MATHIEU DUMBERRY

DEPARTMENT OF PHYSICS, UNIVERSITY OF ALBERTA
EDMONTON, AB · T6G 2E1 · CANADA
PHONE: +1-780-492-3987 · FAX: +1-780-492-0714 · E-MAIL: dumberry@ualberta.ca

PERSONAL

Place of Birth: Montréal, Québec, Canada. Citzenship: Canadian
Languages: fluent in French and English

EDUCATION

1999 – 2004 Harvard University Cambridge, MA, USA
Ph. D. in Geophysics, May 2004
Dissertation: *Torsional oscillations in the Earth's core: theory, observation and geodynamic consequences*
Principal advisor: Jeremy Bloxham

1995 – 1998 University of British Columbia Vancouver, BC, Canada
M. Sc. in Earth and Ocean Sciences, April 1998
Thesis: *Electromagnetic coupling between the fluid core and its solid neighbours*
Principal advisor: Bruce A. Buffett

1991 – 1994 Université de Sherbrooke Sherbrooke, QC, Canada
B. Sc. in Physics, December 1994
Internship advisor: Richard Marchand

PROFESSIONAL AND RESEARCH EXPERIENCE

2014 – present Physics, University of Alberta Edmonton, AB, Canada
Associate Professor

2015 ISTerre, Université Grenoble-Alpes Grenoble, France
Professeur Invité (sabbatical leave)

2008 – 2014 Physics, University of Alberta Edmonton, AB, Canada
Assistant Professor

2004 – 2007 SEE-IGT, University of Leeds Leeds, UK
NERC Postdoctoral Research Fellow

1999 – 2004 EPS, Harvard University Cambridge, MA, USA
Research and Teaching Assistant

1995 – 1998 EOS, University of British Columbia Vancouver, BC, Canada
Research Assistant

List of Publications

Peer-reviewed:

(1) Mitrovica, J. X., Hay, C.C., Morrow, E. Kopp, R. E, **Dumberry, M.** and Stanley, S., 2015, Reconciling past changes in Earth's rotation with 20th century global sea-level rise: resolving Munk's enigma, *Sci. Adv. 1*, e1500679.

(2) **Dumberry, M.** and Rivoldini, A., 2015, Mercury's inner core size and core-crystallization regime, *Icarus, 248*, 254–268.

(3) Davies, C. J., Stegman, D. R. and **Dumberry, M.**, 2014, The strength of gravitational core-mantle coupling, *Geophys. Res. Lett., 41*, 3786–3792, doi:10.1002/2014GL059836.

(4) Koot, L. and **Dumberry, M.**, 2013, The role of the magnetic field morphology on the electromagnetic coupling for nutations, *Geophys. J. Int.,195*, 200-210.

(5) Yseboodt, M., Rivoldini, A., Van Hoolst, T. and **Dumberry, M.**, 2013, Influence of an inner core on the long period forced librations of Mercury, *Icarus, 226*, 41-51.

(6) **Dumberry, M.**, Rivoldini, A., Van Hoolst, T. and Yseboodt, M., 2013, The role of Mercury's core density structure on its longitudinal librations, *Icarus, 225*, 62-74.

(7) Koning, A. H., and **Dumberry, M.**, 2013, Internal forcing of Mercury's long period free librations, *Icarus*, 223, 40–47.

(8) **Dumberry, M.** and Koot, L. 2012, A global model of electromagnetic coupling for Earth nutations, *Geophys. J. Int., 191*, 530-544.

(9) **Dumberry, M.**, 2011, The free librations of Mercury and the size of its inner core, *Geoph. Res. Lett., 38*, L16202, doi:10.1029/2011GL048277.

(10) Veasey, M., and **Dumberry, M.**, 2011, The influence of Mercury's inner core on its physical libration, *Icarus, 214*, 265-274.

(11) Koot, L., and **Dumberry, M.**, 2011, Viscosity of the Earth's inner core: constraints from nutation observations, *Earth Planet. Sci. Lett., 308*, 343-349.

(12) **Dumberry, M.**, 2011, A new twist on inner-core spin, *Nature Geoscience, 4*, 216-217.

