

Matthew Steven Tiscareno

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Education

2004 Ph.D., Planetary Science, University of Arizona
1998 B.S., Planetary Science, California Institute of Technology

Research Experience

Cornell University, Ithaca, New York

2011 – Senior Research Associate
2004 – 2011 Research Associate, advisor: Joseph A. Burns

University of Arizona, Tucson, Arizona

1999 – 2004 Graduate Research Assistant, advisor: Renu Malhotra (previously Paul Geissler, Carolyn Porco)

California Institute of Technology, Pasadena, California

1996 – 1999 Undergraduate Research Assistant, advisor: Michael E. Brown (previously G. Edward Danielson)

Current Research Interests

Orbital and rotational dynamics of planetary and satellite systems
Dynamical behavior and evolution of dense rings
Disk-moon dynamical interactions
Remote sensing of planetary rings
Orbital dynamics of diffuse rings

Team Memberships and Associations

Cassini Project, Imaging Team Associate (J.A. Burns, Team Member), 2004 to present
Uranus Pathfinder Mission Proposal (2010), Team Member and Rings Science Lead (C. Arridge, PI)
Uranus System Mission Proposal (2009), Team Member (M. Hofstadter, PI)
Neptune System “Argo” Mission Proposal (2009), Team Member (C.J. Hansen, PI)

Service to the Science Community

Associate Editor, *Earth Moon and Planets*, September 2011 to present (M. Gudipati, editor-in-chief)
Rings Facilitator, Uranus Working Group, NASA Outer Planets Assessment Group (OPAG), October 2011
Science Program Committee member, 2011 DPS Meeting, Nantes, France (R. Malhotra and M. Grande, co-chairs)
Science/Local Organizing Committee member, Rings2011 Meeting, Ithaca NY (J.A. Burns, chair)
Science advisor to Team X technology study for future Saturn Ring Observer mission (T.R. Spilker, chair), Mar 2010 to May 2010, commissioned by the NRC Planetary Science Decadal Survey.

Tiscareno, M.S., and 49 colleagues 2009. Rings research in the next decade. White paper submitted to the NRC Planetary Science Decadal Survey (Page 6 at <http://www8.nationalacademies.org/ssbsurvey/publicview.aspx>).

Local Organizing Committee member, 2008 DPS Meeting, Ithaca NY (J.F. Bell and B.E. Clark, co-chairs)

Grant Proposal Review Panels: NASA (2008, 2010, 2012), NSF (2008)

Grant Proposal External Reviews: NASA (2007-2011)

NASA Postdoctoral Program External Reviews (2009-2010, 2012)

Manuscript Reviews: *Science*, *Nature*, *Icarus*, *Astronomical Journal*, *Astronomy & Astrophysics*,

Planetary and Space Science, *Earth Moon and Planets*, *Geophysical Research Letters*

Book Proposal Reviews: Cambridge University Press

External Funding

Period	Role	\$K	Source	Short title or description
2011-	Fellow	~100	NASA Early Career Fellowship	Apply for funds upon obtaining permanent position
2010-2013	PI	158	NASA Outer Planets Research	Moons and Rings and In-Between in Saturn System
2010-2013	PI	100	NASA Cassini Data Analysis	Saturn's Rings and Moonlets
2008-2010	PI	100	NASA Cassini Data Analysis	Disk-Moon Interactions in Saturn's Rings

Refereed Reviews and Book Chapters

Citations	Reference	Source: Thomson Reuters (*Astrophysical Data System)
-	Tiscareno, M.S. 2012. Planetary rings. In L. French, and P. Kalas, eds. <i>Solar and Planetary Systems</i> (Springer), invited chapter in press (arXiv:1112.3305).	
11	Cuzzi, J.N., and 22 colleagues (including M.S. Tiscareno) 2010. An evolving view of Saturn's dynamic rings. <i>Science</i> 327 , 1470-1475.	
12	*Colwell, J.E., P.D. Nicholson, M.S. Tiscareno , C.D. Murray, R.G. French, and E.A. Marouf 2009. The structure of Saturn's rings. In M. Dougherty, L. Esposito, and T. Krimigis, eds. <i>Saturn from Cassini-Huygens</i> (Springer).	

