

# James H. Roberts

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## **EDUCATION**

*University of Colorado at Boulder*, Boulder, CO 2001-2006

Ph.D. in Astrophysical, Planetary, and Atmospheric Sciences, May 2006

Dissertation: "Large-scale Structures on Mars"

Advisor: Shijie Zhong

M.S. in Astrophysical, Planetary, and Atmospheric Sciences, December 2003

*Virginia Polytechnic Institute and State University*, Blacksburg, VA 1996-2001

B.S. *magna cum laude* in Geological Sciences, Geophysics option, May 2001

B.S. *magna cum laude* in Physics, Astronomy concentration, May 2001

Minor in English, Minor in Mathematics

## **TEACHING EXPERIENCE**

*Lecturer*: Planetary Science, University of California, Santa Cruz, 2008

- Taught an upper-division calculus and physics-based undergraduate course in planetary science for 12 science majors, 70 minutes a day, 3 days a week
- Developed lesson plan, homework assignments, term projects and exams for the course. Grading all assignments.
- Moderated weekly student-led class discussions of relevant, high-profile journal articles.

*Lead Graduate Teacher*: Department of Astrophysical and Planetary Sciences, University of Colorado, 2004-2006

- Supported teacher training for graduate students.
- Conducted departmental orientation for incoming graduate
- Videotaped graduate instructors and teaching assistants in the classroom and consulted with them
- Facilitated several departmental workshops on teaching and technology
- Presented departmental workshop on teaching as Instructor of Record
- Presented university-wide workshop for the Graduate Teacher Program on teaching science labs
- Served as liaison between the Graduate Teacher Program and my department

*Graduate Part-time Instructor*: General Astronomy: The Solar System, University of Colorado, 2005

- Taught a 3-credit introductory course in astronomy for 48 non-majors over a 5-week period in the summer, 95 minutes a day, 5 days a week.
- Developed lesson plan, homework assignments, exam, and observational project for the course. Graded all assignments with assistance from a teaching assistant.
- Used H-ITT infrared transmitter system for graded in-class survey questions.
- Conducted several classes in Fiske planetarium.
- Conducted several nighttime observation sessions.
- Held office hours

*Teaching Assistant*: University of Colorado, 2001-2004

Provided lecture assistance; ran lab section; delivered occasional lecture; conducted nighttime observation sessions; held office hours; ran homework review sessions; supervised weekly lab

experiments; graded homework assignments, observing projects, and exams.

- Accelerated Introductory Astronomy 1 (Laboratory), 2004
- Ancient Astronomies (Lecture), 2002
- Introductory Astronomy 2 (Lecture), University, 2001

*Graduate Teacher Program:* University of Colorado, 2001-2006

- Participated in university-wide program to improve quality of teaching by graduate students.
- Participated in 80 general and departmental teaching workshops general pedagogy, personal and professional development, multicultural and gender issues in teaching and course design, academic policies, assessment and evaluation, and technology and teaching.
- Completed two consultations with Graduate Teacher Program staff based on videotaped performance while teaching.
- Had teaching observed and evaluated for proficiency by planetary science faculty.
- Created teaching portfolio

### **RESEARCH EXPERIENCE**

*Postdoctoral Scholar:* Department of Earth and Planetary Science, University of California, Santa Cruz, 2006 – Present (research advisor: Prof. Francis Nimmo)

*Graduate Research Assistant:* Department of Physics, University of Colorado, 2001 – 2006 (research advisor: Prof. Shijie Zhong)

*Undergraduate Research Assistant:* Department of Physics, Virginia Tech, 2000-2001

*Undergraduate Research Assistant:* National Solar Observatory, 2000.

*Undergraduate Research Assistant,* Department of Geological Sciences, Virginia Tech, 1998-2000

### **RESEARCH INTERESTS**

My goal is to understand why the various planets and moons of the solar system look the way they do now, what they were like early in their history, and how they evolved to their present state. I approach these questions this by modeling large-scale geodynamics of terrestrial planets and icy satellites. I am primarily concerned with:

- Sources of heat in planetary interiors, tidal dissipation, radioactive decay.
- Solid-state convection and the removal of heat from planetary interiors.
- Surface features and mass anomalies generated by geodynamic processes, and their effect on planetary reorientation.
- The relationship between the thermal and orbital evolution of planets and moons.