(13) Aubert, A., and **Dumberry, M.**, 2011, Steady and fluctuating inner core rotation in numerical geodynamo models, *Geophys. J. Int., 184*, 162-170.

(14) Finlay, C.C., **Dumberry, M.**, Chulliat, A. and Pais, A., 2010, Short timescale core dynamics: theory and observations, *Space Sci. Rev., 155*, 177-218.

(15) **Dumberry, M.**, 2010, Gravitationally driven inner core differential rotation, *Earth Planet. Sci. Lett., 297*, 387-394.

(16) Koot, L., **Dumberry, M.**, Rivoldini, A., de Viron, O and Dehant, V., 2010, Constraints on the coupling at the core-mantle and inner core boundaries inferred from nutation observations, *Geophys. J. Int., 182*, 1279-1294.

(17) **Dumberry, M.** and Mound, J., 2010, Inner core - mantle gravitational locking and the super-rotation of the inner core, *Geophys. J. Int., 181*, 806-817.

(18) **Dumberry, M.**, 2010, Gravity variations induced by core flows, *Geophys. J. Int., 180*, 635-650.

(19) **Dumberry, M.**, 2009, Influence of elastic deformations on the inner core wobble, *Geophys. J. Int., 178*, 57–64.

(20) **Dumberry, M.**, 2009, Taylor's constraint and torsional oscillations, in *Les Houches, session LXXXVIII: Dynamos* . Eds P. Cardin and L. F. Cugliandolo, Elsevier, p383-401.

(21) **Dumberry, M.**, 2008, Gravitational torque on the inner core and decadal polar motion, *Geophys. J. Int., 172*, 903–920.

(22) **Dumberry, M.**, 2008, Variations in gravity caused by a tilt of the inner core, *Geophys. J. Int., 172*, 921–933.

(23) **Dumberry, M.** and Mound, J., 2008, Constraints on core-mantle electromagnetic coupling from torsional oscillations normal modes, *J. Geophys. Res., 113*, B03102, doi:10.1029/2007JB005135.

(24) **Dumberry, M.**, 2007, Geodynamic constraints on the steady and time-dependent inner core axial rotation, *Geophys. J. Int., 170*, 886-895.

(25) **Dumberry, M.**, 2007, Torsional oscillations, in *Encyclopedia of Geomagnetism and Paleomagnetism*, Gubbins, D and Herrero-Bervera, E. Eds., Springer, Dordrecht, The Netherlands, pp.746-748.

(26) **Dumberry, M.** and Finlay, C. C., 2007, Eastward and westward drift of the Earth's magnetic field for the last three millennia, *Earth Planet. Sci. Lett., 254*, 146-157.

(27) **Dumberry, M.** and Bloxham, J., 2006, Azimuthal flows in the Earth's core and changes in the length of day at millennial timescales, *Geophys. J. Int., 165*, 32-46.

(28) **Dumberry, M.**, 2005, Comment on "Could the $M_\omega = 9.3$ Sumatra earthquake trigger a geomagnetic jerk?", *EOS, 86*, 343.

(29) **Dumberry, M.** and Bloxham, J., 2004, Variations in the Earth's gravity field caused by torsional oscillations in the core. *Geophys. J. Int., 159*, 417-434.

(30) **Dumberry, M.** and Bloxham, J., 2003, Torque balance, Taylor's constraint and torsional oscillations in a numerical model of the geodynamo. *Phys. Earth Planet. Inter., 140*, 29-51.

(31) Bloxham, J., Zatman, S. and **Dumberry, M.**, 2002, The origin of geomagnetic jerks. *Nature, 420*, 65-68.

(32) **Dumberry, M.** and Bloxham, J., 2002, Inner core tilt and polar motion. *Geophys. J. Int., 151*, 377-392.

(33) Marchand, R., Charbonneau-Lefort, M., **Dumberry, M.** and Pronovost, B., 2001, ARANEA, a program for generating unstructured triangular meshes with JAVA Graphics User Interface. *Comput. Phys. Comm., 139*, 172-195.

