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**Title: Magnetospheres of the Outer Planets (MOP) 2011 Meeting**

**Short title: Magnetospheres of the Outer Planets (MOP) 2011 Meeting**

**Summary of proposal:**

Boston University will host the next “Magnetospheres of the Outer Planets” meeting on the campus of Boston University on 11-15 July 2011. This is the latest in a continuing series of scientific conferences with the same title, called “MOP” for short, that occur every 2-3 years. The main purpose of the MOP meetings is to present data and original research about the space environments and upper atmospheres of the outer planets and their satellites. The topics covered at MOP are central to several NASA programs, including Outer Planets Research (OPR) and Cassini Data Analysis (CDAP) in the Planetary Science Division and Solar and Heliophysics Science in the Heliophysics Division. We request support for two categories of meeting-related expenses. First, components of the basic infrastructure required to run a meeting. Specifically, printing of the conference program given to all attendees and rental of poster boards for the week-long display of poster presentations. Second, support for student attendees at the meeting. Specifically, subsidized registration fees for many students and travel support for a smaller number of selected students.

**Relevant NASA programs and program officers**

Cassini Data Analysis Program (CDAP)	Max Bernstein	Planetary Science Division
Outer Planets Research Program (OPR)	Terry Hurford	Planetary Science Division
Europa Jupiter System Mission (EJSM)	Curt Niebur	Planetary Science Division
Solar and Heliophysics Science	Jeff Newmark	Heliophysics Division
	Arik Posner	

## MAGNETOSPHERES OF THE OUTER PLANETS (MOP) 2011 MEETING

### 1 – Scientific scope of the conference

Boston University will host the next “Magnetospheres of the Outer Planets” meeting on the campus of Boston University on 11-15 July 2011. This is the latest in a continuing series of scientific conferences with the same title, called “MOP” for short, that occur every 2-3 years. This conference was initially planned for Sendai, Japan. After the earthquake and tsunami, the Tohoku University organizing committee agreed to postpone a meeting in Sendai until a future date. The Scientific Organizing Committee has agreed to hold the 2011 meeting on the original dates in Boston, Massachusetts, USA.

The MOP meetings are the preeminent venue for exchanging scientific results about the space environments of the planets and satellites from Jupiter on out to the Kuiper Belt. Results from NASA missions such as Voyager, Galileo, Cassini, Hubble Space Telescope, Chandra X-ray Observatory, ground-based observations, and theoretical modeling are consistently presented at MOP with a depth of detail and opportunity for open discussion that is unparalleled by any other meeting about this topic.

The main purpose of the MOP meetings is to present data and original research about the space environments and upper atmospheres of the outer planets and their satellites. The topics covered at MOP are central to several NASA programs, including Outer Planets Research (OPR) and Cassini Data Analysis (CDAP) in the Planetary Science Division and Solar and Heliophysics Science in the Heliophysics Division. These topics are also integral to several upcoming NASA spacecraft missions, especially Juno (to be launched in August 2011), and also Jupiter Europa Orbiter, Saturn Probe, and Io Observer (all highlighted in the recent Planetary Science Decadal Survey).

Topics presented at MOP meetings typically include:

- auroral processes
- magnetospheric dynamics
- inner magnetosphere/radiation belts
- magnetosphere-ionosphere-atmosphere coupling
- solar wind interaction
- interactions of rings and moons with magnetospheres
- sources of magnetospheric plasmas
- magnetosphere and internal field modeling
- upper atmospheres and exospheres
- plasma micro-physics
- atomic data laboratory studies
- comparative magnetospheres

Abstracts from the previous MOP meeting (2009, Cologne, Germany) can be seen at <http://lasp.colorado.edu/mop/conference/>

Themes expected to be widely discussed at this MOP meeting include the influence of the Galilean satellites on the magnetosphere of Jupiter, the launch of Juno this summer, and many

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spurred by recent Cassini results, such as the rotation rate of Saturn and the role of Enceladus' water plumes in the Saturnian system.

