

Dr. David P. O'Brien – Curriculum Vitae

Work Address

Planetary Science Institute
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Current Position

Senior 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
Observatoire de la Côte d'Azur, Nice, France
May 2004 – Dec 2004 Postdoctoral Research Associate
Planetary Sciences Department, University of Arizona, Tucson, AZ

Research Interests

Planet formation, water delivery, and the evolution of the early Solar System
Collisional and dynamical evolution of asteroids and trans-Neptunian objects
Thermal modeling of geophysical phenomena
Icy satellite geophysics

Mission Involvement

NASA's Dawn Mission, Participating Scientist (2010 - 2014)
NASA's Dawn Mission, Funded Science Team Associate (2014 - End of Mission, 2019)

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

Professional Societies

American Geophysical Union

Division for Planetary Science, American Astronomical Society

Professional Activities

Scientific organizing committee chair for the 2017 DPS Meeting, Provo, UT

Scientific organizing committee member for the 2016 DPS/EPSC Meeting, Pasadena, CA

Local organizing committee member and assistant webmaster for the 2014 DPS Meeting, Tucson, AZ

Pierazzo International Student Travel Award committee member, 2013-Present

Guest editor for *Journal of Geophysical Research: Planets* special issue "Vesta's Giant Southern Impact Basins", 2013

Co-organizer of the PSI Davis/Hartmann Symposium, 2012

Review panel member for NASA's Solar System Workings Program, 2019

Review panel member for NASA's Europa Mission instrument selections, 2014

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, Planetary Geology and Geophysics, Emerging Worlds, and Exoplanets Research Programs

External reviewer for the NASA Postdoctoral Program fellowship, 2007-present

External reviewer for the Royal Society University Research Fellowship Program, 2012 and 2014

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

Chapter reviewer for the *Asteroids III*, *Asteroids IV*, 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

Instructor for AST101IN, Solar System (Pima Community College), Spring 2021 (two 8-week accelerated sessions)

Instructor for PTYS/ASTR 170A1, Planet Earth: Evolution of the Habitable World (U. Arizona), Fall 2020

Co-Organizer of 5-day fieldtrip to Northern New Mexico for PTYS594a, Planetary Geology Field Practicum (U. Arizona), Fall 2013.

Co-Leader of 3-day Tucson-area fieldtrip for PTYS594a, Fall 2012

Co-Leader of 5-day fieldtrip to Death Valley for PTYS594a, Spring 2012

Co-Leader of 3-day fieldtrip to Canyon de Chelly in northeast Arizona for PTYS 594a, Fall 2011

Co-leader of 4-day fieldtrip to Southern California for PTYS 594a, 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

Teaching Assistant for 7 semesters, non-major undergraduate courses in planetary science and astrobiology (U. Arizona), Fall 1999 - Spring 2003

Teaching Assistant for A&EP 264, Computerized Instrumentation Design (Cornell University), Spring 1997

Advising/Mentoring

Postdoctoral co-advisor for Dr. Jade Bond, 2009-2012

Thesis committee member and co-advisor for Jade Bond, U. Arizona, 2006-2008

Mentor for associate scientist Dr. Susan Benecchi, Planetary Science Institute, 2009-2011

Mentor for associate scientist Dr. Amara Graps, Planetary Science Institute, 2006-2007

Thesis committee member (external) for Takashi Sasaki, U. Idaho, 2010-2014

Outreach

How did Earth get its Water? Borderlands Brewery, Tucson, AZ, February 19, 2020.

NASA's Dawn Mission: Exploring the Dwarf Planet Ceres. Fred Lawrence Whipple Observatory Smithsonian Lecture on Astronomy, Green Valley, AZ, January 10, 2018.

Dawn's Exploration of Dwarf Planet Ceres. Borderlands Brewery, Tucson, AZ, February 24, 2016.

NASA's Dawn Mission: First Views of Ceres. Huachuca Astronomy Club, Sierra Vista, AZ, May 1, 2015.

NASA's Dawn Mission to Vesta and Ceres. Tucson Amateur Astronomy Association, Tucson, AZ, April 3, 2015.

The Giant Asteroid Vesta: Highlights from NASA's Dawn Mission. Sonora Astronomical Society, Green Valley, AZ, January 13, 2015.

The Giant Asteroid Vesta: Highlights from NASA's Dawn Mission. Borderlands Brewery, Tucson, AZ, December 10, 2014.

Highlights from NASA's Dawn Mission to Vesta, Keynote speaker at the Karchner Caverns Star Party, March 22, 2014.

Exploring the Asteroid Vesta with NASA's Dawn Mission. Tucson Country Day School (5th grade), November 19, 2013.

The Giant Asteroid Vesta: Highlights from NASA's Dawn Mission. Huachuca Astronomy Club, Sierra Vista, AZ, November 2, 2012.

Invited Seminars

The Formation and Evolution of the Inner Solar System. Lunar and Planetary Institute, Houston TX, March 2, 2017.

