

Professor John William Hernlund

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Education:

- **Ph.D., Geophysics and Space Physics**–University of California, Los Angeles, 2006
Los Angeles, CA
 - Thesis: Dynamics Associated with Partial Melting in Earth’s Uppermost and Lowermost Mantle and the Structure and Phase Relationships in Earth’s D” Layer.
 - Ph.D. Advisor: Paul J. Tackley; Ph.D. Committee: Abby Kavner, Paul Roberts, Gerald Schubert
 - **M.S., Geophysics and Space Physics**–University of California, Los Angeles, 2005
Los Angeles, CA
 - Qualification by Oral Examination
 - M.S. Advisor: Paul J. Tackley.
 - **B.S., Geology**–Arizona State University, Barrett Honors College, 2000
Tempe, AZ
 - Graduation Honors: Magna Cum Laude
 - Thesis: Development of Experimental Methods to Measure the Electrical Conductivity of Olivine at High Pressure and Temperature
 - Advisor: Professor James A. Tyburczy.
 - ASU Geology field camp, 1999, Professor Donald M. Burt.
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Professional Experience:

- **Full Professor (Tenured), January 2017-Present**–Earth-Life Science Institute, Tokyo Institute of Technology
Tokyo, Japan
 - Teaching duties: 1-2 seminar courses per year and supervision of graduate students.
 - Teaching affiliation: Department of Earth and Planetary Sciences.
- **Vice Director, October 2014-Present**–Earth-Life Science Institute, Tokyo Institute of Technology
Tokyo, Japan
 - Shared responsibility for managing ~100-employee institute, along with the Director (Kei Hirose) and one other Vice Director (Shigeru Ida).
 - Responsibilities: Scientific strategy, international relations, reporting and oversight, international recruitment, human relations, public relations, visitors, workshops.
- **Principal Investigator, August 2013-Present**–Earth-Life Science Institute, Tokyo Institute of Technology
Tokyo, Japan
 - First full-time non-Japanese PI to join ELSI, during the start-up period.
 - Research highlights: Bridgmanite-Enriched Ancient Mantle Structures (BEAMS) Model; Core Formation, Stratification and Mixing; SiO₂ Crystallization in the Core.

- **Project Specialist, 2012-2013**–University of California, Berkeley
Berkeley, California
 - Principal investigator, National Science Foundation funded grant on core evolution.
 - Research highlights: High Core Conductivity; Melt Accumulation at Lithosphere-Asthenosphere Boundary; Inner Core Snow Models.
 - **Post-Doctoral Fellow, 2009-2012**–University of California, Berkeley
Berkeley, California
 - National Science Foundation funded grant on basal magma ocean evolution.
 - Research highlights: Partitioning and Fractionation in Basal Magma Oceans; Deep Mantle Thermal Conductivity, Limits on Exoplanet Dynamos.
 - **Post-Doctoral Fellow, 2007-2009**–University of British Columbia
Vancouver, Canada
 - Fellow, Canadian Institute for Advanced Research, Earth Systems Evolution Program
 - Research highlights: ULVZ Melting and Dynamics; CMB Heat Flow; Melt Ponding in Transition Zone; Spherical Annulus.
 - **Post-Doctorant, 2006-2007**–Institut de Physique du Globe de Paris
Paris, France
 - Affiliated with Laboratoire Dynamique des Systèmes Géologiques.
 - Research highlights: Basal Magma Ocean; Core Temperature Limits; Deep Mantle Seismic Velocity Distributions.
 - **Graduate Student Researcher, 2001-2006**–University of California, Los Angeles
Los Angeles, California
 - Member of the legendary UCLA Geodynamics group.
 - Research highlights: Post-Perovskite Double-Crossing Model; Theory of Decompression Melting Instabilities; Cubed Sphere Code.
 - **Undergraduate Researcher, 1997-2000**–Arizona State University
Tempe, Arizona
 - Employed half-time conducting experiments in the ASU high pressure laboratory.
 - Research highlights: Multi-Anvil Thermal Model; High-Pressure Experiment Development.
 - Other activities: Built Geology Department Website; Installed Seismograph for Public Display.
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Scholarly Awards:

- **Jason Morgan Early Career Award**, American Geophysical Union, 2010.
 - **Durk Doornbos Memorial Prize**, International Union of Geodesy and Geophysics Committee on Study of the Earth's Deep Interior, 2008.
 - **Young Researcher Fellowship Award**, Massachusetts Institute of Technology Conference on Computational Fluid and Solid Mechanics, 2003.
 - **Graduation Award**, College of Liberal Arts and Sciences, Arizona State University, 2000.
 - **Sun Devil Star Award**, Arizona State University, 1999.
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Community Service Activities and Awards:

- **Reviewer**, Over 300 manuscripts and more than 70 research proposals, 2003-present.
- **Chair and Organizer**, Magma Oceanology Workshop, July, 2016.