The MOP meeting's size of 100-150 attendees enables a very collegial and supportive format for students. The large format of AGU and DPS meetings makes graduate and undergraduate student interactions with top experts especially difficult, and often intimidating. Furthermore, the longer format for talks at MOP allows better introductory background to the various sub-topics covered.

### 2 – Current status of planning and preparatory work for the conference

The meeting has been advertised to the relevant scientific communities via, e.g., the PEN, OPAG, DPS, and AGU Space Physics and Aeronomy email lists. A meeting website at <http://www.bu.edu/csp/mop2011/> has been established.

The Scientific Organizing Committee (SOC) is chaired by Fran Bagenal, University of Colorado. Its membership is:

Anil Bhardwaj (VSSC)	Tasuki Ogino (Nagoya Univ.)
Masaki Fujimoto (JAXA)	Chris Paranicas (JHU/APL)
Tamas Gombosi (Univ. Michigan)	Joachim Saur (Univ. Koeln)
Denis Grodent (Univ. Liege)	Patricia Schippers (Univ. Iowa)
Caitriona Jackman (UCL)	Thomas Stallard (Univ. Leicester)
Yasumasa Kasaba (Tohoku Univ.)	Jan-Erik Wahlund (IRFU)
Norbert Krupp (MPS, Katlenburg-Lindau)	J. Waite, Jr. (SwRI)
Krishan Khurana (UCLA)	Philippe Zarka (Obs. Paris)
Atsushi Nishida (GUAS)	

The SOC's membership spans a broad range of scientific disciplines, institutions within the US, and nations around the world. The SOC will set the agenda for the meeting. Much of the SOC's work has been unaffected by the change in meeting location from Sendai to Boston. Abstract submission opened in May 2011 using the Japanese website developed for the Sendai meeting. Abstract submission will close on 27 May and the preliminary program should be issued on 10 June. Six invited tutorial talks have been scheduled (Margy Kivelson, magnetospheric structure and dynamics; Laurent Lamy, Saturn's rotation; Jean-Claude Gerard, global features of aurora; Sebastien Hess, microprocesses of aurora; Marina Galand, atmosphere-ionosphere-magnetosphere coupling; Peter Delamere, satellite-magnetosphere interactions). An additional fourteen talks on specific topics have also been solicited.

The Local Organizing Committee (LOC) is chaired by John Clarke, Boston University. Its membership is:

Christine Benoit (Boston University)	Michael Mendillo (Boston University)
David Bradford (Boston University)	Luke Moore (Boston University)
Nicole Cahill (Boston University)	Kurt Retherford (SwRI)
Supriya Chakrabarti (Boston University)	Paul Withers (Boston University)

## MAGNETOSPHERES OF THE OUTER PLANETS (MOP) 2011 MEETING

The LOC will plan the meeting logistics. Meeting facilities on campus have been arranged. A block of nearby hotel rooms has been contracted. Various social events associated with the meeting have been planned.

### 3 – Relevance to NASA

If this proposal is funded, we anticipate that NASA will be a **primary sponsor of the conference**.

The MOP 2011 meeting will **encourage and facilitate the use of mission data**. Presentations will be based upon the use of data from the Voyager, Galileo, Cassini, and New Horizons spacecraft. Scientists who are not experienced at using these datasets will be able to interact with other scientists who are actively exploring these datasets, including many scientists who played major roles in acquiring and processing these datasets.

The MOP 2011 meeting will also **increase the efficiency of investigators through the open exchange of ideas**. This will be accomplished in multiple ways.

- Six tutorial talks on key topics at the heart of many research questions concerning the magnetospheres of the outer planets. These will also **expose investigators to new subject areas** and help ease their transitions into them.
- Significant amounts of time scheduled for activities designed to facilitate interaction between scientists, especially those who are not currently colleagues. These events include an opening reception, a Wednesday afternoon excursion into the cultural and historical heart of Boston, and a meeting dinner on Thursday evening.
- Contributed oral presentations whose durations exceed the short times available at DPS and AGU meetings, which enable greater depth in the presentation and more generous time for post-talk discussion.
- Dedicated times for poster sessions so that they are not competing for attention with other meeting activities.
- No parallel sessions. All attendees at the meeting will be able to see all of the scientific presentations at the meeting. Thus the number of common presentations seen by any random pair of scientists will greatly exceed the number seen at larger meetings like DPS and AGU.

