

Dr. David P. O'Brien – Curriculum Vitae

Work Address

Planetary Science Institute
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Current Position

Research Scientist, Planetary Science Institute, Tucson, AZ

Education

August 1998 – May 2004 University of Arizona
Ph.D., Planetary Science

August 1994 – May 1998 Cornell University
B.S., Applied and Engineering Physics

Past Experience

Jan 2005 – Dec 2005 Poincaré Fellow
Dr. Alessandro Morbidelli
Observatoire de la Côte d'Azur, Nice, France

May 2004 – Dec 2004 Postdoctoral Research Associate
Prof. Richard Greenberg
Planetary Sciences Department, University of Arizona, Tucson, AZ

Sep 1998 – May 2004 Graduate Research Assistant
Prof. Richard Greenberg
Planetary Sciences Department, University of Arizona, Tucson, AZ

Sep 1999 – May 2003 Teaching Assistant for 7 Semesters
Profs. Jonathan Lunine, Robert Brown, Renu Malhotra,
and Larry Lebofsky
Planetary Sciences Department, University of Arizona, Tucson, AZ

May 1997 – Aug 1998 Undergraduate Research Assistant
Prof. Steven Squyres
Astronomy Department, Cornell University, Ithaca, NY

Research Interests

Planet formation and the dynamical and collisional evolution of the early Solar System

Collisional and dynamical evolution of asteroids and trans-Neptunian objects

Thermal modeling of geophysical phenomena

Icy satellite geophysics

Honors and Awards

NASA Fellowship for Early Career Researchers (2006)

Poincaré Fellowship, Observatoire de la Côte d'Azur, Nice, France (2005)

Graduate Teaching Award, University of Arizona Planetary Sciences Department (Spring 2002)

NASA Graduate Student Research Program fellowship (2000 – 2003)

Asteroid (21774) O'Brien

Currently Funded Grant Proposals

Jan 2009 - Dec 2011 Chemical and Dynamical Modeling of Terrestrial Planet Formation
NASA's Origins of Solar Systems Program
\$224,000

Jun 2009 - May 2012 Collisional and Dynamical Processes in the Solar System
NASA's Planetary Geology and Geophysics Program
\$186,000

Apr 2010 - Mar 2012 Formation and Evolution of Planetary Systems
NASA's Fellowship for Early Career Researchers Program
\$100,000

Jul 2010 - Jun 2013 Quantitative Modeling of Vesta's Impact History and Cratering Record
NASA's Dawn at Vesta Participating Scientist Program
\$200,000

Nov 2010 - Oct 2013 Dynamical and Collisional Evolution of Small Bodies in the Solar System
NASA's Outer Planets Research Program
\$241,000

Professional Societies

American Geophysical Union

Division for Planetary Science, American Astronomical Society

Professional Activities

Review panel chair for NASA's Outer Planets Research program, 2011

Review panel member for NASA's Planetary Geology and Geophysics program, 2006, 2007 and 2009

Review panel member for NASA's Origins of Solar Systems program, 2007

Review panel member for NASA's Outer Planets Research program, 2008

External reviewer for NASA's Origins, Outer Planets Research, Cassini Data Analysis, Lunar
Advanced Science and Exploration Research, and Planetary Geology and Geophysics programs

External reviewer for the NASA Postdoctoral Program fellowship, 2007, 2008 and 2010

Manuscript reviewer for *Icarus*, *Meteoritics and Planetary Science*, *ApJ*, *Planetary and Space Science*,
PASJ, *A&A*, *Earth, Planets and Space*, and *Space Science Reviews*

Chapter reviewer for the *Asteroids III* and *Europa* books

Contributor to the Asteroids and Near Earth Objects decadal survey community white papers, 2009
Organizer of the Planetary Science Institute's weekly seminar series, Fall 2006 and Spring 2007
Member of Planetary Science Institute's Space/Facilities Committee, 2008-Present
Co-organizer of the Planetary Science Institute's internal review program for PG&G proposals, 2009
Co-organizer of grant writing and early career seminars for grad students and postdocs, Spring and Fall 2007, Spring 2009

