

ISSI International Team

Dust - plasma interactions: Observations in the interplanetary medium and in the environment of solar system objects

Final Report

March 2009

Team Members

Ingrid Mann (team leader), Kindai University, Osaka, Japan
Nicole Meyer-Vernet, Observatoire de Paris, Meudon, France
Tadashi Mukai, Kobe University, Japan
Edmond Murad, retired from Air Force Research Laboratory, Newton, USA
Asta Pellinen-Wannberg, Umeå University and Swedish Institute of Space Physics, Kiruna, Sweden
Olga Popova, Institute for Dynamics of Geospheres Russian Academy of Science, Moscow, Russia
Markus Rapp*, Leibniz Institute of Atmospheric Physics, University of Rostock, Germany
Marlene Rosenberg, Dept. of Electrical & Computer Engineering, Univ. of California, San Diego, USA

Due to new functions in his home institution, Markus Rapp could not participate in team activities after spring 2007. Andrzej Czechowski (Polish Space Research Institute, Warsaw) participated in some of the later meetings and also in work for the final review. For some issues concerning cometary dust trail observations we contacted Masateru Ishiguru (Seoul National University). We contacted Sonoyo Mukai (Kindai University, Japan) as expert on atmospheric dust and she participated in work for the final review.

Meetings

We held our team meetings November 6 -10 2006, May 7 -11 2007 and May 13 -16 2008. We enjoyed the friendly and professional working atmosphere at ISSI and always received excellent support from the ISSI staff. Between the meetings we had meetings in subgroups at other places and communicated by e-mail. During the last meeting some members participated via Internet, since other obligations and travel constraints prevented them from travelling to Bern. We had an additional editorial meeting (November 24 - 28 2008) of four of the authors for the review paper at ISSI. During the meetings we also enjoyed discussions with other scientists visiting ISSI. On two occasions we had the opportunity to meet at ISSI with another group and to have a discussion on a subject of mutual interest:

Discussion of surface charging of Martian dust and atmospheric consequences together with working group 'Martian Planetary Boundary Layer: Dynamics and Interactions with the Surface and Free Atmosphere' (team leader A. Petrosyan). Presentation of the topic by Dr. Renno was followed by group discussion.

Discussion about meteor radar observations with the International Team on "Virtual Observatory for Meteoroids" (team leader R. Arlt) where Dr. Pellinen-Wannberg gave a presentations.

Results

The published results (and those submitted for publication) of the team provide a solid basis for future dedicated space research on dusty plasma topics. The two major topics that arose during the discussions within the team are concerned with the observation of high altitude meteors that reveal physical processes that differ from the common meteor phenomena and with the detections of nano dust particles that are accelerated in magnetic fields. Both results were unexpected and were possible because scientists with different backgrounds worked together in a collaboration initiated during discussions at ISSI.

Continued research projects resulting from the team activities

Pellinen-Wannberg, A., E. Murad and Rosenberg, M.: Dusty plasma effects in high altitude meteors.

Pellinen-Wannberg, A., Murad, E. Popowa, O., and other colleagues: The sputtering process during meteoroids entry.

Meyer-Vernet, N. and Mann, I.: Interactions of solar wind crossing cometary dust trails.

Mann, I., Meyer-Vernet, N., and 8 colleagues: Nano Dust in the Solar System: Formation, Interactions and Detection, proposal to ISSI for a International Team.

Publications

Rosenberg, M.: "On the possibility of a lower-hybrid instability driven by fast ions sputtered from a meteoroid" *Planet. Space Sci.* 56 (9) 1190-1193.

Meyer-Vernet, N. Lecacheux, A., Kaiser, M.L., Gurnett, D.A. 2009: Detecting nanoparticles at radiofrequencies: Jovian 1 dust stream impacts on Cassini/ RPWS, *Geophys. Res. Lett.* 36, L03103

Meyer-Vernet, N., Maksimovic, M., Czechowski, A. Mann, I. Zouganelis, I. Goetz, K. Kaiser, M.L. Bougeret, J.-L., and Bale, S.D. 2009: Dust detection by the wave instrument on Stereo: nanoparticles picked-up by the solar wind?, *Solar Physics*, submitted.

Mann, I. Pellinen-Wannberg, A., Murad, E. Popowa, O., Meyer-Vernet, N., Rosenberg, M., Mukai, T., Czechowski, A., and Mukai, S. 2009: Dust plasma interactions in near earth space and interplanetary medium, *Space Sci. Rev.*, submitted.

Mann, I. 2008: Nano dust in cosmic plasma environments, in: (T. Mendonza et al. Eds.) '*Multifacets of Dusty Plasmas*', Proceedings of the 5rd International Conference on the Physics of Dusty Plasmas, ICPDP5, Ponta Delgada, Portugal, 18-33 May 2004, AIP Conference Proceedings, Vol. 1041, (J.T. Mendonca, D.P. Resendes, and P.K. Shukla, eds.), 105-108.

Further publications in preparation

Mann, I., and Czechowski, A. 2009: Dynamics of solar system nano dust in the limit of guiding center approximation, *Astrophys. J.*, in preparation.

A. Pellinen-Wannberg, I. Häggström, E. Murad and M. Rosenberg: Dusty plasma signatures in meteor trails, in preparation.

Conference Presentations related to the team activities

A. Pellinen-Wannberg et al.: Dusty plasma conditions in meteor trails, Contributed oral presentation at the 13th International EISCAT Workshop, Mariehamn, Åland Islands, Finland, August 6-10, 2007

I. Mann: Nano dust in cosmic plasma environments, Invited talk, Conference on the Physics of Dusty Plasmas, ICPDP5, Ponta Delgada, Portugal, 18-23, May 2008.

A. Pellinen-Wannberg, I. Häggström, E. Murad and M. Rosenberg: Dusty plasma signatures in meteor trails, Poster, Conference on the Physics of Dusty Plasmas, ICPDP5, Ponta Delgada, Portugal, 18-23, May 2008.

I. Mann and M. Ishiguro: Optical Properties of Cometary Coma and Trail Particles, presentation at the 5th Annual General Meeting of the Asia Oceania Geosciences Society, Busan, South Korea, 18. June 2008.

N. Meyer-Vernet, M. Maksimovic, A. Czechowski, I. Mann, I. Zouganelis, K. Goetz, M.L. Kaiser, O.C. StCyr, J.-L. Bougeret, S.D. Bale: Voltage Pulses on STEREO/WAVES: Nanoparticles Picked-up by the Solar Wind? Poster, American Geophysical Union, Fall Meeting 2008, abstract #SH13B-1545.