By virtue of its subject matter, the MOP 2011 meeting is most highly relevant to the Outer Planets Research (OPR) Program and Cassini Data Analysis Program (CDAP) in the Planetary Science Division and Solar and Heliophysics Science Program in the Heliophysics Division.

The objective of CDAP, as stated in ROSES, is:

*To enhance the scientific return of the Cassini mission by broadening the scientific participation in the analysis and interpretation of the data returned by the mission.*

Pertinent goals of the Cassini mission ([saturn.jpl.nasa.gov](http://saturn.jpl.nasa.gov)) include:

*Observe Saturn's magnetosphere over a solar cycle*  
*Determine the dynamics of Saturn's magnetotail*  
*Conduct in situ studies of Saturn's ionosphere*  
*Investigate magnetospheric periodicities*

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Two objectives of OPR, as stated in ROSES, are:

*Enhancing the scientific return from the New Horizons, Cassini, Galileo, Voyager, and Pioneer missions by continuing the analysis of their respective data sets through broadened scientific participation.*

*Improving our understanding of the evolution of the outer solar system, including the giant planets, their satellites, and other small bodies.*

As stated in ROSES, the Heliophysics Research Program *supports investigations of the physics of magnetospheres, including their formation and fundamental interactions with plasmas, fields, and particles.*

The MOP 2011 meeting is directly connected to several research objectives in the 2006 NASA Science Plan.

*Heliophysics - Understand the fundamental physical processes of the space environment from the Sun to Earth, to other planets, and beyond to the interstellar medium.*

Attendees will investigate how the basic principles of the conservation of matter, momentum, energy and charge function in the space environment around magnetized planets. This environment is populated with rings and satellites that act as sources and sinks for material.

*Planetary Science - Inventory solar system objects and identify the processes active in and among them.*

Attendees will explore the range of behaviors that are found in plasma environments around magnetized planets.

*Planetary Science - Understand the processes that determine the history and future of habitability of environments on Mars and other solar system bodies.*

Attendees will discuss how planetary magnetospheres serve as shields against the solar wind, which can erode planetary atmospheres over solar system history.

NASA has regularly sponsored the MOP meeting when it has been held in the United States in the past (Table 1).

**Table 1. Recent MOP Meetings**

<b>Year</b>	<b>Location</b>	<b>Sponsors</b>
<b>2009</b>	Cologne, Germany	Europlanet
<b>2007</b>	San Antonio, Texas	SwRI
<b>2005</b>	Leicester, United Kingdom	University of Leicester; registration fund assistance from the Royal Astronomical Society and NASA/JPL
<b>2002</b>	Laurel, Maryland	NASA, JHU Applied Physics Lab.
<b>1999</b>	Paris, France	ESA, CNES, DESPA, Obs. de Paris, etc.
<b>1997</b>	Boulder, Colorado	NASA, JPL, University of Colorado
<b>1994</b>	Graz, Austria	Austrian Space Agency, Austrian Academy of Sciences
<b>1992</b>	Los Angeles, California	NASA, UCLA, JPL
<b>1990</b>	Annapolis, Maryland	NASA, GSFC

## MAGNETOSPHERES OF THE OUTER PLANETS (MOP) 2011 MEETING

### 4 – Management and budget

We request support for two categories of meeting-related expenses. First, components of the basic infrastructure required to run a meeting. Specifically, printing of the conference program given to all attendees and rental of poster boards for the week-long display of poster presentations. Second, support for student attendees at the meeting. Specifically, subsidized registration fees for many students and travel support for a smaller number of selected students.

Our estimate for the cost of renting 30 double-sided large poster boards for the week-long duration of the meeting is \$3K. Our estimate for the cost of printing 150 black and white copies of the program, each containing 50 double-sided sheets of paper, is \$3K.