Teaching

Co-leader of 4-day fieldtrip to Southern California for PTYS 594a, Planetary Geology Field Practicum (U. Arizona), Spring 2011
Co-leader of 5-day fieldtrip to Canyonlands, UT for PTYS 594a, Fall 2010
Co-leader of 4-day fieldtrip to Mojave Desert for PTYS 594a, Spring 2009
Leader of 3-day fieldtrip to Canyon de Chelly in northeast Arizona for PTYS 594a, Spring 2007
Guest lecturer for PTYS 571, Terrestrial Planets (U. Arizona), Fall 2006

Advising/Mentoring

Postdoctoral co-advisor for Dr. Jade Bond, 2009-Present
Thesis committee member and co-advisor for Jade Bond, U. Arizona, 2006-2008
Mentor for associate scientist Dr. Susan Benecchi, Planetary Science Institute, 2009-Present
Mentor for associate scientist Dr. Amara Graps, Planetary Science Institute, 2006-2007
Thesis committee member (external) for Takashi Sasaki, U. Idaho, 2010-Present

Outreach

Astronomy and planetary science talks at local Tucson schools
Event leader for 2004 regional and state Science Olympiad competitions

Invited Seminars

Our Familiar Neighbors and Alien Extrasolar Worlds: Understanding The Diversity of Terrestrial Planets. School of Earth and Space Exploration, Arizona State University, March 28, 2011.
The Origin, Evolution, and Environment of the Asteroid Belt: Implications for Vesta And Ceres. Dawn Science Team Meeting, Pasadena, CA, Jan 19, 2011.
Terrestrial Planet Formation in the Solar System and Beyond. Lunar and Planetary Laboratory, University of Arizona, May 13, 2010.
Collisional and Dynamical Evolution of Small Bodies in the Solar System. Lunar and Planetary Laboratory, University of Arizona, May 12, 2010.
The Terrestrial Planets and Asteroid Belt: Understanding Planet Formation in the Inner Solar System. Department of Earth and Atmospheric Sciences, Purdue University, April 20, 2010.
Terrestrial Planet Formation: From our Solar System to Exotic Extrasolar Worlds. School of Earth and Space Exploration, Arizona State University, March 24, 2010.

- The Paucity of Small Craters on Eros and Itokawa: You Can't Explain This One, Yarkovsky. Planetary Science Institute, Tucson AZ, March 19, 2008.
- Terrestrial Planet Formation: New Insights and Outstanding Questions. Carnegie Institution of Washington, DTM Friday Astronomy Seminar, February 29, 2008.
- Terrestrial Planet Formation in the Solar System and Beyond. Department of Physics and Astronomy, George Mason University, February 27, 2008.
- Terrestrial Planet Formation, Water Delivery, and the Early Evolution of the Asteroid Belt. Earth and Planetary Sciences Department, Harvard University, October 29, 2007.
- The Origin of Water on Earth. Physics and Astronomy Department, University of British Columbia, April 24, 2007.
- High-Resolution Modeling of Terrestrial Planet Formation. Laboratory for Atmospheric and Space Physics, C.U. Boulder, March 1, 2007.
- The Delivery of Water from the Asteroid Belt During Terrestrial Planet Accretion. U.C. Berkeley Center for Integrative Planetary Science, January 31, 2007.
- Terrestrial Planet Formation with Strong Dynamical Friction. Planetary Science Institute, Tucson AZ, April 26, 2006.