The models are developed with the goal of explaining specific surface observations of targeted planetary bodies (e.g. Mars or Enceladus), but with appropriate parameters can be applied to planetary bodies in general.

### **RESEARCH ACCOMPLISHMENTS**

- Determined the support of the Tharsis rise on Mars using convection and hybrid loading models for planetary bodies with elastic lithospheres.
- Determined the conditions under which degree-1 convection may develop in the Martian mantle, and related the convective pattern to the origin of the Martian crustal dichotomy and Tharsis.
- Explained the orientation of the hemispheric dichotomy on Mars as a result of true polar wander driven by crustal thickness variations.
- Developed a model of spatially-varying tidal dissipation in planetary interiors. Used this in conjunction with convection modeling to assess the long-term viability of a subsurface ocean on

Enceladus.

- Examined the effect of regional near-surface heating on underlying convection, melt generation and subsidence, with application to the south polar thermal anomaly on Enceladus.

### **AWARDS**

“Best Should Teach” Silver Award, Graduate Teacher Program, University of Colorado, 2004, 2005

Frank L. Robeson Physics Scholarship, Dept. of Physics, Virginia Tech, 2001

Phi Beta Kappa, Virginia Tech, 2001

Sigma Pi Sigma, Society of Physics Students, Virginia Tech, 2000

Matthew Mikulich Geophysics Scholarship, Department of Geological Sciences, Virginia Tech, 2000

Texaco Geophysics Scholarship, Dept. of Geological Sciences, Virginia Tech, 1999

Marshall Hahn Engineering Scholarship, College of Engineering, Virginia Tech, 1996

### **PROFESSIONAL SOCIETY MEMBERSHIPS**

American Geophysical Union, 2001-present

### **PROFESSIONAL SERVICE**

*Science Definition Team*, New Frontiers Enceladus mission, NASA Goddard Space Flight Center, 2007-present

*Reviewer: Earth and Planetary Science Letters, Geophysical Research Letters, Icarus, Journal of Geophysical Research*, 2006-present

*External Reviewer: NASA ROSES Solicitation, Mars Data Analysis Program*, 2007.

*Open House Volunteer: Sommers-Bausch Observatory*, University of Colorado, 2001-2006

*Laboratory committee: Department of Astrophysical and Planetary Sciences*, University of Colorado, 2005-2006

*Exams committee: Department of Astrophysical and Planetary Sciences*, University of Colorado, 2003-2004

*Library and A/V committee: Department of Astrophysical and Planetary Sciences*, University of Colorado, 2001-2003

*Society of Physics Students*, Virginia Tech, 1997-2001 (Treasurer 2000-2001)

*Sigma Pi Sigma*, Virginia Tech, 2000-2001 (Vice-president 2000-2001)

*Astronomy Club*, Virginia Tech, 1996-2001 (Treasurer, 1997-1998, Vice-president, 1998-2001)

### **CERTIFICATIONS**

*Graduate Certificate in Geophysics*, University of Colorado, 2006

*Graduate Teacher Certification*, University of Colorado, 2006

### **INVITED TALKS**

- “Tidal heating of Enceladus: Stability of a subsurface ocean?” European Geosciences Union General Assembly, Vienna, Austria, 14 April, 2008
- "Heating of Enceladus: Is there a subsurface ocean?" Center for Integrative Planetary Science, UC Berkeley, Berkeley, CA, 24 October 2007
- “The Origin and Orientation of the Martian Hemispheric Dichotomy”, Institute of Geophysics and Planetary Physics, UC Santa Cruz, Santa Cruz, CA, 02 February 2007.