Dawn's Exploration of Dwarf Planet Ceres. USGS Arizona Water Science Center, Tucson, AZ, April 26, 2016.

Dawn's Exploration of Dwarf Planet Ceres. Earths in Other Solar Systems Origins Seminar, Steward Observatory, University of Arizona, December 7th, 2015.

Dawn's Exploration of Vesta and its First Views of Ceres. Centre for Research in Earth and Space Science, York University, Toronto, March 4, 2015.

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.

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.

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.

Peer-Reviewed Publications

- P. Schenk, J. Castillo-Rogez, K. A. Otto, S. Marchi, D. P. O'Brien, M. Bland, K. Hughson, B. Schmidt, J. Scully, D. Buczkowski, K. Krohn, T. Hoogenboom, G. Kramer, V. Bray, A. Neesemann, H. Hiesinger, T. Platz, M.-C. De Sanctis, S. Schroeder, L. Le Corre, L. McFadden, M. Sykes, C. Raymond and C. T. Russell (2021). Compositional control on impact crater formation on mid-sized planetary bodies: Dawn at Ceres and Vesta, Cassini at Saturn. *Icarus* **359**, id. 114343.
- P. Schenk, J. Scully, D. Buczkowski, H. Sizemore, B. Schmidt, C. Pieters, A. Neesemann, D. P. O'Brien, S. Marchi, D. Williams, A. Nathues, M. De Sanctis, F. Tosi, C. T. Russell, J. Castillo-Rogez and C. Raymond (2020). Impact Heat Driven Volatile Redistribution at Occator Crater on Ceres as a Comparative Planetary Process. *Nature Communications* **11**, 3679.
- G. D. Mulders, D. P. O'Brien, F. J. Ciesla, D. Apai and I. Pascucci (2020). Earths in Other Solar Systems N-body Simulations: The Role of Orbital Damping in Reproducing the Kepler Planetary Systems. *The Astrophysical Journal* **897**, id. 72.
- C. M. Pieters, A. Nathues, G. Thangiam, M. Hoffmann, T. Platz, M. C. De Sanctis, E. Ammannito, F. Tosi, F. Zambon, J. H. Pasckert, H. Hiesinger, S. E. Schroder, R. Jaumann, K.-D. Matz, J. C. Castillo-Rogez, O. Ruesch, L. A. McFadden, D. P. O'Brien, M. Sykes, C. A. Raymond and C. T. Russell (2018). Geologic Constraints on the Origin of Red Organic-Rich Material on Ceres. *Meteoritics and Planetary Science* **53**, pp. 1983-1998.
- D. P. O'Brien, A. Izidoro, S. A. Jacobson, S. N. Raymond and D. C. Rubie (2018). The Delivery of Water During Terrestrial Planet Formation. *Space Science Reviews* **214**, 47.
- R. A. Fischer, F. Nimmo and D. P. O'Brien. Radial Mixing and Ru-Mo Isotope Systematics under Different Accretion Scenarios (2018). *Earth and Planetary Science Letters* **482**, pp. 105-114.
- J. E. C. Scully, D. L. Buczkowski, N. Schmedemann, C. A. Raymond, J. C. Castillo-Rogez, S. D. King, M. T. Bland, A. I. Ermakov, D. P. O'Brien, S. Marchi, A. Longobardo, C. T. Russell, R. R. Fu and M. Neveu (2017). Evidence for the Interior Evolution of Ceres from Geologic Analysis of Fractures. *Geophysical Research Letters* **44**, pp. 9564-9572.
- B. E. Schmidt, K. H. G. Hughson, H. T. Chilton, J. E. C. Scully, T. Platz, A. Nathues, H. Sizemore, M. T. Bland, S. Byrne, S. Marchi, D. P. O'Brien, N. Schorghofer, H. Hiesinger, R. Jaumann, J. H. Pasckert, J. D. Lawrence, D. Buczkowski, J. C. Castillo-Rogez, M. V. Sykes, P. M. Schenk, M. C. DeSanctis, G. Mitri, M. Formisano, J.-Y. Li, V. Reddy, L. LeCorre, C. T. Russell and C. A. Raymond (2017). Geomorphological Evidence for Ground Ice on Dwarf Planet Ceres. *Nature Geoscience* **10**, pp. 338-343.
- H. Hiesinger, S. Marchi, N. Schmedemann, P. Schenk, J. H. Pasckert, A. Neesemann, D. P. O'Brien, T. Kneissl, A. I. Ermakov, R. R. Fu, M. T. Bland, A. Nathues, T. Platz, D. A. Williams, R. Jaumann, J. C. Castillo-Rogez, O. Ruesch, B. Schmidt, R. S. Park, F. Preusker, D. L. Buczkowski, C. T. Russell and C. A. Raymond (2016). Cratering on Ceres: Implications for its Crust and Evolution. *Science* **353**, ID: aaf4758.
- O. Ruesch, T. Platz, P. Schenk, L. A. McFadden, J. C. Castillo-Rogez, L. C. Quick, S. Byrne, F. Preusker, D. P. O'Brien, N. Schmedemann, D. A. Williams, J.-Y. Li, M. T. Bland, H. Hiesinger, T. Kneissl, A. Neesemann, M. Schaefer, J. H. Pasckert, B. E. Schmidt, D. L. Buczkowski, M. V. Sykes, A. Nathues, T. Roatsch, M. Hoffmann, C. A. Raymond and C. T. Russell (2016). Cryovolcanism on Ceres. *Science* **353**, ID: aaf4286.
- D. L. Buczkowski, B. E. Schmidt, D. A. Williams, S. C. Mest, J. E. C. Scully, A. I. Ermakov, F. Preusker, P. Schenk, K. A. Otto, H. Hiesinger, D. P. O'Brien, S. Marchi, H. Sizemore, K. Hughson, H. Chilton, M. Bland, S. Byrne, N. Schorghofer, T. Platz, R. Jaumann, T. Roatsch, M. V. Sykes, A. Nathues,