Peer-Reviewed Publications

- D. P. O'Brien and M. V. Sykes. The Origin and Evolution of the Asteroid Belt—Implications for Vesta and Ceres. *Space Science Reviews Dawn Mission Special Issue*, in press.
- K. Righter and D. P. O'Brien. Terrestrial Planet Formation. *Proc. Natl. Acad. Sci.*, in press.
- K. J. Walsh, A. Morbidelli, S. N. Raymond, D. P. O'Brien and A. M. Mandell (2011). A low Mass for Mars from Jupiter's Early Gas-Driven Migration. *Nature* **475**, 206-209.
- J. I. Lunine, D. P. O'Brien, S. N. Raymond, A. Morbidelli, T. Quinn and A. L. Graps (2011). Dynamical Models of Terrestrial Planet Formation. *Advanced Science Letters* **4**, 325-338.
- J. C. Bond, D. P. O'Brien and D. S. Lauretta (2010). The Compositional Diversity of Extrasolar Terrestrial Planets: I. In-Situ Simulations. *The Astrophysical Journal* **715**, pp. 1050-1070.
- F. Nimmo, D. P. O'Brien and T. Kleine (2010). Tungsten Isotopic Evolution During Late-Stage Accretion: Constraints on Earth-Moon equilibration. *Earth and Planetary Science Letters*, **292**, pp. 363-370.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2010). Making the Earth: Combining Dynamics and Chemistry in the Solar System. *Icarus* **205**, pp. 321-337.
- J. Chambers, D. P. O'Brien and A. M. Davis (2010). Accretion of Planetesimals and the Formation of Rocky Planets. *Protoplanetary Dust: The Astrochemical and Cosmochemical Perspectives*, D. Apai and D. S. Lauretta, eds., Cambridge University Press.
- D. P. O'Brien (2009). The Yarkovsky Effect is not Responsible for Small Crater Depletion on Eros and Itokawa. *Icarus* **203**, pp. 112-118.
- S. N. Raymond, D. P. O'Brien, A. Morbidelli and N. A. Kaib (2009). Building the Terrestrial Planets: Constrained Accretion in the Inner Solar System. *Icarus* **203**, pp. 644-662.
- P. Michel, D. P. O'Brien, S. Abe and N. Hirata (2009). Itokawa's Cratering Record as Observed by Hayabusa: Implications for its Age and Collisional History. *Icarus* **200**, pp. 503-513.

- S. J. Kenyon, B. C. Bromley, D. P. O'Brien and D. R. Davis (2008). Formation and Collisional Evolution of Kuiper Belt Objects. *The Solar System Beyond Neptune*, A. Barucci, H. Boehnhardt, D. Cruikshank and A. Morbidelli, eds., University of Arizona Press, pp. 293-313.
- D. P. O'Brien, A. Morbidelli and W. F. Bottke (2007). The Primordial Excitation and Clearing of the Asteroid Belt—Revisited. *Icarus* **191**, pp. 434-452.
- B. Preblich, R. Greenberg, J. Riley and D. P. O'Brien (2007). Tidally Driven Strike-slip Displacement on Europa: Viscoelastic Modeling. *Planetary and Space Science* **55**, pp. 1225-1245.
- D. P. O'Brien, A. Morbidelli and H. F. Levison (2006). Terrestrial Planet Formation with Strong Dynamical Friction. *Icarus* **184**, pp. 39-58.
- D. P. O'Brien, R. Greenberg and J. E. Richardson (2006). Craters on Asteroids: Reconciling Diverse Impact Records with a Common Impacting Population. *Icarus* **183**, pp. 79-92.
- W. F. Bottke, D. Nesvorný, R. E. Grimm, A. Morbidelli and D. P. O'Brien (2006). Iron Meteorites as Remnants of Planetesimals Formed in the Terrestrial Planet Region. *Nature* **439**, pp. 821-824.
- C. D. Neish, R. D. Lorenz, D. P. O'Brien, and the Cassini Radar Team (2006). The Potential for Prebiotic Chemistry in the Possible Cryovolcanic Dome Ganesa Macula on Titan. *International Journal of Astrobiology* **5**, pp. 57-65.
- D. P. O'Brien and R. Greenberg (2005). The Collisional and Dynamical Evolution of the Main-Belt and NEA Size Distributions. *Icarus* **178**, pp. 179-212.
- D. P. O'Brien, R. Lorenz and J. I. Lunine (2005). Numerical Calculations of the Longevity of Impact Oases on Titan. *Icarus* **173**, pp. 243-253.
- J. E. Richardson Jr., H. J. Melosh, R. J. Greenberg and D. P. O'Brien (2005). The Global Effects of Impact-induced Seismic Activity on Fractured Asteroid Surface Morphology. *Icarus* **179**, pp. 325-349.
- D. P. O'Brien and R. Greenberg (2003). Steady-State Size Distributions for Collisional Populations: Analytical Solution with Size-Dependent Strength. *Icarus* **164**, pp. 334-345.
- E. P. Turtle, E. Pierazzo, and D. P. O'Brien (2003). Numerical Modeling of Impact Heating and Cooling of the Vredefort Impact Structure. *Meteoritics and Planetary Science* **38**, pp. 293-303.
- D. P. O'Brien, P. Geissler, and R. Greenberg (2002). A Melt-through Model for Chaos Formation on Europa. *Icarus* **156**, pp. 152-161.
- J. W. Barnes and D. P. O'Brien (2002). Stability of Satellites around Close-in Extrasolar Giant Planets. *The Astrophysical Journal* **575**, pp. 1087-1093.
- G. V. Hoppa, B. R. Tufts, R. Greenberg, T. Hurford, D. P. O'Brien and P. E. Geissler (2001). Europa's Rate of Rotation Derived from the Tectonic Sequence in the Astypalaea Region. *Icarus* **153**, pp. 208-213.

