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Education

B.S., Physics, Massachusetts Institute of Technology, 1968

Ph.D., Planetary Science, Massachusetts Institute of Technology, 1972

Scholarly Interests

Planetary dynamics and celestial mechanics with emphasis on:

- (a) Processes of formation and long-term evolution of planetary systems
- (b) Resonant and secular coupling between the motions of planetary bodies
- (c) Impact processes and their effect on dynamics of small-body populations
- (d) Tidal effects on the evolution and habitability of icy satellites and extra-solar planets.

PUBLICATIONS BY RICHARD GREENBERG (2008-2012)

BOOK

Unmasking Europa: the Search for Life on Jupiter's Ocean Moon, R. Greenberg, Copernicus/Springer/Praxis Books, New York, 2008.

BOOK REVIEWS

Europa, R. Pappalardo et al., eds., Univ. Arizona Press, reviewed in *Meteoritics and Planetary Science*, 2011.

"Near Earth Objects, Our Celestial Neighbors: Opportunity and Risk", Proceedings of IAU Symposium 236, reviewed in *Earth, Moon, and Planets* 105, 57-59, 2009.

REFEREED ARTICLES

Acidification of Europa's subsurface ocean as a consequence of oxidant delivery, *Astrobiology* 12 (2), 151-159, by M.A. Pasek & R. Greenberg, 2012.

Aligned major axes in a planetary system without tidal evolution: The 61 Virginis example, *Monthly Notices RAS* 419, 429-435, by R. Greenberg & C. Van Laerhoven, 2012.

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Exploration and protection of Europa's Biosphere: Implications of permeable ice, *Astrobiology* 11, 183-191, by R. Greenberg, 2011.

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Origin and Dynamics of the Mutually Inclined Orbits of ν Andromedae c and d, *Astrophys. J.* 726, article id. 71, 2011, R. Barnes et al.

Transport rates of radiolytic substances into Europa's ocean: Implications for the potential origin and maintenance of life, *Astrobiology* 10, No. 3, 275-283, 2010, R. Greenberg.

The Icy Jovian Satellites after the Galileo Mission, An invited review for Reports on Progress in Physics (IOP Publishing), Rep. Prog. Phys. 73, 20pp., doi:10.1088/0034-4885/73/3/036801, 2010, R. Greenberg.

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The roles of tidal evolution and evaporative mass loss in the origin of CoRoT-7 b, *Mon. Not. Royal Astron. Soc.* 407, 910-922, 2010, B. Jackson et al.

Tidal Constraints on Planetary Habitability, Proceedings of the "Pathways Towards Habitable Planets" Symposium (eds.: D. Gelino, et al.), 2010, R. Barnes et al.

Tidal effects on brown dwarfs: application to the eclipsing binary 2MASS J05352184-0546085. The anomalous temperature reversal in the context of tidal heating, *Astron. and Astrophys.* 514, id.A22, 2010, R. Heller et al.

Geological implications of a physical libration on Enceladus, *Icarus* 203, 541-552, 2009, T. Hurford et al.

Frequency dependence of tidal Q, *Astrophys. J. Letters* 698, L42-L45, 2009, R. Greenberg.

Tidal Limits to Planetary Habitability, *Astrophysical J. Letters*, 700, L30-L33, 2009, R. Barnes et al.

Observational Evidence for Tidal Destruction of Exoplanets, *Astrophys. J.* 698, 1357-1366, 2009, B. Jackson et al.

Planet-planet scattering leads to tightly packed planetary systems, *Astrophys. J.* 696, L98-L101,

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The influence of obliquity on European cycloid formation, *Icarus* 202, 197-215, 2009, T. A. Hurford et al.

Planetary transits and tidal evolution, Proceedings IAU Symp. No. 253, "Transiting Planets", eds. F. Pont et al., 2009, by B. Jackson et al.

The HD 40307 Planetary System: Super-Earths or Mini-Neptunes? *Astrophys. J.* 695, 1006-1011, 2009, R. Barnes et al.

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Tidal Evolution of Dysnomia, Satellite of the Dwarf Planet Eris, *Icarus* 194, 847-849, 2008, R. Greenberg.

Tidal heating of extra-solar planets, *Astrophys. J.*, 681, 1631-1638, 2008, by B. Jackson, R. Greenberg and R. Barnes.

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Tides and the evolution of planetary habitability, *Astrobiology* 8, 557-568, 2008, by R. Barnes et al.

Extrasolar planet interactions, in *Exoplanets: Detection, Formation and Dynamics*, S. Ferraz-Mello, & Y.S. Sun, eds, Proceedings IAU Symposium No. 249, p. 469-478, 2008, R. Barnes and R. Greenberg.

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Eros' Rahe Dorsum: Implications for internal structure, *Meteoritics and Planetary Science* 43, 435-449 2008, by R. Greenberg

ABSTRACTS AND PRESENTATIONS

Ridges on ridges: Extensions of adjacent topography onto the flanks of European ridges, AAS/DPS Meeting, Reno NV, Oct. 2012, R.Greenberg & C. Van Laerhoven.

Changes in one planet's mass or semi-major axis affects all planets' eccentricities, AAS/DPS Meeting, Reno NV, Oct. 2012, C. Van Laerhoven & R.Greenberg.

Kinematics and dynamics of a high order mean-motion resonance: consideration of the Kepler-16 system, AAS/DDA Meeting, Mt. Hood OR, May 2012, R.Greenberg et al.

Secular dynamics of the Kepler-11 system, AAS/DDA Meeting, Mt. Hood OR, May 2012, C. Van Laerhoven et al.

Propagation of coupled changes in orbital e and a via secular perturbations, AAS/DDA Meeting, Mt. Hood OR, May 2012, R.Greenberg et al.

Origin, dynamics and stability of the mutually inclined orbits of the ν Andromedae planetary system, AAS Meeting, BAAS 43, Jan. 2011, R. Barnes et al.

Secular behavior of exoplanetary systems: self-consistency and comparisons with the planet-planet scattering hypothesis, BAAS 43, Jan. 2011, M. Timpe et al.

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Europa, an invited presentation at the Pardee Keynote Symposium, Exploring for Life in the Cosmos: Celebrating Five Decades of Astrobiology, GSA Annual Meeting, Denver, Nov. 2010.

Secular behavior in multi-planet systems: 61 Virginis, 55 Cancri, etc., AAS/DPS Meeting, Oct. 2010, C. Van Laerhoven & R.Greenberg.

Tidal effects on the habitability of exoplanets: The case of GJ 581d, Astrobio. Science Conf., 2010, R. Barnes et al.

Is CoRoT-7 B the Remnant Core of an Evaporated Gas Giant? AAS Meeting, January 2010, B. Jackson et al.

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Tidal Heating and the Boundaries of the Habitable Zone (invited presentation), AGU meeting, Dec. 2009, R. Greenberg et al.

The Role of Planetary System Architecture in Planetary Habitability, AGU meeting, Dec. 2009, R. Barnes et al.

Vertical Transport through Europa's Crust: Implications for Oxidant Delivery and Habitability, AAS/DPS Meeting, Puerto Rico, October 2009.

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