- M. C. De Sanctis, C. A. Raymond and C. T. Russell (2016). The Geomorphology of Ceres. *Science* **353**, ID: aaf4332.
- S. Marchi, A. I. Ermakov, C. A. Raymond, R. R. Fu, D. P. O'Brien, M. T. Bland, E. Ammannito, M. C. De Sanctis, T. Bowling, P. Schenk, J. E. C. Scully, D. L. Buczkowski, D. A. Williams, H. Hiesinger and C. T. Russell (2016). The Missing Large Impact Craters on Ceres. *Nature Communications* **7**, ID: 12257.
- A. Morbidelli, K. J. Walsh, D. P. O'Brien, D. A. Minton and W. F. Bottke (2015). The Dynamical Evolution of the Asteroid Belt. *Asteroids IV*, P. Michel, F. DeMeo and W. F. Bottke, eds., University of Arizona Press, pp. 493-507.
- W. F. Bottke, M. Broz, D. P. O'Brien, A. Campo Bagatin, A. Morbidelli and S. Marchi (2015). The Collisional Evolution of the Main Asteroid Belt. *Asteroids IV*, P. Michel, F. DeMeo and W. F. Bottke, eds., University of Arizona Press, pp. 701-724.
- A. Nathues, M. Hoffmann, M. Schaefer, L. Le Corre, V. Reddy, T. Platz, E. A. Cloutis, U. Christensen, T. Kneissl, J.-Y. Li, K. Mengel, N. Schmedemann, T. Schaefer, C. T. Russell, D. M. Applin, D. L. Buczkowski, M. R. M. Izawa, H. U. Keller, D. P. O'Brien, C. M. Pieters, C. A. Raymond, J. Ripken, P. M. Schenk, B. E. Schmidt, H. Sierks, M. V. Sykes, G. S. Thangjam and J.-B. Vincent (2015). Sublimation in bright spots on (1) Ceres. *Nature* **528**, pp. 237-240.
- L. A. McFadden, D. R. Skillman, N. Memarsadeghi, J.-Y. Li, S. P. Joy, C. A. Polanskey, M. D. Rayman, M. V. Sykes, P. Tricarico, E. Palmer, D. P. O'Brien, S. Mottola, U. Carsenty, M. Mutchler, B. McLean, S. E. Schroeder, N. Mastrodemos, C. Schiff, H. U. Keller, A. Nathues, P. Gutierrez-Marques, C. A. Raymond and C. T. Russell (2015). Vesta's Missing Moons: Comprehensive Search for Natural Satellites of Vesta by the Dawn Spacecraft. *Icarus* **257**, pp. 207-216.
- P. Michel, M. Jutzi, D. C. Richardson, C. A. Goodrich, W. K. Hartmann and D. P. O'Brien (2015). Selective Sampling During Catastrophic Disruption: Mapping the Location of Reaccumulated Fragments in the Original Parent Body. *Planetary and Space Science* **107**, pp. 24-28.
- C. A. Goodrich, W. K. Hartmann, D. P. O'Brien, S. J. Weidenschilling, L. Wilson, P. Michel and M. Jutzi (2015). Origin and History of Ureilitic Material in the Solar System: The View from Asteroid 2008 TC₃ and the Almahata Sitta Meteorite. *Meteoritics and Planetary Science* **50**, pp. 782-809.
- D. C. Rubie, S. A. Jacobson, A. Morbidelli, D. P. O'Brien, E. D. Young, J. de Vries, F. Nimmo, H. Palme and D. J. Frost (2015). Accretion and Differentiation of the Terrestrial Planets with Implications for the Compositions of Early-Formed Solar System Bodies and Accretion of Water. *Icarus* **248**, pp. 89-108.
- D. P. O'Brien, S. Marchi, A. Morbidelli, W. F. Bottke, P. M. Schenk, C. T. Russell and C. A. Raymond (2014). Constraining the Cratering Chronology of Vesta. *Planetary and Space Science* **103**, pp. 131-142.
- D. A. Williams, D. P. O'Brien, P. M. Schenk, B. W. Denevi, U. Carsenty, S. Marchi, J. E. C. Scully, R. Jaumann, M. C. De Sanctis, E. Palomba, E. Ammannito, A. Longobardo, G. Magni, A. Frigeri, C. T. Russell, C. A. Raymond, T. M. Davison and the Dawn Science Team (2014). Lobate and Flow-Like Features on Asteroid Vesta. *Planetary and Space Science* **103**, pp. 24-35.
- S. Marchi, W. F. Bottke, D. P. O'Brien, P. Schenk, S. Mottola, M. C. De Sanctis, D. A. Kring, D. A. Williams, C. A. Raymond and C. T. Russell (2014). Small Crater Populations on Vesta. *Planetary and Space Science* **103**, pp. 96-103.