Conference Proceedings

- J. C. Bond, D. S. Laretta and D. P. O'Brien (2010). The Diversity of Extrasolar Terrestrial Planets. Proceedings of IAU Symposium 265: Chemical Abundances in the Universe—Connecting First Stars to Planets, K. Cunha, M. Spite and B. Barbuy, eds., Cambridge University Press, pp. 399-402.

Papers in Progress

- A. Morbidelli, J. I. Lunine, D. P. O'Brien, S. N. Raymond and K. J. Walsh. Building Terrestrial Planets. Annual Reviews of Earth and Planetary Sciences, in review.
- J. C. Bond, D. P. O'Brien and D. S. Lauretta. The Compositional Diversity of Extrasolar Terrestrial Planets: II. Simulations with Giant Planet Migration. In preparation.

Invited Conference Presentations

- D. P. O'Brien, S. N. Raymond, A. Morbidelli, J. C. Bond and F. Nimmo (2009). Accretion, Chemical Evolution, and Differentiation of the Terrestrial Planets. Goldschmidt Conference, Davos, Switzerland.
- D. P. O'Brien (2009). The Formation, Growth, and Chemical Evolution of Terrestrial Planets. Gordon Research Conference on Origins Of Solar Systems, Mt. Holyoke College, South Hadley, MA.
- D. P. O'Brien (2008). Terrestrial Planet Formation: New Insights and Outstanding Questions. Invited review talk for the 11th Lunar and Planetary Laboratory Conference, Tucson, AZ.
- D. P. O'Brien, D. R. Davis, S. J. Kenyon and B. C. Bromley (2007). The Collisional Evolution of Small Bodies in the Solar System. 7th Workshop on Catastrophic Disruption in the Solar System, Alicante, Spain.
- D. P. O'Brien (2006). The Collisional Evolution of Trans-Neptunian Objects. International Workshop on Trans-Neptunian Objects: Dynamical and Physical properties, Catania, Italy.
- D. P. O'Brien (2006). Quick Recipes for Making 'Cool' Terrestrial Planets. Invited review talk for the 9th Lunar and Planetary Laboratory Conference, Tucson, AZ.

Recent Conference Presentations

- D. P. O'Brien, M. V. Sykes and P. Tricarico (2011). Collision Probabilities and Impact Velocity Distributions for Vesta and Ceres. LPSC 42, abstract no. 2665.
- J. C. Bond, D. P. O'Brien and S. N. Raymond (2011). The Diversity of Extrasolar Terrestrial Planets: Adding Migration into the mix. Joint DPS/EPSC Meeting, Nantes, France.
- K. J. Walsh, A. Morbidelli, S. N. Raymond, D. P. O'Brien and A. M. Mandell (2011). The Asteroid Belt and Mars' Small Mass Explained by Large-Scale Gas-Driven Migration of Jupiter. Joint DPS/EPSC Meeting, Nantes, France.
- D. C. Rubie, D. P. O'Brien, F. Nimmo, A. Morbidelli, D. J. Frost and H. Palme (2011). Heterogeneous Accretion of the Terrestrial Planets. LPSC 42, abstract no. 1061.
- W. K. Hartmann, C. A. Goodrich, D. P. O'Brien, P. Michel, S. J. Weidenschilling and M. V. Sykes (2011). Breakup and Reassembly of the Ureilite Parent Body, Formation of 2008 TC3/Almahata Sitta, and Delivery of Ureilites to Earth. LPSC 42, abstract no. 1360.
- K. J. Walsh, A. Morbidelli, S. N. Raymond, D. P. O'Brien and A. M. Mandel (2011). The Asteroid Belt and Mars' Small Mass Explained by Large-Scale Gas-Driven Migration of Jupiter. LPSC 42, abstract no. 2585.
- T. M. Davison, F. J. Ciesla, G. S. Collins and D. P. O'Brien (2011). The Role of Impacts in the Thermal Evolution of Planetesimals. LPSC 42, abstract no. 2254.
- T. M. Davison, G. S. Collins, F. J. Ciesla and D. P. O'Brien (2011). The Energy Budget of Planetesimal Collisions: A Quantitative Analysis. LPSC 42, abstract no. 2530.

