

# SABINE STANLEY

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## **EDUCATION:**

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- Ph.D. in Geophysics, Harvard University [2004]
- M.A. in Geophysics, Harvard University [2003]
- B.Sc. Honors in Astronomy & Physics. University of Toronto [1999]

## **PROFESSIONAL EXPERIENCE:**

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- Associate Professor (Tenured), Department of Physics, University of Toronto [2010-now]
- Assistant Professor, Department of Physics, University of Toronto [2005-2010]
- Postdoctoral Researcher, Department of Earth, Atmospheric & Planetary Sciences, Massachusetts Institute of Technology [2004-2005]
- Graduate Research Assistant, Department of Earth & Planetary Sciences, Harvard University [1999-2004]
- Teaching Fellow, Division of Engineering & Applied Sciences, Harvard University [1999-2004]
- Research Assistant, Department of Earth and Planetary Sciences, Harvard University [summer 1998]

## **AWARDS AND HONORS:**

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- Sloan Research Fellow [2011-2013]
- William Gilbert Award, American Geophysical Union, Geomagnetism and Paleomagnetism section [2010]
- Ranjini Ghosh Excellence in Teaching Award, University of Toronto [2010]
- Early Researcher Award, Ministry of Research and Innovation, Province of Ontario [2009]
- Graduate Teaching Award, University of Toronto [2007]
- 3 Outstanding Student Paper Awards, American Geophysical Union [2002, 2003, 2004]
- NSERC Doctoral Graduate Scholarship [2002-2004]
- 7 Certificate of Distinction in Teaching Awards, Harvard University [2000-2003]
- 2 Teaching Fellow Awards, Harvard University [2000, 2002]
- NSERC Masters Graduate Scholarship [2000-2002]

## **RESEARCH INTERESTS:**

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- planetary magnetic fields, planetary interiors and evolution, dynamo theory, early solar system magnetism, planetary cores, planetary crustal magnetic fields, planetary fluid dynamics, extrasolar planets, numerical simulations of convection and dynamo action, magnetohydrodynamics, core-mantle interactions

## **PRESENTATIONS:**

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### INVITED CONFERENCE PRESENTATIONS:

- Stanley, S., “Numerical modelling of planetary dynamos”, *American Physical Society, Division of Plasma Physics Meeting*, 2011.
- Stanley, S., “Numerical modelling of planetary dynamos”, *European Planetary Science Congress – Division of Planetary Sciences (EPSC-DPS) Joint Meeting*, 2011.
- Stanley, S., Vilim, R., Weiss, B.P., Elkins-Tanton, L.T., “Dynamo generation in asteroids and planetesimals”, *American Geophysical Union (AGU) Fall Meeting*, 2010.
- Stanley, S., Zuber, M.T., Elkins-Tanton, L.T., Parmentier, E.M., “The dynamo’s sensitivity to core-mantle thermal interactions: Investigations of Mars and Earth”, *AGU Fall Meeting*, 2009.
- Stanley, S., “A dynamo model for axisymmetrizing Saturn’s internal magnetic field using thermal winds in stably stratified layers”, *AGU Fall Meeting*, 2009.
- Stanley, S., “Planetary Dynamos”, *Canadian Institute for Theoretical Astrophysics (CITA) Workshop on Stellar Magnetism*, 2009.
- Stanley, S., Elkins-Tanton, L., Zuber, M., Parmentier, E.M., “Creating abnormal dynamo models to explain the abnormal magnetic fields of Mars and Mercury”, *Joint Assembly of the AGU and Canadian Geophysical Union (CGU)*, 2009.
- Stanley, S., Elkins-Tanton, L., Zuber, M.T., and Parmentier, E.M., “Mars’ Paleomagnetic Field as the Result of a Single-Hemisphere Dynamo”, *European Geophysical Union (EGU) Spring Meeting*, 2009.
- Stanley, S., “Dynamo models of Mercury, Uranus and Neptune: The Weird Ones”, *International Space Science Institute Workshop on Planetary Magnetism*, 2008.
- Stanley, S., “Dynamoes of the Ice Giants”, *Ecoles de Physique Summer School on Dynamoes*, 2007.
- Stanley, S., Zuber, M.T. and Bloxham, J., “Determining core properties from a planet’s magnetic field morphology”, *AGU Fall Meeting*, 2005.
- Stanley, S., “What can planetary magnetic fields tell us about their interiors?”, *Gordon Research Conference: Interior of the Earth*, 2005.
- Stanley, S. and Bloxham, J. “Convective region geometry as the cause of Uranus’ and Neptune’s unusual magnetic fields”, *CGU – AGU Joint Assembly*, 2004.
- Stanley, S., Bloxham J., Zuber, M.T. and Hutchison, W.E., “Can Mercury’s magnetic field be generated by a dynamo?”, *MESSENGER (MErcury Surface, Space Environment, Geochemistry, and Ranging) Science Team Meeting*, 2004.
- Stanley, S. and Bloxham, J., “Numerical models of planetary magnetic fields”, *AGU-EGU Joint Assembly*, 2003.