- J.-B. Vincent, P. Schenk, A. Nathues, H. Sierks, M. Hoffmann, R. W. Gaskell, S. Marchi, D. P. O'Brien, M. V. Sykes, C. T. Russell, M. Fulchignoni, H. U. Keller, C. A. Raymond, E. Palmer and F. Preusker (2014). Crater Depth-to-Diameter Distribution and Surface Properties of (4) Vesta. *Planetary and Space Science* **103**, pp. 57-65.
- D. T. Blewett, D. L. Buczkowski, O. Ruesch, J. E. Scully, D. P. O'Brien, R. Gaskell, T. Roatsch, T. J. Bowling, A. Ermakov, H. Hiesinger, D. A. Williams, C. A. Raymond and C. T. Russell (2014). Vesta's North Pole Quadrangle Av-1 (Albana): Geologic Map and the Nature of the South Polar Basin Antipodes. *Icarus* **244**, pp. 13-22.
- D. P. O'Brien, K. J. Walsh, A. Morbidelli, S. N. Raymond and A. M. Mandell (2014). Water Delivery and Giant Impacts in the 'Grand Tack' Scenario. *Icarus* **239**, pp. 74-84.
- V. Reddy, J. A. Sanchez, W. F. Bottke, E. A. Cloutis, M. R. M. Izawa, D. P. O'Brien, P. Mann, M. Cuddy, L. Le Corre, M. J. Gaffey and G. Fujihara (2014). Chelyabinsk Meteorite Explains Unusual Spectral Properties of Baptistina Asteroid Family. *Icarus* **237**, pp. 116-130.
- S. A. Jacobson, A. Morbidelli, S. N. Raymond, D. P. O'Brien, K. J. Walsh and D. C. Rubie (2014). Highly Siderophile Elements in the Earth's Mantle as a Clock for the Moon-forming Impact. *Nature* **508**, pp. 84-87.
- C. A. Goodrich, A. Bischoff and D. P. O'Brien (2014). Asteroid 2008 TC₃ and the Fall of Almahata Sitta, a Unique Meteorite Breccia. *Elements* **10**, pp. 31-37.
- F. J. Ciesla, T. M. Davison, G. S. Collins and D. P. O'Brien (2013). Thermal Consequences of Impacts in the Early Solar System. *Meteoritics and Planetary Science* **48**, pp. 2559-2576.
- C. T. Russell, C. A. Raymond, R. Jaumann, H. Y. McSween, M. C. DeSanctis, A. Nathues, T. H. Prettyman, E. Ammannito, V. Reddy, F. Preusker, D. P. O'Brien, S. Marchi, B. W. Denevi, D. L. Buczkowski, C. M. Pieters, T. B. McCord, J.-Y. Li, D. W. Mittlefehldt, J.-P. Combe, D. A. Williams, H. Hiesinger, R. A. Yingst, C. A. Polansky and S. P. Joy (2013). Dawn Completes its Mission at 4 Vesta. *Meteoritics and Planetary Science* **48**, pp. 2076-2089.
- T. M. Davison, D. P. O'Brien, F. J. Ciesla and G. S. Collins (2013). The Early Impact Histories of Meteorite Parent Bodies. *Meteoritics and Planetary Science* **48**, pp. 1894-1981.
- B. J. Buratti, P. A. Dalba, M. D. Hicks, V. Reddy, M. V. Sykes, T. B. McCord, D. P. O'Brien, C. M. Pieters, T. H. Prettyman, L. A. McFadden, A. Nathues, L. Le Corre, S. Marchi, C. A. Raymond and C. T. Russell (2013). Vesta, Vestoids, and the HED Meteorites: Interconnections and Differences based on Dawn Framing Camera Observations. *Journal of Geophysical Research: Planets* **118**, pp. 1991-2003.
- T. J. Bowling, B. C. Johnson, H. J. Melosh, B. A. Ivanov, D. P. O'Brien, R. Gaskell and S. Marchi (2013). Antipodal Terrains Created by the Rheasilvia Basin Forming Impact on Asteroid 4 Vesta. *Journal of Geophysical Research: Planets* **118**, pp. 1821-1834.
- L. Le Corre, V. Reddy, N. Schmedemann, K. J. Becker, D. P. O'Brien, N. Yamashita, P. N. Peplowski, T. H. Prettyman, J.-Y. Li, E. A. Cloutis, B. W. Denevi, T. Kneissl, E. Palmer, R. W. Gaskell, A. Nathues, M. J. Gaffey, D. W. Mittlefehldt, W. B. Garry, H. Sierks, C. T. Russell and C. A. Raymond (2013). Olivine or Impact Melt: Nature of the "Orange" Material on Vesta from Dawn. *Icarus* **226**, pp. 1568-1594.
- S. Marchi, W. F. Bottke, B. A. Cohen, K. Wunnemann, D. A. Kring, H. Y. McSween, M. C. De Sanctis, D. P. O'Brien, P. Schenk, C. A. Raymond and C. T. Russell (2013). High-Velocity Collisions from the Lunar Cataclysm Recorded in Asteroidal Meteorites. *Nature Geoscience* **6**, pp. 303-307.