- D. C. Rubie, D. J. Frost, D. P. O'Brien, F. Nimmo, A. Morbidelli and H. Palme (2011). Accretion and Differentiation of the Terrestrial Planets. Goldschmidt Conference, Prague, Czech Republic.
- S. N. Raymond, K. J. Walsh, A. Morbidelli, D. P. O'Brien and A. M. Mandell (2011). How Jupiter's Two-Phase Gas-Driven Migration Shaped the Inner Solar System. Goldschmidt Conference, Prague, Czech Republic.
- C. A. Dwyer, F. Nimmo, E. Asphaug, D. P. O'Brien and J. E. Chambers (2011). Erosion during accretion: Consequences for planetary iron-silicate ratios and tungsten isotope anomalies. Gordon Research Conference on Origins Of Solar Systems, Mt. Holyoke College, South Hadley, MA.
- C. A. Dwyer, F. Nimmo, E. Asphaug, D. P. O'Brien and J. E. Chambers (2011). Erosion during accretion: Consequences for planetary iron-silicate ratios and tungsten isotope anomalies. AGU Fall Meeting, San Francisco, CA.
- D. P. O'Brien, K. J. Walsh, A. Morbidelli, S. N. Raymond, A. M. Mandell and J. C. Bond (2010). Early Giant Planet Migration in the Solar System: Geochemical and Cosmochemical Implications for Terrestrial Planet Formation. American Astronomical Society, DPS meeting 42, Pasadena, CA, abstract no. 04.03.
- D. P. O'Brien (2010). Collision Velocities in the Asteroid Belt: Implications for Melt Production on Meteorite Parent Bodies. 73rd Meteoritical Society Meeting, New York, NY.
- K. J. Walsh, A. Morbidelli, S. N. Raymond, D. P. O'Brien and A. M. Mandell (2010). Origin of the Asteroid Belt and Mars' Small Mass. American Astronomical Society, DPS meeting 42, Pasadena, CA, abstract no. 04.02.
- N. Haghhighipour, E. R. D. Scott, G. J. Taylor and D. P. O'Brien (2010). Reconciling Giant Planet Formation With the Origin and Impact History of the Parent Bodies of Differentiated Meteorites. American Astronomical Society, DPS meeting 42, Pasadena, CA, abstract no. 02.06.
- D. C. Rubie, D. J. Frost, F. Nimmo, D. P. O'Brien, Y. Nakajima, A. Vogel, U. Mann and H. Palme (2010). Heterogeneous Accretion and Core-Mantle Differentiation of the Terrestrial Planets. Paneth Kolloquium, Nördlingen, Germany.
- T. M. Davison, G. S. Collins, F. Ciesla and D. P. O'Brien (2010). Cumulative Impact Heating of Planetesimals. 73rd Meteoritical Society Meeting, New York, NY.
- J. C. Bond, D. P. O'Brien, D. S. Lauretta and J. I. Lunine (2010). Extrasolar Planets: From Silicates to Carbon. Gordon Research Conference on Environmental Bioinorganic Chemistry, Salve Regina University, Newport, RI.
- J. C. Bond, D. P. O'Brien and D. S. Lauretta (2010). The Diversity of Extrasolar Terrestrial Planets. ESF-FWF Conference in Partnership with LFUI, Putting our Solar System in Context: Origin, Dynamical and Physical Evolution of Multiple Planet Systems, Universitätszentrum Obergurgl, Austria.
- C. A. Dwyer, F. Nimmo, E. Asphaug and D. P. O'Brien (2010). Erosion During Accretion: Consequences for Iron-Silicate Ratios and Tungsten Isotope Anomalies. Goldschmidt Conference, Knoxville, Tennessee.
- D. C. Rubie, D. J. Frost, F. Nimmo, D. P. O'Brien, U. Mann and H. Palme (2010). Accretion of Volatile Elements to the Earth and Moon. LPSC 40, abstract no. 1134.
- C. A. Dwyer, F. Nimmo, E. Asphaug and D. P. O'Brien (2010). Erosion During Accretion: Consequences for Planetary Iron-Silicate Ratios and Tungsten Isotope Anomalies. LPSC 40, abstract no. 2271.
- T. M. Davison, G. S. Collins, F. J. Ciesla and D. P. O'Brien (2010). Heating Planetesimals by Impacts. LPSC 40, abstract no. 2230.