Refereed Journal Articles

Citations	Reference	Source: Thomson Reuters
-	Tiscareno, M.S. 2012. A modified "Type I migration" model for propeller moons in Saturn's rings. <i>Planet. Space Sci.</i> , submitted.	
-	Arridge, C.S., C.B. Agnor, N. Andre, K.H. Baines, L.N. Fletcher, D. Gautier, M.D. Hofstadter, G.H. Jones, L. Lamy, Y. Langevin, O. Mousis, N. Nettelmann, C.T. Russell, T. Stallard, M.S. Tiscareno , G. Tobie and 63 additional colleagues. Uranus Pathfinder: Exploring the origins and evolution of Ice Giant planets. <i>Exp. Astron.</i> , in press.	
2	Hedman, M.M., J.A. Burns, M.W. Evans, M.S. Tiscareno , and C.C. Porco 2011. Saturn's curiously corrugated C ring. <i>Science</i> 332 , 708-711.	
3	Hedman, M.M., J.A. Burt, J.A. Burns, and M.S. Tiscareno 2010. The shape and dynamics of a heliotropic dusty ringlet in the Cassini Division. <i>Icarus</i> 210 , 284-297 (arXiv:1006.2703).	
8	Tiscareno, M.S. , J.A. Burns, M. Sremcevic, K. Beurle, M.M. Hedman, N.J. Cooper, A.J. Milano, M.W. Evans, C.C. Porco, J.N. Spitale, and J.W. Weiss 2010. Physical characteristics and non-keplerian orbital motion of "propeller" moons embedded in Saturn's rings. <i>Astrophys. J. Lett.</i> 718 , L92-L96 (arXiv:1007.1008).	
2	Tiscareno, M.S. , J.A. Burns, J.N. Cuzzi, and M.M. Hedman 2010. Cassini imaging search rules out rings around Rhea. <i>Geophys. Res. Lett.</i> 37 , L14205 (arXiv:1008.1764).	
-	Spilker, T.R., C.S. Borden, W. Smythe, B. Cole, A. Petropoulos, J. Dankanich, H. Kamhawi, P. Schmitz, L. Mason, J. Elliott, N. Strange, R. Moeller, P. Nicholson, M. Tiscareno , L. Spilker, L. Dudzinski, K. Reh, and S. Benson 2010. Saturn Ring Observer concept and architecture options. <i>Journal of the British Interplanetary Society</i> 63 , 345-350.	
-	Hedman, M.M., N.J. Cooper, C.D. Murray, K. Beurle, M.W. Evans, M.S. Tiscareno , and J.A. Burns 2010. Aegaeon (Saturn LIII), a G ring object. <i>Icarus</i> 207 , 433-447 (arXiv:0911.0171).	
6	Tiscareno, M.S. , R.P. Perrine, D.C. Richardson, M.M. Hedman, J.W. Weiss, C.C. Porco, and J.A. Burns 2010. An analytic parameterization of self-gravity wakes in Saturn's rings, with application to occultations and propellers. <i>Astron. J.</i> 139 , 492-503 (arXiv:0911.3161).	
7	Tiscareno, M.S. , P.C. Thomas, and J.A. Burns 2009. The rotation of Janus and Epimetheus. <i>Icarus</i> 204 , 254-261 (arXiv:0904.3515).	
3	Morrison, S.J., P.C. Thomas, M.S. Tiscareno , J.A. Burns, and J. Veverka 2009. Grooves on small saturnian satellites and other objects: Characteristics and significance. <i>Icarus</i> 204 , 262-270.	
5	Tiscareno, M.S. , and R. Malhotra 2009. Chaotic diffusion of resonant Kuiper Belt objects. <i>Astron. J.</i> 138 , 827-837 (arXiv:0807.2835).	
3	Hedman, M.M., J.A. Burns, M.S. Tiscareno , and C.C. Porco 2009. Organizing some very tenuous things: Resonant structures in Saturn's faint rings. <i>Icarus</i> 202 , 260-279.	
7	Weiss, J.W., C.C. Porco, and M.S. Tiscareno 2009. Ring edge waves and the masses of nearby satellites. <i>Astron. J.</i> 138 , 272-286.	
7	Hedman, M.M., C.D. Murray, N.J. Cooper, M.S. Tiscareno , K. Beurle, M.W. Evans, and J.A. Burns 2009. Three tenuous rings/arcs for three tiny moons. <i>Icarus</i> 199 , 378-386.	
22	Tiscareno, M.S. , J.A. Burns, M.M. Hedman, and C.C. Porco 2008. The population of propellers in Saturn's A Ring. <i>Astron. J.</i> 135 , 1083-1091 (arXiv:0710.4547).	
18	Hedman, M.M., J.A. Burns, M.S. Tiscareno , C.C. Porco, G.H. Jones, E. Roussos, N. Krupp, C. Paranicas, and S. Kempf 2007. The source of Saturn's G Ring. <i>Science</i> 317 , 653-656.	
34	Tiscareno, M.S. , J.A. Burns, P.D. Nicholson, M.M. Hedman, and C.C. Porco 2007. Cassini imaging of Saturn's rings II: A wavelet technique for analysis of density waves and other radial structure in the rings. <i>Icarus</i> 189 , 14-34 (astro-ph/0610242).	