- **Co-Chair and Organizer**, Workshop on Transport Properties in the Earth's Core, October, 2013.
 - **Editorial Board**, *Physics of the Earth and Planetary Interiors*, 2013-present.
 - **Citation for Excellence in Refereeing**, *Geochemistry, Geophysics, Geosystems*, American Geophysical Union, 2012.
 - **Chair**, Gordon Research Seminar on Interior of the Earth, June, 2011.
 - **Co-Chair**, Workshop on Geodynamics of the Lithosphere and Deep Earth (GLADE), July, 2010.
 - **Citation for Excellence in Refereeing**, *Geophysical Research Letters*, American Geophysical Union, 2008.
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Institutional Service:

- **Vice Director**, Shared responsibility for establishing and managing an inter-disciplinary institute with ≈ 100 staff, 2014-Present.
 - **Chair**, ELSI Recruitment (Led recruitment of 30+ junior scientists and 6 senior scientists as committee chair), 2013-Present.
 - **Chair**, ELSI Events and Visitors (Oversee ELSI symposia, workshops, and visitors programs as committee chair), 2013-Present.
 - **Chair**, ELSI Relations (Managed public relations, outreach, international partnerships as committee chair), 2014-2016.
 - **Chair**, ELSI Organizational Reform (Complete administrative re-organization of the growing institute), 2014.
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Grants Awarded:

- **Title:** Possibility of Terrestrial Exoplanet Magnetic Fields in Light of New Discoveries
Funding Agency: Astrobiology Center of Japan
Award: \approx \$8,000 **Grant Period:** 2017-2018 **Role:** PI.
- **Title:** Core-Mantle Evolution
Funding Agency: Japan Society for the Promotion of Science
Award: \approx \$1,000,000 **Grant Period:** 2015-2020 **Role:** Co-I.
- **Title:** Development of small-size detector for anti-neutrino directionality and construction of "Particle Geoscience"
Funding Agency: Earthquake Research Institute (ERI), University of Tokyo
Award: \approx \$11,000 **Grant Period:** 2015-2016 **Role:** Co-I (1 of 10).
- **Title:** Earth-Life Science Institute, World Premiere International Research Center
Funding Agency: Ministry of Education, Culture, Sports, Science, and Technology (Japan)
Award: \approx \$100,000,000 **Grant Period:** 2012-2021 **Role:** co-PI and Vice Director.
- **Title:** CSEDI: Combined Geodynamical and Seismological Modeling of the Inner Core Boundary Region
Funding Agency: National Science Foundation
Award: \$434,941 **Grant Period:** 2012-2015 **Role:** PI (Co-I: Vernon Cormier).
- **Title:** CSEDI: Melt stability and dynamics in the deep Earth
Funding Agency: National Science Foundation
Award: \$250,061 **Grant Period:** 2009-2011 **Role:** Author (PI: Michael Manga).

- **Title:** Heat transfer and phase relations in the Earth's deep interior
Funding Agency: Ministry of Higher Education and Research (France)
Award: ≈\$100,000 **Grant Period:** 2006-2007 **Role:** Proposer (Host Stéphane Labrosse).
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Current and Former Researchers in Geodynamics:

- **Dr. Marine Lasbleis** (France), Core and Magma Ocean Evolution, 2015-Present.
 - **Dr. Maxim Ballmer** (Germany), Geodynamics, 2014-2015 (now at ETH-Zurich).
 - **Dr. Matthieu Laneuville** (France), Planetary Evolution, 2014-Present.
 - **Dr. Hiroki Ichikawa** (Japan), Computational Geophysics, 2013-Present.
 - **Dr. Christine Houser** (USA), Global Seismology, 2013-Present.
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Graduate Students Supervised:

- **Irene Bonati**, Ph.D. (2017-Present).
- **Scott D. Hull**, Masters, Ohio State Univ. (2017-Present; co-supervised with Wendy Panero).

