

# Visitor Research Report

**Visitor Name:** Dr. Igor Alexeev  
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**Area of Research:** Space Weather, in particular, Geomagnetic Storm Time Phenomena

**Period of Visit:** May 5, 2008 through June 6, 2008

**Goal:** The goal of the visit is to join the model efforts by MSU scientists to observations and data analysis efforts at Virginia Tech/ NIA. The topics are related to the polar cap electric potential saturation effect and to the time dynamics in the geomagnetic tail and magnetopause current after sudden impulses observed by the onground equatorial magnetic disturbances. Particularly useful in the analysis is the MLT-UT maps of the low latitude magnetic disturbance method to analyze the time profile of onground disturbances that has been developed at Virginia Tech.

**Strategy:** To realize these goals it was planned to take part in the Cross Polar Cap Potential (CPCP) saturation Meeting which was in Ann Arbor, Michigan on 22-23 May 2008. About 17 experts and 10 students will be attend this meeting to discuss free of the all existing data and models which described the cross polar cap potential drop saturation under sever solar wind and interplanetary magnetic field conditions. We plan to present a joint talk to this meeting and to discus our results with the experts. For more understanding of the possibility of MHD modeling code by Michigan University to study the transient phenomena the test run of the shock encounter of the magnetosphere have been realized. The interesting cases of the jump of the solar wind pressure must be determined and examples of the MLT-UT maps for a part of them must be created. All cases must be divided to 3 groups depending on the type of the time profile of the  $H_{sym}$  geomagnetic index. The tutorial for all members of the team by Elena Belenkaya will be planned. In this presentation the MSU team approach to the reconnection phenomena in the Earth magnetosphere for northward IMF must be made in a short and clear form.

**Accomplishments:** Two presentations have been in this meeting: one by the VTU team “Reverse convection potential saturation during northward IMF” by F.D. Wilder, C.R. Clauer and J.B.H. Baker, and the other one “Nonlinear polar cap potential drop dependence on the solar wind velocity” by C. Robert Clauer, Virginia Polytechnic Institute and State University and Igor I. Alexeev, Elena S. Belenkaya, Scobeltsyn Nuclear Physics Institute, Moscow State University. The model of the solar wind – magnetosphere interaction which have been created by the MSU team previously gives a possibility to explain the nonlinear dependence of the polar cap potential drop on the solar wind velocity. The same approach can explain the two times attenuation of the potential drop during northward IMF.

The cases of interest during the four years have been chosen (about 15 cases). For each case the solar wind monitor ACE data demonstrate the 2-3 minutes jump in the solar wind pressure from a quiet level around 2 nPa up to 4-15 nPa or, the other words, by two - seven times. In each cases the corresponding jump of H-component of the equatorial geomagnetic field have been observed in the H\_sym time profile. The time delay between the moment when IMF shock cross of the ACE position and H\_sym jump at the Earth orbit gave the possibility to estimate the shock front velocity. It changes from 361 km/s to 670 km/s in the chosen cases. It have been discovered that all cases can be separated by three different groups. For the first one the H-sym jump looks as a Haviside step function. The onground field increases on some constant value after the shock arrival and it is constant during one hour before the jump and one hour after the jump moment. Usually, the duration of the magnetic field increasing is about 5 minutes. The second type of the time profiles looks as a sawtooth function. After enhancement the onground magnetic field returns to a quiet level. The last third group demonstrated a mixed behaviors. After the H-component increasing it returns to the other constant level which does not coincide with the undisturbed level.

**Future Works:** In future we plan to continue to prepare for publication in AGU journal of two papers which describe received during the visit the results and to study the IMF dependence of the onground response on the solar wind jump.

**Pending Publications:**

1. Contribution of the magnetopause and tail current to the equatorial onground disturbances after SI. By C. R. Clauer, F. Wilder, Alexeev I.I., Belenkaya E.S., and Kozlovsky A.
2. Transition current system in the one or two polar caps. By Belenkaya E.S., C. R. Clauer, and Alexeev I. I.

**Seminar Presented:** Seminar NIA 04 June 2008. 11:00  
“MHD Simulation and Saturation of the Polar Cap Potential Drop. SSC at low-latitude magnetic observatories” by Igor I. Alekseev and Elena S. Belenkaya, Lomonosov Moscow State University, Scobeltsyn Institute of Nuclear Physics, Moscow, 119992, Russia (visiting scientists to Bob Clauer, VTU and NIA, Hampton, VA, USA)