- H. Y. McSween Jr., E. Ammannito, V. Reddy, T. H. Prettyman, A. W. Beck, M. C. De Sanctis, A. Nathues, L. Le Corre, D. P. O'Brien, N. Yamashita, T. J. McCoy, D. W. Mittlefehldt, M. J. Toplis, P. Schenk, E. Palomba, D. Turrini, F. Tosi, F. Zambon, A. Longobardo, F. Capaccioni, C. A. Raymond and C. T. Russell (2013). Composition of the Rheasilvia Basin, a Window Into Vesta's Interior. *Journal of Geophysical Research: Planets* **118**, pp. 335-346.
- K. J. Walsh, A. Morbidelli, S. N. Raymond, D. P. O'Brien and A. M. Mandell (2012). Populating the Asteroid Belt from two Parent Source Regions due to the Migration of Giant Planets—"The Grand Tack". *Meteoritics and Planetary Science* **47**, pp. 1941-1947.
- V. Reddy, L. Le Corre, D. P. O'Brien, A. Nathues, E. A. Cloutis, D. D. Durda, W. F. Bottke, M. U. Bhatt, D. Nesvorny, D. Buczowski, J. E. C. Scully, E. M. Palmer, H. Sierks, P. J. Mann, K. J. Becker, A. W. Beck, D. Mittlefehldt, J.-Y. Li, R. Gaskell, C. T. Russell, M. J. Gaffey, H. Y. McSween, T. B. McCord, J.-P. Combe and D. Blewett (2012). Delivery of Dark Material to Vesta via Carbonaceous Chondritic Impacts. *Icarus* **221**, pp. 544-559.
- J. C. Carter-Bond, D. P. O'Brien and S. N. Raymond (2012). The Compositional Diversity of Extrasolar Terrestrial Planets. II. Migration Simulations. *The Astrophysical Journal* **760**, 44.
- B. W. Denevi, D. T. Blewett, D. L. Buczowski, F. Capaccioni, M. T. Capria, M. C. De Sanctis, W. B. Garry, R. W. Gaskell, L. Le Corre, J.-Y. Li, S. Marchi, T. J. McCoy, A. Nathues, D. P. O'Brien, N. E. Petro, C. M. Pieters, F. Preusker, C. A. Raymond, V. Reddy, C. T. Russell, P. Schenk, J. E. C. Scully, J. M. Sunshine, F. Tosi, D. A. Williams and D. Wyrick (2012). Pitted Terrain on Vesta and Implications for the Presence of Volatiles. *Science* **338**, pp. 246-249.
- T. Sasaki, J. W. Barnes and D. P. O'Brien. Outcomes and Duration of Tidal Evolution in a Star-Planet-Moon System (2012). *The Astrophysical Journal* **754**, 51.
- P. Schenk, D. P. O'Brien, S. Marchi, R. Gaskell, F. Preusker, T. Roatsch, R. Jaumann, D. L. Buczowski, T. B. McCord, H. Y. McSween, D. A. Williams, R. A. Yingst, C. A. Raymond and C. T. Russell (2012). The Geologically Recent Giant Impact Basins at Vesta's South Pole. *Science* **336**, pp. 694-697.
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- D. P. O'Brien (2016). Mechanisms for Water Delivery to Terrestrial Planets. Workshop on the Delivery of Water to Proto-planets, Planets and Satellites, International Space Science Institute, Bern, Switzerland.
- D. P. O'Brien, S. Marchi, A. Morbidelli, W. F. Bottke, P. Schenk, C. T. Russell and C. A. Raymond (2014). The Impact History of Vesta. Vesta in the Light of Dawn Workshop, Houston, TX, abstract no. 2049.
- D. P. O'Brien, S. Marchi, P. Schenk, R. Jaumann, H. Y. McSween, V. Reddy, B. W. Denevi, J.-B. Vincent, C. T. Russell and C. A. Raymond (2012). The Cratering History of Vesta. Geological Society of America Meeting, Charlotte, NC, abstract no. 225-2.
- 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, 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 (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