- D. P. O'Brien, P. Michel and M. Jutzi (2009). Collisional Evolution of High-Inclination Asteroids: Implications for Asteroid Strength. American Astronomical Society, DPS meeting 41, Fajardo, Puerto Rico, abstract no. 27.03.
- J. C. Bond, D. P. O'Brien and D. S. Lauretta (2009). The Chemical Diversity of Extrasolar Terrestrial Planets. Gordon Research Conference on Origins of Solar Systems, Mt. Holyoke College, South Hadley, MA.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2009). Chemical and Dynamical Modeling of Terrestrial Planet Formation. IAU 265: Chemical Abundances in the Universe—Connecting First Stars to Planets, Rio de Janeiro, Brazil.
- J. C. Bond, D. P. O'Brien and D. S. Lauretta (2009). The Chemical Diversity of Extrasolar Terrestrial Planets. American Astronomical Society, DPS meeting 41, Fajardo, Puerto Rico, abstract no. 5.01.
- F. J. Ciesla, G. S. Collins, T. M. Davidson and D. P. O'Brien (2009). Collisions Among Porous Planetesimals and the Water Content of Planetary Embryos. Goldschmidt Conference, Davos, Switzerland.
- D. P. O'Brien, A. Morbidelli and S. N. Raymond (2008). Planetary Embryos in the Primordial Asteroid Belt: Constraints on Embryo Mass. American Astronomical Society, DPS meeting 40, Ithaca, NY, abstract no. 58.06.
- D. P. O'Brien and A. Morbidelli (2008). The Collisional Evolution of Trojan Asteroids—A Possible Origin of the L4-L5 Asymmetry. Asteroids, Comets, and Meteors Conference, Baltimore, MD.
- F. Nimmo, D. P. O'Brien and T. Kleine (2008). Core Formation in Silicate Bodies. AGU Fall Meeting, San Francisco, CA, abstract no. MR31B-04.
- S. N. Raymond, D. P. O'Brien, A. Morbidelli and N. Kaib (2008). Building the Terrestrial Planets: Constraining Planetary Accretion in the Inner Solar System. American Astronomical Society, DDA meeting 39, Boulder, CO, abstract no. 17.03.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2008). Chemical and Dynamical Modeling of Terrestrial Planet Formation. 5th Astrobiology Science Conference, Santa Clara, CA.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2008). Composition of Simulated Terrestrial Planets. LPSC 39, abstract no. 1438.
- D. P. O'Brien and R. Greenberg (2007). The Lack of Small Craters on Eros is not due to the Yarkovsky Effect. American Astronomical Society, DPS meeting 39, Orlando, FL, abstract no. 50.06.
- D. P. O'Brien, P. Michel and S. Abe (2007). Interpreting Itokawa's Cratering Record. 7th Workshop on Catastrophic Disruption in the Solar System, Alicante, Spain.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2007). Chemical Composition of Model Terrestrial Planets. Gordon Research Conference on Origins of Solar Systems, Mt. Holyoke College, South Hadley, MA.
- J. C. Bond, D. S. Lauretta and D. P. O'Brien (2007). Chemical and Dynamical Modelling of Terrestrial Planet Formation. 70th Meteoritical Society Meeting, Tucson, AZ.
- J. Lunine, A. Graps, D. P. O'Brien, A. Morbidelli, L. Leshin and A. Coradini (2007). Asteroidal Sources of Earth's Water Based on Dynamical Simulations. LPSC 38, abstract no. 1616.
- A. L. Graps, J. I. Lunine, J. Chambers, A. Morbidelli, L. A. Leshin and D. P. O'Brien (2007). The Origin of Water on Mars. EGU General Assembly, Vienna, Austria, abstract no. 10556.