**PUBLICATIONS**

- Roberts, J.H. and F. Nimmo (2008), [Near-surface heating on Enceladus and the south polar thermal anomaly](#), *Geophys. Res. Lett.* **35**, L09201, doi:10.1029/2008GL033725.
- Roberts, J.H. and F. Nimmo (2008), [Tidal heating and the long-term stability of a subsurface ocean on Enceladus](#), *Icarus* **194**, 675-289, doi:10.1016/j.icarus.2007.11.010.
- Zhong, S., N. Zhang, Z.X. Li, and J.H. Roberts (2007), [Supercontinent cycles, true polar wander, and very long-wavelength mantle convection](#), *Earth Planet. Sci. Lett.*, **261**, 551-564.
- Roberts, J.H. and S. Zhong (2007), [The cause for the north-south orientation of the crustal dichotomy and the near-equatorial location of Tharsis on Mars](#), *Icarus*, **190**, 24-31, doi:10.1016/j.icarus.2007.03.002.
- Roberts, J.H. and S. Zhong (2006), [Degree-1 convection in the Martian mantle and the origin of the hemispheric dichotomy](#), *J. Geophys. Res.*, **111**, E06013, doi:10.1029/2005JE002668.
- Roberts, J. H. and S. Zhong (2004), [Plume-induced topography and geoid anomalies and their implications for the Tharsis rise](#), *J. Geophys. Res.*, **109**, E03009, doi:10.1029/2003JE002226.
- Zhong, S. and J. H. Roberts (2003), [On the support of the Tharsis rise on Mars](#), *Earth Planet. Sci. Lett.* **214**, 1-9.

**CONFERENCE PROCEEDINGS**

- Roberts, J. H. and F. Nimmo (2008), [Near-surface heating on Enceladus and the south polar thermal anomaly](#), *Lunar Planet. Sci. Conf. XXXIX*, 1481.
- Roberts, J. H., R. J. Lillis, M. Manga, and H. V. Frey (2008), [Impact-related heating and the cessation of the Martian dynamo: Early Results](#), *Lunar Planet. Sci. Conf. XXXIX*, 1358.
- Roberts, J. H. and F. Nimmo (2007), The effect of near-surface heating on the underlying convection pattern with application to Enceladus, *Eos Trans. AGU*, **88** (52), Fall Meet. Suppl. Abstract P31B-0539.
- Roberts, J. H. and F. Nimmo (2007), [Long-term stability of a Subsurface Ocean on Enceladus](#), *Workshop on Ices Oceans and Fire: Satellites of the Outer Solar System*, 1357.
- Roberts, J. H. and F. Nimmo (2007), [Stability of a Subsurface Ocean on Enceladus](#), *Lunar Planet. Sci. Conf. XXXVIII*, 1429.
- Roberts, J. H. and S. Zhong (2006), The cause for the north-south orientation of the crustal dichotomy and the equatorial location of Tharsis on Mars, *Eos Trans. AGU*, **87** (52), Fall Meet. Suppl. Abstract P31C-0155.
- Roberts, J. H. and S. Zhong (2006), [Degree-1 Mantle Convection and the Origin of the Martian Hemispheric Dichotomy](#), *Lunar Planet. Sci. Conf. XXXVII*, 1447.
- Roberts, J. H. and S. Zhong (2006), [Polar Wander of Mars Driven by Degree-1 Mantle Convection and its Implications for the Formation of the Crustal Dichotomy and the Tharsis Rise](#), *Lunar Planet. Sci. Conf. XXXVII*, 1206.
- Roberts, J. H. and S. Zhong (2005), [Degree-1 Mantle Convection and the Origin of the Martian Hemispheric Dichotomy](#), *Lunar Planet. Sci. Conf. XXXVI*, 1399.
- Roberts, J. H. and S. Zhong (2005), [Crustal Relaxation and Its Implications for the Martian Crustal Dichotomy](#), *Lunar Planet. Sci. Conf. XXXVI*, 2170.
- Roberts, J. H. and S. Zhong (2004), [Degree-1 Mantle Convection as a Process for Generating the Martian Hemispheric Dichotomy](#), *Workshop on Hemispheres Apart: The Origin and Modification of the Martian Crustal Dichotomy*, 4028.
- Roberts, J. H. and S. Zhong (2004), [Plume-Induced Topography and Geoid Anomalies and Their Implications for the Tharsis Rise on Mars](#), *Lunar Planet. Sci. Conf. XXXV*, 1125.
- Roberts, J. H., E. R. Craine, and M. S. Giampapa (2001), [Photometric Monitoring of M67 with the GNAT 0.5-m Telescope](#), *AAS 197*, 40.04.