- H. G. Sizemore, D. P. O'Brien, A. Neesemann, D. A. Crown, D. C. Berman, D. L. Buczkowski and J. E. C. Scully (2021). High-Resolution Geologic Mapping of Urvara Crater, Ceres: Basemap, Crater Counting, and Feature Maps. Annual Meeting of Planetary Geologic Mappers, id. 7046.
- G. D. Mulders, D. P. O'Brien, F. J. Ciesla, D. Apai and I. Pascucci (2020). The Role of Planetesimals and Gas in the Orbital Assembly of Close-In Exoplanets. DPS Meeting 52, abstract no. 312.04.
- H. G. Sizemore, D. A. Crown, D. P. O'Brien, D. C. Berman, D. L. Buczkowski, J. E. C. Scully and A. Neesemann (2020). High-Resolution Geologic Mapping of Urvara Crater, Ceres. Annual Meeting of Planetary Geologic Mappers, id. 7036.
- G. D. Mulders, F. J. Ciesla, D. P. O'Brien, D. Apai and I. Pascucci (2020). The Role of Planetesimals and Gas in the Orbital Assembly of Close-In Exoplanets. American Astronomical Society Meeting 235, id. 224.07.
- M. C. Brennan, R. A. Fischer, F. Nimmo and D. P. O'Brien (2019). Martian Core Formation: Implications from the Hf-W System. Goldschmidt Conference, Barcelona, Spain, abstract no. 386.
- C. M. Pieters, J. C. Castillo, R. Jaumann, T. B. McCord, D. P. O'Brien, L. C. Quick, C. A. Raymond, C. T. Russell, P. Schenk, H. G. Sizemore, M. V. Sykes and D. A. Williams (2018). Sequence of Events During and After Emplacement of Cerealia Facula Deposits on Ceres. AGU Fall Meeting, Washington, DC, abstract no. P33D-3860.
- P. Schenk, H. G. Sizemore, D. Buczkowski, B. E. Schmidt, S. Marchi, D. P. O'Brien, L. C. Quick, C. M. Pieters, M. V. Sykes, C. A. Raymond and J. C. Castillo (2018). Occator Crater at 35 km Altitude: Dawn XM2 Mapping of a Pristine Impact Basin on a Hydrous Dwarf Planet. AGU Fall Meeting, Washington, DC, abstract no. P24A-02.
- J. E. C. Scully, D. A. Williams, D. Buczkowski, P. Schenk, B. E. Schmidt, H. Sizemore, M. E. Landis, M. Sori, J. H. Pasckert, A. Neesemann, D. P. O'Brien, J. C. Castillo, C. A. Raymond, C. T. Russell, R. Jaumann, K. Stephan, M. V. Sykes and The Dawn Team (2018). Ready for Their Close-up: Insights about Occator's Bright Faculae Derived from New, Highest Resolution Observations of Ceres. AGU Fall Meeting, Washington, DC, abstract no. P24A-03
- P. M. Schenk, B. E. Schmidt, H. G. Sizemore, C. M. Pieters, D. A. Williams, D. P. O'Brien, S. Marchi, C. T. Russell, J. C. Castillo-Rogez and C. A. Raymond (2018). Anatomy of a Large Impact Crater on a Dwarf Planet: XM2 Initial High-Resolution Mapping of Occator Crater from Dawn. Geological Society of America Meeting, Indianapolis, IN, abstract no. 238-9.