### CONTRIBUTED CONFERENCE PRESENTATIONS (AS FIRST AUTHOR):

- Stanley, S., Elkins-Tanton, L., Zuber, M. T. and Parmentier, E. M., “Mars’ Paleomagnetic Field as the Result of a Single-Hemisphere Dynamo”, *AGU Fall Meeting*, 2008.
- Stanley, S., “A dynamo model of Saturn’s extremely axisymmetric magnetic field”, *Committee on Space Research*, 2008.
- Stanley, S., “A dynamo model of Saturn’s extremely axisymmetric magnetic field”, *AGU Spring Meeting*, 2008.
- Stanley, S., Zuber, M.T. and Bloxham, J., “Determining dynamo region properties from observations of a planet’s magnetic field”, *AGU Fall Meeting*, 2006.

- Stanley, S., Zuber, M.T., Bloxham, J. and Hutchison, W.E., “Force balances in thin shell dynamo models with applications to Mercury and Mars”, *EGU Annual Meeting*, 2005.
- Stanley, S., Zuber, M.T., Bloxham, J. and Hutchison, W.E., “Using future observations to determine whether the source of Mercury’s magnetic field is an active dynamo”, *Lunar and Planetary Science Conference*, 2005.
- Stanley, S., Bloxham, J., Hutchison, W.E. and Zuber, M.T., “Thin shell dynamo models consistent with Mercury’s weak observed magnetic field”, *AGU Fall Meeting*, 2004.
- Stanley, S., Bloxham, J., Hutchison, W.E. and Zuber, M.T., “Can Mercury’s weak observed magnetic field be generated by a dynamo?”, *AGU Fall Meeting*, 2003.
- Stanley, S., and Bloxham, J., “Numerical modeling of planetary dynamos”, *Planetary Dynamos Workshop*, 2003.
- Stanley, S., and Bloxham, J., “Numerical modeling of Uranus’ and Neptune’s unusual magnetic fields”, *AGU Fall Meeting*, 2002.
- Polano, S., and Bloxham, J., “Numerical modeling of the magnetic fields of Uranus and Neptune”, *AGU Fall Meeting*, 1998. (note: Polano is my maiden name).

CO-AUTHORED CONFERENCE PRESENTATIONS (WITH MY STUDENTS AS FIRST AUTHOR):

- Dharmaraj, G. and Stanley, S., “Influence of thermal and velocity boundary conditions on planetary dynamos”, *AGU Fall Meeting*, 2011.
- Leung, J. and Stanley, S., “Mars magnetic field intensity: Relationship to core-mantle boundary thermal variability”, *EPSC-DPS Joint Meeting*, Nantes, FR, 2011.
- Vilim, R., Stanley, S. and Elkins-Tanton, L., “The effect of an electrically conducting lower mantle on planetary dynamos in large terrestrial exoplanets”, *EPSC-DPS Joint Meeting*, Nantes, FR, 2011.
- Dharmaraj, G. and Stanley, S., “Effect of inner core conductivity on planetary dynamos”, *Canadian Association of Physics (CAP) Congress*, 2010.
- Dharmaraj, G. and Stanley, S., “The effects of inner core conductivity on planetary dynamo models”, *AGU Fall Meeting*, 2009.
- Vilim, R., Stanley, S., Hauck, S.A., “Dynamo models incorporating iron ‘snow zones’ consistent with Mercury’s weak observed magnetic field”, *AGU Fall Meeting*, 2009.
- Vilim, R., Stanley, S., Hauck, S.A., “Dynamo models incorporating iron snow zones consistent with Mercury’s weak observed magnetic field”, *Gordon Research Conference: Interior of the Earth*, 2009.
- Dharmaraj, G., Stanley, S., “Effects of inner core conductivity on planetary magnetic field morphology”, *Gordon Research Conference: Interior of the Earth*, 2009.
- Vilim, R., Stanley, S. and Hauck, S.A., “Dynamo models incorporating iron snow zones consistent with Mercury’s weak observed magnetic field”, *Joint Assembly of the AGU and CGU*, 2009.
- Dharmaraj, G., Stanley, S., “Effects of inner core conductivity on planetary magnetic field morphology”, *Joint Assembly of the AGU and CGU*, 2009.
- Vilim, R., Stanley, S., and Hauck, S., “The effect of iron ‘snow’ layers on magnetic field generation in Mercury”, *AGU Fall Meeting*, 2008.