(34) **Dumberry, M.** and Buffett, B. A., 1999, On the validity of the geostrophic approximation for calculating the changes in the angular momentum of the core. *Phys. Earth Planet. Inter., 112*, 81-99.

(35) Marchand, R. and **Dumberry, M.**, 1996, CARRE: a quasi-orthogonal mesh generator for 2D edge plasma modelling. *Comput. Phys. Comm., 96*, 232-246.

(36) Marchand, R., **Dumberry, M.**, Demers, Y., Côté, C., Le Clair, G., Larsen, J.-M., Bonnin, X. and Braams, B. J., 1995, Up-down symmetry in double null divertor experiments and magnetic field topology. *Nucl. Fusion, 35*, 297-304.

Submitted articles:

(37) **Dumberry, M.**, Earth Rotation, Excitation, Core, *submitted to Encyclopedia of Geodesy*.

(38) **Dumberry, M.**, and Wieczorek, M. A., The forced precession of the Moon's inner core, *submitted to J. Geophys. Res. Planets*.

Fellowships, Awards and Academic Honors

- Professeur Invité, Université Grenoble-Alpes, Grenoble, France, February – July 2015.
- Visiting professor fellowship, Inst. Physique du Globe, Paris, France, Oct. – Nov. 2014
- Discovery grants, NSERC, 2008 – 2013, 2013–2018
- Best Young Scientist Award, Canadian Geophysical Union, May 2013
- Awarded the "Zatman lecture" (young scientist award), SEDI, Kunming, China, July 2008.
- Postdoctoral Fellowship, NERC (UK), 2004 – 2007.
- Outstanding student paper award, Geodesy Section, AGU Fall Meeting, 2002.
- Certificate of Excellence in Teaching, Harvard University, Fall of 2000 and Spring of 2001.
- Ph. D. Scholarship, FCAR (Québec), 2001 – 2002.
- Ph. D. Scholarship, NSERC (Canada), 1999 – 2001.
- M. Sc. Scholarship, FCAR (Québec), 1995 – 1997.

Invited Seminars

- Department of Physics, University of Münster, Germany, June 2015
- Institute of Geophysics, ETH, Zurich, Switzerland, May 2015
- Institut des Sciences de la Terre, Université Grenoble-Alpes, Grenoble, France, March 2015
- Institut de Physique du Globe, Paris, France, January 2015
- School of Earth and Environment, University of Leeds, Leeds, UK, September 2014
- Dept. Sci. de la Terre et de l'Atmosphère, Univ. du Québec, Montréal, Canada, Sept. 2014
- Dept. of Earth and Planetary Sciences, McGill University, Montréal, Canada, Sept. 2014
- Département de Physique, Université de Montréal, Montréal, Canada, Sept. 2014
- Department of Physics, University of Alberta, Edmonton, Canada, September 2013
- Department of Physics, University of Toronto, Toronto, Canada, March 2013
- Div. Geology and Planetary Sciences, CalTech, Los Angeles, USA, Oct. 2010
- Earth, Planetary and Space Sciences, UCLA, Los Angeles, USA, Oct. 2010
- School of Environmental Sciences, University of Liverpool, Liverpool, UK, Nov. 2007
- Department of Geosciences, Princeton University, Princeton, USA, March 2007
- School of Geosciences, University of Edinburgh, Edinburgh, UK, February 2007
- Department of Physics, University of Alberta, Edmonton, Canada, January 2007
- Institut de Physique du Globe, Strasbourg, France, November 2006
- Dept. Sci. de la Terre et de l'Atmosphère, Univ. du Québec, Montréal, Canada, Oct. 2006
- Earth, Planetary and Space Sciences, UCLA, Los Angeles, USA, March 2006
- School of Mathematics and Statistics, University of Newcastle, Newcastle, UK, Nov. 2005
- Department of Physics, University of Toronto, Toronto, Canada, March 2005
- School of Earth and Environment, University of Leeds, Leeds, UK, February 2005
- Department of Earth Sciences, University College London, London, UK, January 2005
- Department of Geosciences, Princeton University, Princeton, USA, April 2004
- Dept. Sci. de la Terre et de l'Atmosphère, Univ. du Québec, Montréal, Canada, Nov. 2003
- Earth, Environmental and Planetary Sci., Brown Univ., Providence, USA, March 2002.