- J. E. C. Scully, D. A. Williams, D. Buczkowski, P. M. Schenk, B. E. Schmidt, H. G. Sizemore, M. Landis, M. M. Sori, J. H. Pasckert, A. Neesemann, D. P. O'Brien, J. C. Castillo-Rogez, C. A. Raymond, C. T. Russell, R. Jaumann, K. Stephan and M. V. Sykes (2018). New Insights About Occator's Bright Faculae Derived from Geologic Mapping of Highest Resolution Observations of Ceres. Geological Society of America Meeting, Indianapolis, IN, abstract no. 238-8.
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- R. A. Fischer, F. Nimmo and D. P. O'Brien (2018). What can the Hf-W System tell Us About the Mechanism and Timing of Earth's Core Formation? Differentiation: Building the Internal Architecture of Planets, Pasadena, California, abstract no. 4007.
- R. A. Fischer, F. Nimmo and D. P. O'Brien (2018). The Origin of the Moon's Earth-Like ^{182}W Isotopic Composition. LPSC 49, abstract no. 2195.
- G. D. Mulders, I. Pascucci, D. Apai, F. J. Ciesla and D. P. O'Brien (2017). Constraining Planet Formation Models from the Kepler Exoplanet Population. Habitable Worlds 2017: A System Science Workshop, Laramie, Wyoming, abstract no. 4047.
- R. A. Fischer, F. Nimmo and D. P. O'Brien (2017). Radial Mixing and Ru-Mo Isotope Systematics Under Different Accretion Scenarios. AGU Fall Meeting, New Orleans, LA, abstract no. 207223.
- P. Schenk, T. Platz, H. Hiesinger, D. P. O'Brien, S. Marchi, B. Schmidt, H. Sizemore, C. A. Raymond and C. T. Russell (2017). Ceres, Vesta, Saturn's Moons and the Role of Water Ice in Planetary Cratering. Asteroids, Comets, and Meteors Conference, Montevideo, Uruguay, abstract no. 1.a.5.
- T. M. Davison, E. Shivarani, G. S. Collins, D. P. O'Brien, F. J. Ciesla and P. A. Bland (2017). Collisional Histories of Small Planetesimals. LPSC 48, abstract no. 2296.
- R. A. Fischer, F. Nimmo, E. Cottrell and D. P. O'Brien (2016). Effects of Core Formation on the Hf-W system. AGU Fall Meeting, San Francisco, CA, abstract P51A-2122.
- P. Schenk, S. Marchi, D. P. O'Brien, T. Platz, M. T. Bland, D. Buczkowski, J. E. C. Scully, E. Ammannito, C. A. Raymond and C. T. Russell (2016). Impact Crater Morphology and the Central Pit/Dome of Occator: Ceres as an Ice-rich Body. AGU Fall Meeting, San Francisco, CA, abstract P41C-03.
- J. E. Scully, D. Buczkowski, N. Schmedemann, S. King, D. P. O'Brien, J. Castillo-Rogez, C. A. Raymond, S. Marchi, C. T. Russell, G. Mitri and M. T. Bland (2016). The Surface and Interior Evolution of Ceres Revealed by Fractures and Secondary Crater Chains. Joint DPS/EPSC Meeting, Pasadena, CA, abstract no. 321.02.
- S. Marchi, C. A. Raymond, R. Fu, A. I. Ermakov, D. P. O'Brien, M. C. De Sanctis, E. Ammannito and C. T. Russell (2016). Ceres' Internal Structure as Inferred from its Large Craters. Joint DPS/EPSC Meeting, Pasadena, CA, abstract no. 506.02.
- J. E. Richardson and D. P. O'Brien (2016). The Disposition of Impact Ejecta Resulting from the AIDA-DART Mission to Binary Asteroid 65803 Didymos: An Independent Investigation. Joint DPS/EPSC Meeting, Pasadena, CA, abstract no. 329.06.
- D. C. Rubie, S. A. Jacobson, A. Morbidelli, F. Nimmo, D. P. O'Brien, H. Palme, E. D. Young, D. J. Frost (2016). The Origin of Earth's Water. New Challenges in Volatile Cycling in the Deep Earth, Tohoku University, Japan.

- D. P. O'Brien, S. Marchi and P. M. Schenk (2016). The Lunar Chronology Cannot Be Directly Scaled to the Asteroid Belt. LPSC 47, abstract no. 2024.
- S. Marchi, D. P. O'Brien, P. M. Schenk, R. Fu, A. Ermakov, M. C. De Sanctis, E. Ammannito, D. A. Williams, S. C. Mest, C. A. Raymond and C. T. Russell (2016). Cratering on Ceres: The Puzzle of the Missing Large Craters. LPSC 47, abstract no. 1281.
- R. A. Fischer, F. Nimmo and D. P. O'Brien (2016). Radial Mixing Under Different Accretion Scenarios: Observational Constraints. LPSC 47, abstract no. 2454.
- P. Michel, M. Jutzi, C. A. Goodrich, D. P. O'Brien, D. C. Richardson and W. K. Hartmann (2016). Selective Sampling During Catastrophic Disruption: The Effect of the Parent Body's Size and the Impact Energy Regime. LPSC 47, abstract no. 1413.
- P. M. Schenk, S. Marchi, D. P. O'Brien, M. Bland, T. Platz, T. Hoogenboom, G. Kramer, S. Schroder, M. C. De Sanctis, D. Buczkowski, M. Sykes, L. A. McFadden, O. Ruesch, L. Le Corre, B. Schmidt, K. Hughson, C. T. Russell, J. Scully, and C. A. Raymond (2016). Impact Cratering on the Small Planets Ceres and Vesta: S-C Transitions, Central Pits, and the Origin of Bright Spots. LPSC 47, abstract no. 2697.
- J. E. C. Scully, C. A. Raymond, D. L. Buczkowski, D. P. O'Brien, G. Mitri, S. D. King, C. T. Russell and T. Platz (2016). Implications for the Geologic Evolution of Ceres, Derived from Global Geologic Mapping of Linear Features. LPSC 47, abstract no. 1618.
- B. Travis, W. Feldmen, H. Sizemore, D. P. O'Brien and M. Sykes (2015). Internal Convection on Ceres: A Possible Explanation for Dome Formation. AGU Fall Meeting, San Francisco, CA, abstract P53E-2192.
- S. Marchi, D. Williams, S. Mest, P. Schenk, D. P. O'Brien, M. C. De Sanctis, A. Ermakov, J. Castillo, R. Jaumann, A. Neesemann, H. Hiesinger, R. Park, T. Kneissl, N. Schmedemann, C. Raymond and C. Russell (2015). The Collisional History of Dwarf Planet Ceres Revealed by Dawn. AGU Fall Meeting, San Francisco, CA, abstract P53E-2185.
- H. Sizemore, D. Williams, T. Platz, D. P. O'Brien, S. Mest, R. A. Yingst, D. Crown, D. Buczkowski, P. Schenk, J. Scully, R. Jaumann, T. Roatsch, F. Preusker, A. Nathues, M. C. De Sanctis, C. Russell and C. Raymond (2015). Preliminary Geological Map of the Ac-H-13 Urvara Quadrangle of Ceres: An Integrated Mapping Study Using Dawn Spacecraft Data. AGU Fall Meeting, San Francisco, CA, abstract P53E-2180.
- S. Marchi, M. C. De Sanctis, D. P. O'Brien, E. Ammannito, J. Castillo-Rogez, R. Jaumann, P. Schenk, C. Raymond, C. Russell and R. Park (2015). The Origin of Dwarf Planet Ceres Constrained by Dawn. DPS Meeting 47, National Harbor, MD, abstract no. 103.03.
- H. Sizemore, D. A. Williams, T. Platz, D. P. O'Brien, S. Mest, D. Crown, R. A. Yingst, D. L. Buczkowski, P. M. Schenk and J. Scully (2015). Initial Geologic Mapping of the Ac-H-13 Urvara Quadrangle of Ceres Using Dawn Spacecraft Data. Geological Society of America Meeting, Baltimore, MD, abstract no. 308-13.
- P. Schenk, S. Marchi, D. P. O'Brien, O. Ruesch, M. Bland, J. C. Castillo-Rogez, H. Hiesinger, K. H. G. Hughson, L. Le Corre and J.-Y. Li (2015). An Ice-Rich Mantle on Ceres from Dawn Mapping of Central Pit and Peak Crater Morphologies. Geological Society of America Meeting, Baltimore, MD, abstract no. 282-5.
- P. Schenk, S. Marchi, D. P. O'Brien, K. Otto, R. Jaumann, D. Williams, C. Raymond and C. Russell (2015). Impact Craters on Ceres: Evidence for Water-Ice Mantle? European Planetary Science Congress, Nantes, France, abstract EPSC2015-400.