Student Mentoring and/or Internships:

- **Jac Van Driel**, University College London (2016).
 - **Maude Geissman**, Ecole Normale Supérieure de Paris (2016).
 - **Marine Lasbleis**, Ecole Normale Supérieure de Lyon (2011-2015).
 - **Hitoshi Gomi**, Tokyo Institute of Technology (2011-2013).
 - **Ryuichi Nomura**, Tokyo Institute of Technology (2010-2011).
 - **Emma Rainey**, University of California, Los Angeles (2009-2014).
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Lecture Course Experience:

- **Guest Lecturer, 2016**–Tokyo Institute of Technology
Tokyo, Japan
 - Prepared and delivered 3 lectures for a team-style seminar course.
- **Guest Professor, 2015**–Kyushu University
Fukuoka, Japan
 - Prepared and taught a lecture course titled “The Core-Mantle Boundary.”
- **Guest Lecturer, 2015**–Tokyo Institute of Technology
Tokyo, Japan
 - Prepared and delivered lectures for a team-style seminar course.
- **Co-Organizer, 2014**–ELSI Summer School on Computational Methods
Tokyo, Japan
 - In partnership with the Computational Infrastructure in Geodynamics (UC Davis).
- **Guest Lecturer, 2014**–Tokyo Institute of Technology
Tokyo, Japan
 - Prepared and delivered lectures for a team-style seminar course.
- **Teaching Assistant, 2005**–University of California, Los Angeles
Los Angeles, California
 - ESS10: Exploring Mars, the Red Planet, with Rubie Professor Ashwin Vasavada.

- **Teaching Assistant, 2001**—University of California, Los Angeles
Los Angeles, California
 - ESS1: Introduction to Earth and Space Sciences, under Professor Peter Bird.
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Publications:

- **Submitted, in Revision, or Accepted for Publication:**

- Hirose, K., R. Sinmyo, and J. Hernlund, Perovskite in Earth's Deep Interior, *Science*, in press, 2017.
- Laneuville, M., J. Hernlund, S. Labrosse, and N. Guttenberg, Crystallization of a compositionally stratified basal magma ocean, *Phys. Earth Planet. Inter.*, in press, 2017.

- **Published:**

- Jacobson, S., D. Rubie, J. Hernlund, A. Morbidelli, and M. Nakajima, Formation, stratification and mixing of the cores of Earth and Venus, *Earth Planet. Sci. Lett.*, **474**:375-386, 2017.
- Ballmer, M.D., C. Houser, J. Hernlund, R. Wentzcovitch, K. Hirose, Persistence of strong silica-enriched domains in the Earth's lower mantle, *Nature Geoscience*, **10**:236-240, 2017.
- Hirose, K., G. Morard, R. Sinmyo, K. Umemoto, J. Hernlund, G. Helffrich, S. Labrosse, SiO₂ crystallization and compositional evolution of the Earth's core, *Nature*, **543**:99-102, 2017.
- Hernlund, J.W., Chemistry of Core-Mantle Boundary, in *Deep Earth: Physics and Chemistry of the Lower Mantle and Core*, R. Fischer and H. Terasaki (eds.), American Geophysical Union Monograph, 201-208, 2016.
- Scharf, C., N. Virgo, H.J.II Cleaves, M. Aono, et al., A strategy for origins of life research, *Astrobiology*, **15**:1031-1042, 2015.
- Labrosse, S., J.W. Hernlund, and K. Hirose, Fractional Melting and Freezing in the Deep Mantle and Implications for the Formation of a Basal Magma Ocean, in *The Early Earth: Accretion and Differentiation*, Geophysical Monograph 212, J. Badro and M. Walter (eds.), American Geophysical Union, 2015.
- Hernlund, J.W. and A.K. McNamara, Dynamics of the Core-Mantle Boundary Region, *Treatise on Geophysics*, 2nd Edition, **7**:461-519, 2015.
- Rainey, E.S.G., J. Hernlund, and A. Kavner, Temperature distributions in the laser-heated diamond anvil cell from 3-D numerical modeling, *J. Appl. Phys.*, **114**:204905, 2013.
- Sakamaki, T., A. Suzuki, E. Ohtani, H. Terasaki, S. Urakawa, Y. Katayama, K. Funakoshi, Y. Wang, J.W. Hernlund, M.D. Ballmer, Ponded melt at the boundary between the lithosphere and asthenosphere, *Nature Geoscience*, 10.1038/NGEO1982, 2013.
- Hirose, K., S. Labrosse, and J.W. Hernlund, Composition and state of the core, *Ann. Rev. Earth Planet. Sci.*, **41**:657-691, 2013.
- Gomi, H., K. Ohta, K. Hirose, S. Labrosse, R. Caracas, M.J. Verstraete, and J.W. Hernlund, The high conductivity of iron and thermal evolution of the Earth's core, *Phys. Earth Planet. Int.*, **224**:88-103, 2013.
- Hernlund, J., Deep Earth: Mantle fabric unravelled? *Nature Geosci.*, **6**:516-518, 2013.
- Ohta, K., T. Yagi, N. Taketoshi, K. Hirose, T. Komabayashi, T. Baba, Y. Ohishi, and J. Hernlund, Lattice thermal conductivity of MgSiO₃ perovskite and post-perovskite at the core-mantle boundary, *Earth Planet. Sci. Lett.* **349-350**:109-115, 2012.

