in this research area. The compilation features review articles that collectively document the various aspects of polar wind research throughout its history, as well as papers that report recent studies on the topic. We hope that publication of this special issue will enable the space science community to better understand the physics in the polar wind. We further hope that this special issue would encourage more investigators in space science to explore this research area, as the collection could serve as a springboard for young scientists, in particular, to begin studies of the polar wind.

We note that this special issue is dedicated to the International Space Science Institute (ISSI) in Bern, Switzerland for sponsoring and hosting the workshop, “Most Recent Advances in the New Polar Wind Theory and Observations,” on August 7–11, 2000. Through invitations, the ISSI gathered an “International Team” of experts on polar wind for the workshop, which provided a forum to freely discuss research work on the topic. The Team was led by Supriya Ganguli (whose last name is now Banerjee) and Tom Chang, and also included the following scientists: T. Abe, G.V. Khazanov, J. Lemaire, W.K. Peterson, R.W. Schunk, S.W.Y. Tam, and A.W. Yau. We are pleased to note that all the members of the “International Team” have contributed to this special dedication to ISSI by authoring or co-authoring at least one article in the collection.

We would like to thank Supriya Banerjee and Tom Chang for their involvement in organizing the ISSI workshop and for writing the Foreword of this special issue. The Foreword provides a short introduction to the polar wind, as well as a brief description of each article in this collection. We are indebted to the reviewers for their timely and

thoughtful responses that improved the quality of the submitted papers. Last but not least, we are grateful to Professors T. Killeen and W. Lotko for their support of the idea for this special issue as Editors-in-Chief of the Journal.

*Guest Editors*

Sunny W.Y. Tam

*Kavli Institute for Astrophysics and Space Research,  
Massachusetts Institute of Technology,  
Cambridge, MA 02139, USA  
Plasma and Space Science Center,  
National Cheng Kung University,  
Tainan 70101, Taiwan*

*E-mail addresses:* [wyt@space.mit.edu](mailto:wyt@space.mit.edu),  
[sunwytam@pssc.ncku.edu.tw](mailto:sunwytam@pssc.ncku.edu.tw)

Viviane Pierrard

*Belgian Institute for Space Aeronomy,  
Brussels, Belgium*

*E-mail address:* [viviane.pierrard@oma.be](mailto:viviane.pierrard@oma.be)

Robert W. Schunk

*Center for Atmospheric and Space Sciences,  
Utah State University,*

*Logan, UT 84322-4405, USA*

*E-mail address:* [schunk@cc.usu.edu](mailto:schunk@cc.usu.edu)