- 11 Hedman, M.M., J.A. Burns, M.R. Showalter, C.C. Porco, P.D. Nicholson, A.S. Bosh, **M.S. Tiscareno**, R.H. Brown, B.J. Buratti, K.H. Baines, and R. Clark 2007. Saturn's dynamic D Ring. *Icarus* **188**, 89-107.
- 14 **Tiscareno, M.S.**, P.D. Nicholson, J.A. Burns, M.M. Hedman, and C.C. Porco 2006. Unravelling temporal variability in Saturn's spiral density waves: Results and predictions. *Astrophys. J. Lett.* **651**, L65-L68 (astro-ph/0609242).
- 37 **Tiscareno, M.S.**, J.A. Burns, M.M. Hedman, C.C. Porco, J.W. Weiss, L. Dones, D.C. Richardson, and C.D. Murray 2006. 100-meter-diameter moonlets in Saturn's A Ring from observations of 'propeller' structures. *Nature* **440**, 648-650.
- 198 Porco, C.C., and 35 colleagues (including **M.S. Tiscareno**) 2005. Imaging of Titan from the Cassini spacecraft. *Nature* **434**, 159-168.
- 93 Porco, C.C., and 34 colleagues (including **M.S. Tiscareno**) 2005. Cassini imaging science: Initial results on Saturn's rings and small satellites. *Science* **307**, 1226-1236.
- 80 Porco, C.C., and 34 colleagues (including **M.S. Tiscareno**) 2005. Cassini imaging science: Initial results on Phoebe and Iapetus. *Science* **307**, 1237-1242.
- 56 Porco, C.C., and 34 colleagues (including **M.S. Tiscareno**) 2005. Cassini imaging science: Initial results on Saturn's atmosphere. *Science* **307**, 1243-1247.
- 39 **Tiscareno, M.S.**, and R. Malhotra 2003. The dynamics of known Centaurs. *Astron. J.* **126**, 3122-3131 (astro-ph/0211076).
- 138 Porco, C.C., and 23 colleagues (including **M.S. Tiscareno**) 2003. Cassini imaging of Jupiter's atmosphere, satellites, and rings. *Science* **299**, 1541-1547.
- 8 **Tiscareno, M.S.**, and P.E. Geissler 2003. Can redistribution of material by sputtering explain the hemispheric dichotomy of Europa? *Icarus* **161**, 90-101.
- Total number of citations: First-author papers: 182 All papers: 804
Citations per pre-2011 item: First-author papers: 16.55 All papers: 31.62
h-index (see Wikipedia article): First-author papers: 7 All papers: 12

Popular Articles

- Tiscareno, M.S.**, and M.M. Hedman 2013. Planetary rings. In T. Spohn and T.V. Johnson, eds. *Encyclopedia of the Solar System* (Elsevier), invited chapter in preparation.
- Tiscareno, M.S.**, and M.M. Hedman 2009. News and views: Saturn's colossal ring. *Nature* **461**, 1064-1065.
- Tiscareno, M.S.** 2007. Ringworld Revelations. *Sky & Telescope* **113** (2), 32-39.

Academic Work

- Tiscareno, M.S.** 2004. Chaotic diffusion in the outer solar system, and other topics. Ph.D. thesis, Univ. of Arizona.