The full registration fee is \$400 and the student registration fee is \$200, meaning that each student attendee will benefit from a \$200 reduction in their registration fee. We anticipate twenty student attendees at the meeting, giving a total registration fee subsidy of \$4K.

Based on reasonable estimates for the costs of travel, accommodation, and meals, we anticipate that a single student's travel expenses will exceed \$1000. We request funds to provide five student attendees with a \$1000 travel award, giving a total of \$5K. Students whose travel expenses are less than \$1000 will receive no more than their actual expenses.

PI Withers will solicit from each registered student a one page description of the importance to their career of attendance at the MOP meeting and their need for travel support. Withers and the LOC will then select students for travel awards based upon the merit of their scientific abstract, the value to their professional development of attendance at this meeting, and their stated need.

NASA funds will be devoted to students at US institutions. Additional funds, if available from other sources, will be used to support some students at non-US institutions.

**The total amount of direct costs we request is \$15K.**

## Biographical Sketch for PI Paul Withers

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 Boston University  
 725 Commonwealth Avenue  
 Boston MA 02215

Tel: (617) 353 1531  
 Fax: (617) 353 6463  
 Email: withers@bu.edu  
 Citizenship: British (Green Card holder)

### Education

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- PhD, Planetary Science, University of Arizona 2003
- MS, Physics, Cambridge University, Great Britain 1998
- BA, Physics, Cambridge University, Great Britain 1998

### Professional Experience

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- Assistant Professor, Astronomy Department (Boston Univ.) 2010-present
- Senior research associate Dr. Michael Mendillo (Boston Univ.) 2007 – 2010  
 Research associate Dr. Michael Mendillo (Boston Univ.) 2003 – 2007  
 Analysis of ionospheric data from Venus, Mars and Earth, plus numerical modeling
- Graduate research assistant Dr. Stephen Bougher (Univ. of Arizona) 1998 – 2003  
 Studied tides in the martian upper atmosphere. Played an advisory role in mission operations for Mars Global Surveyor and Mars Odyssey aerobraking

### Selected Fellowships, Honors, and Awards

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- NASA Early Career Fellowship 2009
- CEDAR Postdoctoral Fellowship from NSF for upper atmospheric research 2003
- Kuiper Memorial Award from the University of Arizona for excellence 2002  
 in academic work and research in planetary science
- Nominated for the Meteoritical Society/Geological Society of America's 2002  
 Best Student Paper in Planetary Sciences Award

### Membership of Committees and Working Groups

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- DPS Nominating Committee 2008-present
- Mars Exploration Program Analysis Group (MEPAG) Goals Committee 2008-present  
 member
- Mars Exploration Program Analysis Group (MEPAG) Mars Human 2004-2005  
 Precursor Science Steering Group - Atmospheric Focus Team member



