

Isamu Matsuyama

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RESEARCH INTERESTS

Understanding the formation and evolution of planetary interiors, with an emphasis on the interactions between tidal dissipation, rotational dynamics, orbital dynamics, and the interior structure.

EDUCATION

Ph.D. Astronomy and Astrophysics, University of Toronto, Toronto, ON, Canada, 2005

M.Sc. Astrophysics, University of Toronto, Toronto, ON, Canada, 2000

B.A. Physics, Universidad de Los Andes, Bogotá, Colombia, 1999

EMPLOYMENT

2017 - present Associate Professor, Department of Planetary Sciences, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, USA

2011 - 2017 Assistant Professor, Department of Planetary Sciences, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, USA

2008 - 2011 Postdoctoral fellow, University of California Berkeley, Berkeley, CA, USA

2005 - 2008 Postdoctoral fellow, Carnegie Institution of Washington, Washington, DC, USA

GRANTS AWARDED

2019 - 2022 Recent Activity in the Saturn System: Origins and Organic Composition of Red Streaks on Tethys; NASA Cassini Data Analysis (CDAP) program; Co-I

2017 - 2020 Interior Structure, Stresses, and Tectonics of Planets; NASA Solar System Workings (SSW) program; PI

2018 - 2021 The Deep Lunar Interior From Multi-Satellite Data Analysis; NASA Lunar Data Analysis (LDAP) program; Co-I

2016 - 2019 *True Polar Wander of Terrestrial Planets and Its Implications for the Long-Term Stability of Polar Volatiles*; NASA Solar System Workings (SSW); PI

2015 - 2018 *Subsurface Oceans in icy satellites*; NASA Habitable Worlds program; PI

2012 - 2016 *Global lunar figure and its interior, orbit, and rotation*; NASA Lunar Advanced Science and Exploration Research (LASER) program; PI

2012 - 2016 *Constraints on the deep interior structure of the Moon*; NASA Gravity Recovery and Interior Laboratory (GRAIL) Guest Scientist Program; PI

AWARDS

2008 - 2011 Miller Research Fellowship, University of California Berkeley, Berkeley, CA, USA.

2005 - 2008 Carnegie Fellowship, Carnegie Institution of Washington, Washington, DC, USA.

2000 - 2005 University of Toronto Fellowship, University of Toronto, Toronto, ON, Canada.

1999 - 2000 Connaught Scholarship, University of Toronto, Toronto, ON, Canada.

CLASSES TAUGHT

PTYS 505B - Principles of Planetary Physics

PTYS 170A - Planet Earth: Evolution of a Habitable World

INVITED PRESENTATIONS

- 2019 The Core of the Moon, Palais du Pharo, Marseille, France
- 2018 Royal Observatory of Belgium, Belgium; Delft University of Technology, The Netherlands; UC Santa Cruz; Caltech
- 2017 Hokkaido University, Hokkaido, Japan
- 2016 Latin American XV Regional International Astronomical Union Meeting, Colombia
- 2015 University of Toronto, Toronto, Canada; 11th Recontres du Vietnam, Planetary Systems: A Synergistic View, Quy Nhon, Vietnam
- 2013 Universidad de Los Andes, Bogotá, Colombia.
- 2012 Lunar and Planetary Laboratory
- 2011 Division of Planetary Sciences Meeting of the American Astronomical Society
- 2010 Caltech, Lunar and Planetary Laboratory, UCLA, UC Berkeley, UC Davis
- 2009 Washington University, UC Santa Cruz
- 2007 Harvard University, University of Toronto
- 2005 Third Harvard-Smithsonian Conference on Theoretical Astrophysics, Harvard University
- 2004 KITP program, Planet Formation: Terrestrial and Extra Solar, UC Santa Barbara
- 2003 Herzberg Institute for Astrophysics, Victoria, Canada; XIXth IAP Colloquium: Extrasolar Planets Today and Tomorrow, Paris, France