- Coltice, N., M. Moreira, J. Hernlund, and S. Labrosse, Helium and Neon in mantle plumes record the crystallization of a basal magma ocean, *Earth Planet. Sci. Lett.*, **308**:193-199, 2011.
- Nomura, R., H. Ozawa, S. Tateno, K. Hirose, J. Hernlund, S. Muto, H. Ishii, and N. Hiraoka, Spin crossover and iron-rich silicate melt in the Earth's deep mantle, *Nature*, **473**:199-202, 2011.
- Gaidos, E., M. Manga, J.W. Hernlund, and C. Conrad, Thermodynamic limits on magnetodynamos in rocky exoplanets, *Astrophysical Journal*, **718**:596-609, 2010.
- Hernlund, J.W., On the interaction of the geotherm with a post-perovskite phase transition in the deep mantle, *Phys. Earth Planet. Inter.*, **180**:222-234, 2010.
- Hernlund, J.W. and A.M. Jellinek, Dynamics and structure of a stirred partially molten ultralow velocity zone, *Earth Planet. Sci. Lett.*, **296**:1-8, 2010.
- Lee, C-T., P. Luffi, T. Höink, J. Li, R. Dasgupta, J.W. Hernlund, Upside-down differentiation and generation of a primordial lower mantle, *Nature*, **463**:930-935, 2010.
- Hernlund, J.W. and P.J. Tackley, Modeling mantle convection in the 'Spherical Annulus', *Phys. Earth Planet. Inter.*, **171**: 48-54, 2008.
- Hernlund, J.W., P.J. Tackley, and D.J. Stevenson, Buoyant melting instabilities beneath extending lithosphere, 1. Numerical models, *J. Geophys. Res.*, **113**:B04405, 2008.
- Hernlund, J.W., D.J. Stevenson, and P.J. Tackley, Buoyant melting instabilities beneath extending lithosphere, 2. Linear analysis, *J. Geophys. Res.*, **113**:B04406, 2008.
- Hernlund, J.W. and C. Houser, On the distribution of seismic velocities in Earth's deep mantle, *Earth Planet. Sci. Lett.*, **265**:423-437, 2008.
- Lay, T., J. Hernlund, and B.A. Buffett, Core-mantle boundary heat flow, *Nature Geosci.*, **1**:25-32, 2008.
- Labrosse, S., J.W. Hernlund, and N. Coltice, A crystallizing dense magma ocean at the base of the Earth's mantle, *Nature*, **450**:866-869, 2007.
- Tackley, P.J., T. Nakagawa, and J.W. Hernlund, Influence of the post-perovskite transition on thermal and thermo-chemical mantle convection, *Post-Perovskite: The Last Mantle Phase Transition*, AGU Monograph, 2007.
- Hernlund, J.W. and P.J. Tackley, Some dynamical consequences of partial melting at the base of Earth's mantle, *Phys. Earth Planet. Inter.*, **162**:149-163, 2007.
- Hernlund, J.W. and S. Labrosse, Geophysically consistent values of the perovskite to post-perovskite transition Clapeyron slope, *Geophys. Res. Lett.*, **34**:L05309, 2007.
- Lay, T., J. Hernlund, E.J. Garnero, and M.S. Thorne, A post-perovskite lens and D" heat flux beneath the central Pacific, *Science*, **314**:1272-1276, 2006.
- Hernlund, J.W., K. Leinenweber, D. Locke, and J.A. Tyburczy, A numerical model for steady-state temperature distributions in solid-medium high-pressure cell assemblies, *American Mineralogist*, **91**:295-305, 2006.
- Tackley, P.J., S. Xie, T. Nakagawa, and J.W. Hernlund, Experimental studies of mantle convection: Philosophy, accomplishments and thermo-chemical structure and evolution, in: *Earth's Deep Mantle: Structure, Composition, and Evolution*, AGU Monograph, 85-102, 2005.
- Hernlund, J.W., C. Thomas, and P.J. Tackley, A doubling of the post-perovskite phase boundary and structure of the Earth's lowermost mantle, *Nature*, **434**:882-886, 2005.
- Hernlund, J.W. and P.J. Tackley, Three-dimensional spherical shell convection at infinite prandtl number using the 'Cubed Sphere' method. *Proceedings of the Second M.I.T. Conference on Computational Fluid and Solid Mechanics*, 2003.