**Selected Peer Reviewed Publications**

- **Withers** and Catling (2010) Observations of atmospheric tides at the season and latitude of the Phoenix atmospheric entry, *Geophysical Research Letters*, 37, L24204, doi:10.1029/2010GL045382
- **Withers** (2010) Trajectory and atmospheric structure from entry probes: Demonstration of a real-time reconstruction technique using a simple direct-to-Earth radio link, *Planetary and Space Science*, 58, 2044-2049
- Hathi, Ball, Colombatti, Ferri, Leese, Towner, **Withers**, Fulchignoni and Zarnecki (2009) Huygens HASI servo accelerometer: A review and lessons learned, *Planetary and Space Science*, 57, 1321-1333
- Colombatti, **Withers**, Ferri, Aboudan, Ball, Bettanini, Gaborit, Harri, Hathi, Leese, Makinen, Stoppato, Towner, Zarnecki, Angrilli, and Fulchignoni (2008) Reconstruction of the trajectory of the Huygens probe using the Huygens Atmospheric Structure Instrument (HASI), *Planetary and Space Science*, 56, 586-600
- **Withers** (2007) A technique to determine the mean molecular mass of a planetary atmosphere using pressure and temperature measurements made by an entry probe: Demonstration using Huygens data, *Planetary and Space Science*, 55, 1959-1963
- Montabone, Lewis, Read, and **Withers** (2006) Reconstructing the weather on Mars at the time of the MERs and Beagle 2 landings, *Geophysical Research Letters*, 33, L19202, doi:10.1029/2006GL026565
- **Withers** and Smith (2006) Atmospheric entry profiles from the Mars Exploration Rovers Spirit and Opportunity, *Icarus*, 185, 133-142, doi:10.1016/j.icarus.2006.06.013
- Mendillo, **Withers**, Hinson, Rishbeth, and Reinisch (2006) Effects of solar flares on the ionosphere of Mars, *Science*, 311, 1135-1138
- Bougher, Bell, Murphy, Lopez-Valverde, and **Withers** (2006) Polar warming in the Mars thermosphere: Seasonal variations owing to changing insolation and dust distributions, *Geophysical Research Letters*, 33, L02203, doi:10.1029/2005GL024059
- **Withers** (2006) Mars Global Surveyor and Mars Odyssey Accelerometer observations of the martian upper atmosphere during aerobraking, *Geophysical Research Letters*, 33, L02201, doi:10.1029/2005GL024447
- Fulchignoni and 42 colleagues, including **Withers** (2005) In situ measurements of the physical characteristics of Titan's environment, *Nature*, 438, 785-791, doi:10.1038/nature04314
- **Withers**, Bougher, and Keating (2003) The effects of topographically-controlled thermal tides in the martian upper atmosphere as seen by the MGS Accelerometer, *Icarus*, 164, 14-32
- **Withers**, Towner, Hathi, and Zarnecki (2003) Analysis of entry accelerometer data: A case study of Mars Pathfinder, *Planetary and Space Science*, 51, 541-561
- **Withers**, Lorenz, and Neumann (2002) Comparison of Viking Lander descent data and MOLA topography reveals kilometer-scale error in Mars atmosphere profiles, *Icarus*, 159, 259-261
- **Withers** and Neumann (2001) Enigmatic northern plains of Mars, *Nature*, 410, 651
- Lorenz, Lunine, **Withers**, and McKay (2001) Titan, Mars and Earth: Entropy production by latitudinal heat transport, *Geophysical Research Letters*, 28, 415 – 418

## **Biographical Sketch for Co-I John Clarke**

**Present Position:** Professor  
Dept. of Astronomy and Center for Space Physics  
Boston University  
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(617)-353-0247 email: jclarke@bu.edu

**Education:** Ph.D (Physics) the Johns Hopkins University 1980  
M.A. (Physics) the Johns Hopkins University 1978  
B.S. (Physics) Denison University 1974

**Previous Positions:** 1987 - 2001: Research Scientist, University of Michigan  
1985-1987: Advanced Instruments Scientist, Hubble Space Telescope Project, NASA Goddard Space Flight Center  
1984-1985: Associate Project Scientist, Hubble Space Telescope Project, NASA Marshall Space Flight Center  
1980-1984: Assistant Research Physicist, Space Sciences Laboratory, University of California, Berkeley

### **Selected Refereed Publications:**

1. "Identification of the UV Nightglow from Venus", P.D. Feldman, H.W. Moos, J.T. Clarke, and A.L. Lane, *Nature*, 279, 221 (1979).
2. "Detection of Auroral H Ly  $\alpha$  Emission from Uranus", J.T. Clarke, *Astrophys. J. Lett.*, 263, L105 (1982).
3. "A Search for the Deuterium Lyman-alpha Emission from the Atmosphere of Mars", J.-L. Bertaux, J.T. Clarke, M. Mumma, T. Owen, and E. Quemerais, *Science with the Hubble Space Telescope*, ESO Proc. No. 44, 459 (1993).
4. "Ultraviolet Remote Sensing Techniques for Planetary Aeronomy", J.T. Clarke and L. Paxton, chapter in "Atmospheres in the Solar System: Comparative Aeronomy", AGU Monograph 130, p. 339 (2002).