INVITED LECTURES:

- MIT, Department of Earth, Atmospheric and Planetary Sciences, 2012
- Princeton Plasma Physics Laboratory, 2012

- University of Alberta, Department of Physics, 2012
- Université de Montréal, Département de Physique, 2012
- University of Ontario Institute of Technology, Sharcnet Seminar, 2012
- University of Rochester, Department of Astronomy/Astrophysics, 2011
- University of Toronto Alumni Association “Canadian Perspectives” Lecture, 2010
- Royal Astronomical Society, Ontario Science Centre, 2009
- California Institute of Technology, Division of Geological & Planetary Sciences, 2007
- University of Toronto, Department of Physics, 2007
- University of California Los Angeles, Department of Earth & Space Sciences, 2007
- University of Toronto, Department of Geology, 2007
- Carnegie Institute of Washington, Department of Terrestrial Magnetism, 2006
- University of Colorado Boulder, Department of Astrophysical & Planetary Sciences, 2006
- University of Chicago, Department of Geophysical Sciences, 2006
- University of Toronto at Mississauga, Department of Chemical and Physical Sciences, 2006
- Princeton University, Department of Geosciences, 2006
- Royal Military College, Department of Physics, 2006
- University of British Columbia, Physics and Astronomy Department, 2005
- University of Toronto, Department of Astronomy & Astrophysics, 2005
- University of California Berkeley, Department of Earth & Planetary Sciences, 2005
- Brown University, Department of Geosciences, 2004

## **TEACHING EXPERIENCE:**

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### UNDERGRADUATE:

- PHY460/1460 Nonlinear Physics [2011]
- PHY254 Mechanics: From Oscillations to Chaos [2010]
- PHY395 Physics of the Earth [2008-2012]
- PHY151 Foundations of Physics [2005-2009]

### GRADUATE:

- PHY2406: Planetary Dynamo Theory [2012]
- PHY2109: Kinematic and Dynamic Dynamo Theory [2007, 2009, 2010]
- PHY2609: Planetary Physics [2007, 2009]

### RESEARCH SUPERVISION:

- Since 2005 I have or am in the process of supervising:
- 5 M.Sc. students, 3 Ph.D. students, 4 undergraduate students, 1 postdoctoral fellow, 2 research assistants

## **PROFESSIONAL ACTIVITIES:**

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- External Peer Reviewer for grant proposals:
  - NASA Outer Planets Research (OPR) Program [2011]
  - NASA Planetary Geology & Geophysics (PGG) Program [2008]
- Journal Referee:
  - *Astrophysical Journal* [2004]