- **Citation Statistics:**

- Google Scholar Profile (Click Link): <http://tinyurl.com/lte3slx>
 - Number of Citations: 2,282
 - H-Index: 20
 - Academic Age: 11 years since Ph.D.
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Invited Lectures and Seminars:

- Keynote, XV Workshop on Numerical Modelling of Lithosphere and Mantle Dynamics, the Netherlands (August 2017).
- Fundamentals of Life in the Universe Symposium, Groningen, the Netherlands (August 2017).
- Annual Wilson Lecture, Center for Earth Evolution and Dynamics, University of Oslo (August 2017).
- Accretion and Early Differentiation of the Earth and Terrestrial Planets, Nice, France (May-June 2017).
- Department of Earth Sciences Seminar, Hong Kong University (February 2017).
- Workshop on Planetary Diversity, Tokyo (November 2016).
- Before the Moon Workshop, Tokyo (November 2016).
- 1st Asia-Pacific Workshop on Lithosphere and Mantle Dynamics, Taipei (September 2016).
- Center for Earth Evolution and Dynamics, University of Oslo, (October 2016).
- Kyushu University, Fukuoka (November 2015).
- International Institute for Carbon Neutral Energy Research, Fukuoka (November 2015).
- Institute for the Physics and Mathematics of the Universe, Tokyo (July 2015).
- American Geophysical Union Fall Meeting, San Francisco (December 2014).
- Tohoku University, Sendai (November 2014).
- Geological Society of London, UK (September 2014).
- Bayerisches Geoinstitut, Bayreuth University, Germany (September 2014).
- 10th Anniversary of Post-Perovskite, Bristol University (May 2014).
- Earthquake Research Institute, Tokyo University (January 2014).
- American Geophysical Union Fall Meeting, San Francisco (December 2013).
- American Geophysical Union Fall Meeting, San Francisco (December 2012).
- California Institute of Technology, Pasadena (February 2012).
- American Geophysical Union Fall Meeting, San Francisco (December 2011).
- University of Utah, Salt Lake City (November 2011).
- University of California, Santa Cruz (April 2011).
- American Geophysical Union Fall Meeting, San Francisco (December 2010).
- Carnegie Institution of Washington, D.C. (November 2010).
- University of Maryland, Baltimore (November 2010).
- University of California, Davis (October 2010).
- European Geophysical Union Meeting, Vienna (May 2010).
- Yale University, Connecticut (April 2010).
- Tokyo Institute of Technology, Japan (March 2010).
- American Geophysical Union Fall Meeting, San Francisco (December 2009).
- Rice University, Houston (October 2009).
- University of California Department Colloquium, Berkeley (September 2009).
- European Workshop on Numerical Modeling of Mantle Convection and Lithospheric Dynamics, Switzerland (July 2009).
- COMPRES Annual Meeting Keynote Lecture, New Hampshire (June 2009).
- Tokyo Institute of Technology, Tokyo, (March 2009).
- Water Dynamics Symposium, Sendai (March 2009).
- Tohoko University, Sendai (February 2009).

- University of California, Los Angeles (February 2009).
- California Institute of Technology, Pasadena (February 2009).
- American Geophysical Union Fall Meeting, San Francisco (December 2008).
- Workshop on Transport Properties in Earth's Deep Mantle, Yunishigawa Onsen (October 2008).
- Goldschmidt Conference, Vancouver (July 2008).
- University of California, Santa Cruz (April 2008).
- Scripps Institution of Oceanography (April 2008).
- American Geophysical Union Fall Meeting, San Francisco (December 2007).
- University of Southern California, Los Angeles (November 2007).
- Earth and Ocean Sciences, University of Liverpool (March 2007).
- Laboratoire des Sciences de la Terre, École Normale Supérieure de Lyon (February 2007).
- Laboratoire de Géophysique Interne et Tectonophysique (LGIT), Grenoble (November 2006).
- Institut für Geophysik, Eidgenössische Technische Hochschule (ETH), Zürich (May 2006).
- Hewett Club Lecture, University of California, Riverside (October 2005).
- Geology Seminar, California State University, Northridge (September 2005).
- VLAB Workshop, University of Minnesota (July 2005).
- Earth and Planetary Sciences, Washington University (July 2005).
- Seismo-seminar, California Institute of Technology (June 2005).
- D.E.E.P. Seminar, Arizona State University (May 2005).
- Institute of Geophysics and Planetary Physics Seminar, Los Angeles (April 2005).