- C. A. Goodrich, A. M. Fioretti, D. P. O'Brien, M. Zolensky, P. Jenniskens and M. H. Shaddad (2015). Comparing the Foreign Clast Populations of Almahata Sitta and Typical Polymict Ureilites, with Implications. 78th Meteoritical Society Meeting, Berkeley, CA, abstract no. 5018.
- D. P. O'Brien, B. J. Travis, W. C. Feldman, M. V. Sykes, P. M. Schenk, S. Marchi, C. T. Russell and C. A. Raymond (2015). The Potential for Volcanism on Ceres due to Crustal Thickening and Pressurization of a Subsurface Ocean. LPSC 46, abstract no. 2831.
- T. M. Davison, G. S. Collins, D. P. O'Brien, F. J. Ciesla, P. A. Bland and B. J. Travis (2015). Impact Bombardment of Ceres. LPSC 46, abstract no. 2116.
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- D. P. O'Brien and K. J. Walsh (2014). Evaluating Different Scenarios for the Formation and Early Evolution of the Asteroid Belt. DPS Meeting 46, Tucson, AZ, abstract no. 414.14.
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- S. A. Jacobson, D. C. Rubie, A. Morbidelli, D. P. O'Brien, E. D. Young, J. de Vries, F. Nimmo, H. Palme and D. J. Frost (2014). Accretion and Core-Mantle Differentiation of the Earth and Other Terrestrial Planets. DPS Meeting 46, Tucson, AZ, abstract no. 504.03.
- A. Morbidelli, K. J. Walsh, D. P. O'Brien, D. A. Minton and W. F. Bottke (2014). Dynamical Evolution of the Asteroid Belt. Asteroids, Comets, and Meteors Conference, Helsinki, Finland, abstract no. 5793.
- W. F. Bottke, M. Broz, D. P. O'Brien, A. Campo Bagatin and A. Morbidelli (2014). Exploring the Collisional Evolution of the Asteroid Belt. Asteroids, Comets, and Meteors Conference, Helsinki, Finland, abstract no. 6809.
- S. A. Jacobson, A. Morbidelli, D. C. Rubie, D. P. O'Brien, S. Raymond, S. Stewart and S. Lock (2014). Planet Formation Within the Grand Tack Model. LPSC 45, abstract no. 2274.
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- P. Schenk, D. P. O'Brien, H. Y. McSween, D. Buczkowski, R. Gaskell, K. Otto, F. Preusker, S. Marchi, A. Yingst, S. Mest, C. A. Raymond and C. T Russell (2014). Megascale Impacts in Vesta's South Pole: The Morphologic Constraints. Vesta in the Light of Dawn Workshop, Houston, TX, abstract no. 2039.