PROFESSIONAL ACTIVITIES

- 2003 - present Reviewer for publications: *Icarus*; *Journal of Geophysical Research (Planets)*; *Geophysical Research Letters*; *Astrophysical Journal*; *Nature*; *Monthly Notices of the Royal Astronomical Society*; *Earth, Moon, and Planets*; *Europa (University of Arizona Space Science Series)*
- 2007 - present Grant proposal reviewer: NASA Planetary Geology and Geophysics program, NASA Cassini Data Analysis program, NASA Origins of Solar Systems program, NASA LASER program, NASA Emerging Worlds program, NASA Habitable Worlds program

PUBLICATIONS

Refereed Journal Articles

* = Student as first author

43. *Hay, H. C. F. C., & **Matsuyama, I.** (2019). Tides Between the TRAPPIST-1 Planets. *Astrophys. J.*, 875, 22.
42. Cruikshank et al. (2019). Recent cryovolcanism in Virgil Fossae on Pluto. *Icarus*, 330, 155–168.
41. Nimmo, F., & **Matsuyama, I.** (2019). Tidal dissipation in rubble-pile asteroids. *Icarus*, 321, 715–721.
40. *Hay, H. C. F. C., & **Matsuyama, I.** (2019). Nonlinear tidal dissipation in the subsurface oceans of Enceladus and other icy satellites. *Icarus*, 319, 68–85.

39. **Matsuyama, I.**, Beuthe, M., Hay, H. C. F. C., Nimmo, F., & Kamata, S. (2018). Ocean tidal heating in icy satellites with solid shells. *Icarus*, 312, 208–230.
38. Hemingway, D. J., & **Matsuyama, I.** (2017). Isostatic equilibrium in spherical coordinates and implications for crustal thickness on the Moon, Mars, Enceladus, and elsewhere. *Geophys. Res. Lett.*, 44, 7695–7705.
37. *Hay, H. C. F. C., & **Matsuyama, I.** (2017). Numerically modelling tidal dissipation with bottom drag in the oceans of Titan and Enceladus. *Icarus*, 281, 342–356
36. *Keane, J. T., **Matsuyama, I.**, Kamata, S., & Steckloff, J. K. (2016). Reorientation and faulting of Pluto due to volatile loading within Sputnik Planitia. *Nature*, 540, 90–93.
35. Zuber et al. (2016). Gravity field of the Orientale basin from the Gravity Recovery and Interior Laboratory Mission. *Science*, 354, 438–441.
34. ***Matsuyama** et al. (2016), GRAIL, LLR, and LOLA constraints on the interior structure of the Moon. *Geophys. Res. Lett.*, 43.
33. Siegler et al. (2016), Lunar true polar wander inferred from polar hydrogen. *Nature*, 531, 480–484
32. Bouley et al. (2016), Late Tharsis formation and implications for early Mars. *Nature*, 531, 344–347.
31. Kamata, **Matsuyama**, and Nimmo (2015). Tidal resonance in icy satellites with subsurface oceans, *J. Geophys. Res. Planets*, 120, 1528-1542.
30. **Matsuyama, I.** (2014). Tidal dissipation in the oceans of icy satellites. *Icarus*, 242, 11–18.
29. *Keane and **Matsuyama** (2014). Evidence for Lunar True Polar Wander, and a Past Low-Eccentricity, Synchronous Lunar Orbit. *Geophys. Res. Lett.*, 41.
28. Williams et al. (2014), Lunar interior properties from the GRAIL mission. *J. Geophys. Res.*, 119.
27. **Matsuyama** et al. (2014), Planetary reorientation, *Ann. Rev. Earth. Planet. Sci.*, 42, 605.
26. Chan et al. (2014), Time-dependent rotational stability of dynamic planets with elastic lithospheres. *J. Geophys. Res.*, 119, 169.
25. Andrews-Hanna et al. (2013), Ancient igneous intrusions and early expansion of the Moon revealed by GRAIL, *Science*, 339, 675.
24. **Matsuyama** (2013), Fossil figure contributions to the lunar figure. *Icarus*, 222, 411.
23. Creveling et al. (2012), Mechanisms for oscillatory true polar wander. *Nature*, 491, 244.
22. Chan et al. (2011), The rotational stability of a convecting Earth: assessing inferences of rapid TPW in the late cretaceous. *Geophys. J. Int.*, 187, 1319.
21. Chan et al. (2011), The rotational stability of a convecting Earth: the Earth's figure and TPW over the last 100 Myr. *Geophys. J. Int.*, 187, 773.
20. **Matsuyama** and Nimmo (2011), Reorientation of Vesta: Gravity and tectonic predictions. *Geophys. Res. Lett.*, 38, L14205.
19. **Matsuyama** and Manga (2010), Mars without the equilibrium rotational figure, Tharsis, and the remnant rotational figure. *J. Geophys. Res.*, 115, E12020.
18. **Matsuyama** and Bills (2010), Global contraction of planetary bodies due to despinning: application to Mercury and Iapetus, *Icarus*, 209, 271.
17. **Matsuyama** et al. (2010), The rotational stability of a triaxial ice-age Earth. *J. Geophys. Res.*, 115, B05401.