- *Earth Planet. Sci. Lett.* [2008, 2009, 2010, 2011]
- *Geophys. J. Int.* [2008]
- *Geophys. Res. Lett.* [2004, 2007, 2008, 2010]
- *Icarus* [2009, 2010, 2011, 2012]
- *J. Geophys. Res.* [2012]
- *Nature* [2006]
- *Physics Today* [2011]
- *Phys. Earth Planet Int.* [2008, 2009 (2), 2010]
- *Science* [2005, 2010, 2011]
- *Space Science Rev.* [2009]
- Panel Member for grant proposal evaluation:
  - NASA Mars Fundamental Research Program (MFRP) [2010]
  - SciNet Local Resource Allocation Competition (LRAC) [2010]
  - NASA Lunar Advanced Science and Exploration Research (LASER) Program [2009]
  - NASA Planetary Geology & Geophysics (PGG) Program [2005]
- Convenor for Conference Sessions:
  - American Geophysical Union (AGU) Fall Meeting: Planetary Magnetic Fields: Observations and Models [2010]
  - AGU Fall Meeting: Interiors of Terrestrial Planets and Super-Earth Exoplanets [2010]
  - Gordon Research Conference: *Interior of the Earth* [2009]
  - AGU Fall Meeting: Magnetism of the Terrestrial Planets [2006]
  - AGU Fall Meeting: Interiors of the Giant Planets [2006]
  - AGU Fall Meeting: Planetary Interiors and Geodynamics II [2003]
- Reviewer for Monographs:
  - “Treatise on Geophysics, Volume 5: Geomagnetism and Planetary Magnetism”, Chapter 1. [2006]
  - “Physics of the Earth”, new edition by Frank Stacey [2006]
- Member of Canadian Space Exploration Working Group (CSEWG) Planetary Geology and Geophysics Section, co-writer of CSEWG report: “Canadian Scientific Priorities for the Global Exploration Strategy” available on the Canadian Space Agency website at: <http://www.asc-csa.gc.ca/eng/events/2008/csew2008.asp> [2008-2009].
- Program Committee Member, Study of Earth’s Deep Interior (SEDI) Section, American Geophysical Union/Canadian Geophysical Union Spring Joint Assembly [2008-2009]
- member: American Astronomical Society (AAS), American Geophysical Union (AGU), American Physical Society (APS), Canadian Association of Physicists (CAP), Canadian Geophysical Union (CGU), European Geophysical Union (EGU)

#### **OUTREACH ACTIVITIES:**

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- Twitter feed for *Planetary Geology and Geophysics in Canada*: @pgg\_canadian [2012]

- Speaker:
  - Chaos Workshop for Grade 12 physics class from TDCH Woodbridge [2012]
  - High School Gifted Program Conference workshop: *The Physics of Chaos*, hosted by Toronto Catholic District School Board [2012]
  - Physics and Astronomy Student Union (PASU) Lecture [2011]
  - “Girls Rock Science workshop: *Chaos: What is it? Where is it? How do we study it?*” for high-school girls. [2010, 2009, 2008]
  - “Balancing Teaching and Research” session for new faculty at the University of Toronto. [2010]
  - International Physics Olympiad Training Camp for Canadian high school students [2010]
  - University of Toronto Spring Reunion Open House [2007]
  - Workshop for women graduate students considering careers in Academia, University of Toronto [2007]
  - Physics & Astronomy Students Union (PASU) “Physics Subject POST Selection session”, University of Toronto. [2007]
  - “UofT in Space” event during UofT Fall Campus Days. [2006]
  - Department of Physics NSERC Undergraduate Summer Research Lecture Series. [2006]
  - 2006 Speaker at Canadian Association for Girls in Science (CAGIS) event: “The Physics of Ice Skating”. 2006]
- Mentor for Physics Mentorship Program [2010/11]
- Master of Ceremonies for Astronomy and Space Exploration (ASX) Society event: *7<sup>th</sup> Annual Expanding Canada’s Frontiers Symposium*. [2010]
- Television or radio appearances:
  - CBC’s *Test the Nation* representing the winning “Nerds” team for the Annual IQ test. [2010]
  - Perimeter Institute’s *Quantum to Cosmos* festival event: *Worlds Beyond Earth*. [2009]
  - CBC Radio’s *Quirks and Quarks* [2009 (2), 2008 (2)]
- Presenter at *Science Rendezvous*, city-wide event held in Toronto, ON. [2009, 2008]
- Interviewee:
  - for local high school student’s physics project on “Women in Physics”. [2009]
  - for National Geographic television documentary entitled “The Earth Stood Still” [2009]
  - for Discovery Channel television documentary entitled “The World Without” [2009]
  - for *Nature* news story [2008]
- Host for Physics Department at UofT’s March Break Open House. [2008, 2012]

#### **PUBLICATIONS:**

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- Dharmaraj, G. and **Stanley, S.**, “Effect of inner core conductivity on planetary dynamo models”, submitted.
- Leung, J., **Stanley, S.** and Mitrovica, J.X., “Mars’ hemispheric dynamo: Implications for magnetic field intensity and true polar wander”, submitted.