Invited oral presentations at international conferences

- A generalized quasi-geostrophic model of thermal convection, AGU fall meeting, San Francisco, CA, USA, December 2015
- Earth's core contribution to variations in length of day, AGU fall meeting, San Francisco, CA, USA, December 2015
- A generalized quasi-geostrophic model of thermal convection, CGU/AGU spring meeting, Montréal, QC, Canada, May 2015
- Mercury's inner core size and core-crystallization regime, EGU general assembly, Vienna, Austria, April 2015
- Steady and time-dependent zonal flows generated by convection in rapidly rotating spherical shells, 8th Euromech conference, Bad Reichenhall, Germany, September 2010.
- Geodynamic constraints on the inner core super-rotation, AGU fall meeting, San Francisco, CA, USA, December 2008.
- Geodetic constraints on core dynamics and core-mantle interactions, Zatman Lecture, 11th Symposium of SEDI, Kunming, China, July 2008.
- Taylor's constraint and torsional oscillations, Physics Summer School, Les Houches, France, August 2007.
- Geodynamic constraints on the steady and time-dependent inner core axial rotation, IUGG General Assembly, Perugia, Italy, July 2007.
- Torques on the inner core and polar motion at decade timescales, EGU general assembly, Vienna, Austria, April 2005.
- Inner core tilt and polar motion, AGU fall meeting, San Francisco CA, USA, December 2003.

Recent presentations at conferences

Oral presentations as first author (not including invited presentations)

- A generalized quasi-geostrophic model of thermal convection, *IUGG*, Prague, June 2015.
- A generalized quasi-geostrophic model of thermal convection, *EGU*, Vienna, April 2015.
- The interior structure and convective dynamics of Mercury's core: constraints from gravity and rotation observations, *IAGA*, Merida, August 2013.
- Interior models of Mercury with equatorial ellipticity, *EPSC*, Madrid, Sept. 2012.
- The free librations of Mercury and size of its inner core, *AGU*, San Francisco, Dec. 2011.
- Constraints on the magnetic field at the core-mantle and inner core boundaries from Earth's nutations, *IUGG*, Melbourne, July 2011.
- Constraints on the magnetic field at the core-mantle and inner core boundaries from Earth's nutations, *AGU*, San Francisco, Dec. 2010
- Inner core-mantle gravitational locking and rotation of the inner core, *EGU*, Vienna, May 2010.

Poster presentations as first author

- QGZ: a quasi-geostrophic model of thermal convection, *AGU*, San Francisco, Dec. 2014.
- QGZ: a quasi-geostrophic model of thermal convection, *SEDI*, Japan, Aug. 2014.
- Mercury's inner core size and core-crystallization regime, *SEDI*, Japan, Aug. 2014.
- The interior structure and convective dynamics of Mercury's core: constraints from gravity and rotation observations, *GRC*, South Hadley, USA, June 2013.
- Inner core-mantle gravitational coupling in interior models of Mercury, *AGU*, San Francisco, December 2012.
- Interior models of Mercury with equatorial ellipticity, *SEDI*, Leeds, July 2012.
- Gravitational driving of inner core super-rotation, *SEDI*, Santa Barbara, July 2010.
- Gravitational driving of inner core super-rotation, *EGU*, Vienna, May 2010.
- Gravity variations induced by core flows, *EGU*, Vienna, May 2010.

Oral presentations by students & postdocs (in **bold***)*

- **More, C.** and Dumberry, M., Using a two-dimensional approach to model the short timescale zonal flow in Earth's core, *IUGG*, Prague, June 2015.
- **Koot, L.**, Constraints on the structure and dynamics of the core-mantle and inner core boundaries inferred from nutations (**Invited**), *SEDI*, Leeds, July 2012.
- **Koning, A. H.** and Dumberry, M., Internal forcing of Mercury's long period free librations, *EPSC*, Madrid, Sept. 2012.
- **Laycock, D.** and Dumberry M., A quasi-geostrophic model of zonal wind generation on the gas giants, *AGU*, San Francisco, Dec. 2011.
- **Koot, L** et al. Constraints on the couplings at the core-mantle and inner core boundaries inferred from nutation observations (**Invited**), *AGU*, San Francisco, Dec. 2009.