16. **Matsuyama** et al. (2009), Dispersal of Protoplanetary Disks by Central Wind Stripping. *Astrop. J.*, 700, 10.
15. Kite et al. (2009), True Polar Wander driven by late-stage volcanism and the distribution of paleopolar deposits on Mars. *Earth Planet. Sci. Lett.*, 280, 254.
14. **Matsuyama** and Nimmo (2009), Gravity and tectonic patterns of Mercury: Effect of tidal deformation, spin-orbit resonance, nonzero eccentricity, despinning, and reorientation. *J. Geophys. Res.*, 114, E01010.
13. Schenk et al. (2008), True polar wander on Europa from global-scale small-circle depressions. *Nature*, 453, 368.
12. **Matsuyama** and Nimmo (2008), Tectonic patterns on reoriented and despun planetary bodies. *Icarus*, 195, 459.
11. Daradich et al. (2007), Equilibrium rotational stability and figure of Mars. *Icarus*, 194, 463.
10. **Matsuyama** and Nimmo, (2007), Rotational stability of tidally deformed planetary bodies. *J. Geophys. Res.*, 112, E11003.
9. **Matsuyama** et al. (2007), Reorientation of planets with lithospheres: The effect of elastic energy. *Icarus*, 191, 401.
8. Nimmo and **Matsuyama**. (2007), Reorientation of icy satellites by impact basins. *Geophys. Res. Lett.*, 34, L19203.
7. Perron et al. (2007), Evidence for an ancient martian ocean in the topography of deformed shorelines. *Nature*, 447, 840.
6. Mitrovica et al. (2006), Reanalysis of ancient eclipse, astronomic and geodetic data: A possible route to resolving the enigma of global sea-level rise. *Earth Planet. Sci. Lett.*, 243, 390.
5. **Matsuyama** et al. (2006), Rotational stability of dynamic planets with elastic lithospheres. *J. Geophys. Res.*, 111, E02003.
4. Mitrovica et al. (2005), The rotational stability of an ice-age earth. *Geophys. J. Int.*, 161, 491.
3. Hogerheijde et al. (2003), Indications for Grain Growth and Mass Decrease in Cold Dust Disks around Classical T Tauri Stars in the MBM 12 Young Association. *Astrophys. J.*, 593, L101.
2. **Matsuyama** et al. (2003), Halting Planet Migration by Photoevaporation from the Central Source. *Astrophys. J.*, 585, L143.
1. **Matsuyama** et al. (2003), Viscous Diffusion and Photoevaporation of Stellar Disks. *Astrophys. J.*, 582, 893.