

INTRODUCTION

The Geospace Environment Modeling (GEM) program is a National Science Foundation initiative to coordinate and focus research on those questions that need solving to bring about a global model of the geospace environment, from the solar wind to the upper atmosphere. The GEM program was conceived as a series of distinct campaigns each aimed at addressing questions associated with a particular region or problem within the entire system. These campaigns would be staggered in time, but some would run concurrently until the stage was reached where a global model could begin to be assembled. The first campaign, which focuses on the cusp and boundary layers, began in 1991. At its meeting in December 1991, the GEM Steering Committee decided that planning should begin for the second campaign and proposed that it should focus on the physics of the geotail and substorms. It was decided to hold the first of two planning workshops that would define the goals and strategies of the campaign in the summer of 1992. This report describes the results of that first workshop.

The goal of the first workshop was to form a community consensus on what are the outstanding questions in the physics of the tail and substorms that stand in the way of the development of a global geospace circulation model, and which we can reasonably expect to solve on a 3-5 year time scale using a community-wide, coordinated, collaborative approach to solving these problems. A second workshop, to be held a year later, will address the methods of tackling these questions.

The first GEM Workshop on the Physics of the Tail and Substorms was organized by the GEM Steering Committee and held in Snowmass, Colorado on July 2-3, 1992, immediately following a three day workshop on the GEM Cusp and Boundary Layer Campaign. About 80 scientists gathered in Snowmass to attend the workshop. These scientists took part in the discussions and as a result helped formulate the contents of this report. Their names are listed as an appendix.

The Workshop opened with three plenary talks given by F. Coroniti, W. Baumjohann, and H. Opgenoorth. They were asked to provide personal answers to the overall question being raised by the workshop, with emphasis respectively on theory and models, observations in the tail, and observations made on or near Earth. The hope was that these opening sets of questions would help set the stage for and provoke subsequent discussion. This report opens with written versions of these three presentations. The Workshop then divided into three working groups to facilitate discussion among the participants. The three working groups focused on different topics. The Working Group on Tail Structure was co-chaired by Joachim Birn and Don Fairfield. The Working Group on Tail Dynamics was co-chaired by Richard Wolf and Howard Singer. The Working Group on Low Altitude Signatures of Tail Processes was co-chaired by John Samson and Robert Lysak. Each working group began by asking two speakers to focus on one particular question. Wolf and Singer chose as their working group's topic the physics of the substorm current wedge. One of their two speakers, Tony Lui, provided a written version of his remarks which are included here. This report ends with the three reports from the Working Groups, which form the conclusions of the Workshop and of this report. The styles of the reports differ considerably, but this report is probably all the stronger for that. All three working groups concluded that we are not short of questions to pose.

We hope this report is useful in helping guide the future directions of geotail and substorm physics towards what the community feels are the outstanding questions in this area. The report should be especially useful as an initial document for the second workshop whose goal will be to formulate effective strategies for addressing the questions outlined here. The second workshop will be held in Snowmass, on July 1-2, 1993.

Recently a GEM Geospace General Circulation Model (GGCM) working group was formed under the leadership of George Siscoe. This working group is beginning the process of putting together the component parts into a global model. This report will provide some input to this new working group. We look forward to much more productive interactions between the working groups at the next GEM Snowmass Workshop.