Poster presentations by students & postdocs (in **bold***)*

- **More, C.** and Dumberry, M., A two-dimensional approach to modelling the short timescale zonal flow in Earth's core, *AGU*, San Francisco, Dec. 2015.
- **More, C.** and Dumberry, M., Using a two-dimensional approach to model the short timescale zonal flow in Earth's core, *AGU*, San Francisco, Dec. 2014.
- **Laycock, D.** and Dumberry, M., A quasigeostrophic model of zonal wind generation in the gas giants, *AGU*, San Francisco, Dec. 2014.
- **More, C.** and Dumberry, M., Adding a Lorentz force to an existing QG model of the outer core, *GRC*, South Hadley, Mass., June 2013.
- **Laycock, D.** and Dumberry, M., A quasigeostrophic model of zonal wind generation in the gas giants, *GRC*, South Hadley, Mass., June 2013.
- **Laycock, D.** and Dumberry, M., A quasigeostrophic model of zonal wind generation in the gas giants, *AGU*, San Francisco, Dec. 2012.
- **Laycock, D.** and Dumberry, M., A quasigeostrophic model of zonal wind generation in the gas giants, *CIRES workshop*, Boulder, May 2012.
- **Koot, L.** and Dumberry, M., Effect of the Earth's magnetic field spatial distribution on the electromagnetic coupling at the fluid core boundaries for nutations, *AGU*, San Francisco, Dec. 2011.

- **Koot, L.** and Dumberry, M., Viscosity of the Earths inner core: constraints from nutation observations, *AGU*, San Francisco, Dec. 2010.
- **Laycock, D.** and Dumberry, A quasigeostrophic model of zonal flow generation in the gas giants, *AGU*, San Francisco, Dec. 2010.
- **Veasey, M.** and Dumberry, The effects of core-mantle gravitational coupling on the rotational dynamics of Mercury, *AGU*, San Francisco, Dec. 2010.
- **Koot, L.** and Dumberry, M., Nutations constraints on the mechanical coupling at the inner-core boundary: effect of a visco-elastic inner core, *SEDI*, Santa Barbara, July 2010.
- **Veasey, M.** and Dumberry, Using Mercury's physical libration in longitude to constrain its interior geometry, *EGU*, Vienna, May 2010.

Students & Postdocs

Current Graduate Students

- Colin More, PhD candidate, *Excitation of zonal flow accelerations in the Earth's core*, started in April. 2011. Honors: *NSERC doctoral fellowship, Hibbs travel award*. Service: *current president of the graduate students association*.

Former Postdoctoral Research Assistant

- Laurence Koot, July 2009 – December 2010, *Earth's nutations and core-mantle electromagnetic coupling*. Now a postdoctoral Fellow at *Royal Observatory of Belgium*.

Former Graduate Students

- Daniel Laycock, PhD, September 2009 – December 2014, *A generalized two dimensional quasi-geostrophic model of thermal convection*, Honors: *NSERC doctoral fellowship, Hibbs travel award, Hibbs fellowship, J. Gordin Kaplan Graduate Student Award.* Now employed at the Royal Bank of Canada.
- Martin Veasey, MSc., July 2008 – October 2010, *The free librations of Mercury and the size of its inner core*. Honors: *Hibbs travel award*. Now employed by the British Defense Service.

Former Undergraduate Students

- Simone Strohmair, undergraduate research project, *Librations on Mercury*, January to May 2013.
- Matthew Quigley, Summer undergraduate research, *Archaeomagnetic westward drift*, May to August, 2012, Honors: *Physics department summer research grant*. Currently completing undergraduate degree in Physics, Univ. of Alberta.
- Alice H. Koning, Co-op internship, September to December 2011, *Internal forcing of Mercury's long period free librations*. Currently pursuing an MSc in Astrophysics, Univ. of Alberta.
- Mitchell Liddell, Summer undergraduate research, May to August 2009, Honors: *NSERC undergraduate research grant*. Currently pursuing a PhD in Geophysics, Imperial College, London, UK.