- Chan, N.-H., Mitrovica, J.X., Matsuyama, I., Creveling, J.R. and **Stanley, S.**, “The rotational stability of a convecting Earth: Assessing inferences of rapid TPW in the late cretaceous”, *Geophys. J. Int.* **187**, 1319-1333 (2011).
- Chan, N.H., Mitrovica, J.X., Matsuyama, I., Latychev, K., Creveling, J.R., **Stanley, S.** and Morrow, E., “The rotational stability of a convecting Earth: The Earth’s figure and TPW over the last 100 Myr”, *Geophys. J. Int.* **187**, 773-782 (2011).
- Serbanescu, R.M., Kushner, P.J. and **Stanley, S.**, Putting computation on a par with experiments and theory in the Undergraduate Physics curriculum, *American Journal of Physics* **79**, 919 (2011).
- **Stanley, S.**, A dynamo model for axisymmetrizing Saturn’s magnetic field, *Geophys. Res. Lett.* **37**, L05201, doi:10.1029/2009GL041752 (2010).
- Vilim, R., **Stanley, S.**, Hauck, S.A., Iron snow zones as a mechanism for generating Mercury’s weak observed magnetic field, *J. Geophys. Res.* **115**, E11003 (2010).
- Weiss, B.P., Rochette, P., **Stanley, S.**, Paleomagnetic Records of Meteorites and Early Planetary Differentiation, *Space Sci. Rev.* **152**, 341-490 (2010).
- **Stanley, S.** and Glatzmaier, G., Dynamo models for planets other than Earth, *Space Sci. Rev.* **152**, 617-649 (2010).
- Weiss, B.P., Berdahl, J.S., Elkins-Tanton, L.T., **Stanley, S.**, Lima, E.A., Carporzen, L., Magnetism on the Angrite Parent Body and the Early Differentiation of Planetesimals, *Science*, **322**, 713-716 (2008).
- **Stanley, S.**, Elkins-Tanton, L.T., Zuber, M.T., Parmentier, E.M., Mars’ Paleomagnetic Field as the Result of a Single-Hemisphere Dynamo, *Science*, **321**, 1822-1825 (2008).
- **Stanley, S.** and Mohammadi, A., Effects of an outer thin stably-stratified layer on planetary dynamos, *Phys. Earth Planet. Int.*, **168**, 179-190 (2008).
- **Stanley, S.**, Dynamos of the ice giants, in: *Dynamos*, ed: P. Cardin and L. Cugliandolo. Elsevier, Amsterdam, 451-464 (2008).
- **Stanley, S.**, Zuber, M.T. and Bloxham, J., Using reversed magnetic flux spots to determine a planet’s inner core size, *Geophys. Res. Lett.*, **34**, L19205 (2007).
- Zuber, M.T., Aharonson, O., Aurnou, J.M., Cheng, A.F., Hauck, S.A., Heimpel, M.H., Neumann, G.A., Peale, S.J., Phillips, R.J., Smith, D.E., Solomon, S.C., **Stanley, S.**, The Geophysics of Mercury: Current Status and Anticipated Insights from the MESSENGER Mission, *Space Science Rev.*, **131**, 105-132 (2007).
- **Stanley, S.** and Bloxham, J., Numerical dynamo models of Uranus’ and Neptune’s magnetic fields, *Icarus*, **184**, 556-572 (2006).

- **Stanley, S.**, Bloxham, J., Hutchison, W. E. and Zuber, M.T., Thin shell dynamo models consistent with Mercury's weak surface magnetic field, *Earth Planet. Sci. Lett.*, **234**, 27-38 (2005).
- **Stanley, S.** and Bloxham, J., Convective-region geometry as the cause of Uranus' and Neptune's unusual magnetic fields, *Nature*, **428**, 151-153 (2004).
- **Stanley, S.**, So many dynamos: A study of planetary magnetic field morphologies, Ph.D. Thesis, Harvard University, Cambridge, MA.
- Percy, J.R. and **Polano, S.**, Pulsation Modes in M Giants, in: *A half century of stellar pulsation interpretation: A Tribute to Arthur N. Cox*, ed: P.A. Bradley and J.A. Guzik. ASP Conference Series **135**, 249-253 (1998). (Note: Polano is my maiden name).