Teaching Experience

Fall 2015	University of Alberta "Physics of the Earth", GEOPH 210 *Lecturer*	Edmonton, AB, Canada
Winter 2012 2013, 2014, 2016	University of Alberta "Introductory Computational Physics", PHYS 234 *Lecturer*	Edmonton, AB, Canada
Winter 2011, 2012, 2013	University of Alberta "Introduction to Geophysics", GEOPH 110 *Lecturer*	Edmonton, AB, Canada
Fall 2008, 2009, 2010, 2013	University of Alberta "Gravity, Magnetic and Electrical Techniques", GEOPH 325 *Lecturer*	Edmonton, AB, Canada
Winter 2008, 2009, 2010, 2011	University of Alberta "Global Geodynamics", GEOPH 440/521 *Lecturer*	Edmonton, AB, Canada
Spring 2003	Harvard University "History of the Earth", EPS 8 (Profs. Paul F. Hoffman and Daniel P. Schrag) *Teaching Fellow*	Cambridge, MA, USA
Fall 2000 and Spring 2001	Harvard University "Applied Mathematics 21a,b", AM 21a,b (Prof. Jeremy Bloxham) *Teaching Fellow*	Cambridge, MA, USA
Spring 2000	Harvard University "Introduction to Planetary Physics", EPS 106 (Prof. Jeremy Bloxham) *Teaching Fellow*	Cambridge, MA, USA

Public Lectures

- The days are getting longer: Studying Earth's rotation with ancient eclipse observations, Royal Astronomical Society of Canada, Edmonton, September 2013
- The days are getting longer: Studying Earth's rotation with ancient eclipse observations, Alumni day, Department of Physics, University of Alberta, September 2011
- The days are getting longer: Studying Earth's rotation with ancient eclipses and modern technology, Astronomical Observatory public talk series, Department of Physics, University of Alberta, February 2016

SERVICE

- Hiring committee member, Dept. of Physics, University of Alberta, Fall 2015.
- Study of the Earth's Interior (SEDI) advisory board member (liaison officer with International Association of Geodesy), since June 2015.
- Panelist for GFD (Germany) funding program: *Study of Earth system dynamics with a constellation of potential field missions (Dynamic Earth)*, Berlin, February 2015.
- Panelist for NSF (USA) geophysics funding program, October 2013.
- Chair of division 1, working group 1, International Association of Geomagnetism and Aeronomy (IAGA) (2011-2015).
- Graduate Scholarship & Best Student Paper Award committees, Univ. Alberta (2010-2013).
- Faculty of Science representative on Faculty of Engineering Council (2012-2013).
- Regular organizer and convener of sessions at international meetings.
- Served on numerous PhD candidacy exams, MSc and PhD thesis defenses.
- Reviewed approximately 100 scientific papers, including many for top journals such as *Nature*, *Science*, *Nature Geoscience* and *PNAS*.
- Regular reviewer of grant applications for *NSERC (Canada)*, *NSF (USA)*, *NASA (USA)*, *NERC (UK)* and *ANR (France)*.

OUTREACH & MEDIA

- "La fonte des glaciers influence la rotation de la Terre", radio Interview, *Radio Canada première chaîne*, December 16, 2015. (http://ici.radio-canada.ca/emissions/la_croisee/2015-2016/chronique.asp?idChronique=392862)
- "The slowing of the Earth, and sea level rise", radio Interview, *The Link, Radio-Canada International*, December 16, 2015. (http://www.rcinet.ca/en/author/mmontgomery/page/4/)
- "Melting glaciers, rising sea level slow down Earth's rotation", news story, *CBC online*, December 11, 2015. (http://www.cbc.ca/news/technology/sea-level-earth-rotation-1.3361446)
- Radio Interview, *midi 30, Radio Canada Alberta*, May 8, 2014.
- "Watch that wobble", news story, *New Scientist*, issue of 18 February 2006, no. 2539.