Invited Talks

- "What can planetary rings teach us about planetary systems?"
12 March 2012: Georgia Institute of Technology, Department Colloquium
- "The Uranian Ring System"
17 October 2011: NASA OPAG Uranus Working Group, Pasadena CA
- "Dynamics of planetary rings"
13 April 2011: DDA Meeting **42**, 8.01
- "The rotation of Janus and Epimetheus"
8 April 2011: European Geophysical Union Meeting (Vienna, Austria), PS6.1-4336
- "The changing orbits of 'propeller' moons in Saturn's rings"
6 April 2011: European Geophysical Union Meeting (Vienna, Austria), PS3.1-1600
- 15 December 2010: Fall AGU Meeting, P33D-01
- "Saturn's rings: A nearby astrophysical disk"
31 January 2011: University of Idaho, Department Colloquium
5 November 2010: Wells College, Department Colloquium
- "Orbital dynamics of trans-Neptunian objects"
28 June 2010: TNO 2010 Meeting, Philadelphia PA
- "Saturn's rings: Up close and personal with an astrophysical disk"
10 May 2010: Peking University (Beijing, China), KIAA Dynamics of Astrophysical Disks Workshop

“Saturn’s rings: Direct observations of disk-embedded masses”
 1 February 2010: University of Colorado, Department Colloquium
 17 September 2009: Cornell University, Department Colloquium
 “Saturn’s rings: An accessible astrophysical disk”
 10 January 2008: AAS Meeting **211**, 109.06 (Special Session: “The Dynamics of Astrophysical Disks”)
 “Knots and ripples in the fabric of Saturn’s rings”
 5 December 2007: University of Maryland, Department Colloquium
 “Ring reconnaissance with weak waves”
 13 December 2006: Fall AGU Meeting, Session P34A-02

Abstracts and Presentations at Scientific Meetings

Only presentations given in person are listed below. An additional 35 co-author presentations are not listed.

- Tiscareno, M.S., et al.** 2011. Observations of ejecta clouds produced by impacts onto Saturn’s rings. *EPSC-DPS*
Tiscareno, M.S., et al. 2011. Observations of ejecta clouds produced by impacts onto Saturn’s rings. *Rings2011*
 Nicholson, P.D., **M.S. Tiscareno**, and L.J. Spilker. The Saturn Ring Observer: In situ studies of planetary rings.
Fall AGU, P23B-1633
Tiscareno, M.S., et al. 2010. Rhea: Still ringless. *DPS* **42**, 6.04
Tiscareno, M.S., et al. 2010. Directly observing the orbital evolution of disk-embedded masses. *DDA* **41**, 11.01
 Byington, B.M., **M.S. Tiscareno, et al.** 2010. The effect of viewing geometry on propeller observations in Saturn’s
 A ring. *DDA* **41**, 9.14
Tiscareno, M.S., et al. 2009. Observations of ejecta clouds produced by impacts onto Saturn’s rings.
Fall AGU, P54A-08
Tiscareno, M.S., et al. 2009. Rings research in the next decade. *Fall AGU*, P52A-09
Tiscareno, M.S., et al. 2009. Rings research in the next decade. *DPS* **41**, 16.32
Tiscareno, M.S., et al. 2009. Saturn’s A Ring has no inner edge. *DPS* **41**, 25.04
 Burns, J.A., **M.S. Tiscareno, et al.** 2009. Giant propellers outside the Encke Gap in Saturn’s rings. *DPS* **40**, 30.07
Tiscareno, M.S., et al. 2008. An analytic parameterization of self-gravity wakes. *DPS* **40**, 21.06
Tiscareno, M.S., J.A. Burns, and P.C. Thomas 2008. The rotation of Janus and Epimetheus. *DDA* **39**, 13.03
 Torrey, P.A., **M.S. Tiscareno, J.A. Burns, and C.C. Porco.** Mapping complexity: The wavy edges of the Encke and
 Keeler Gaps in Saturn’s rings. *DDA* **39**, 15.19
Tiscareno, M.S., et al. 2007. The population of propellers in Saturn’s A Ring. *DPS* **39**, 10.05
Tiscareno, M.S., et al. 2007. Numerical simulations of the G Ring arc. *DDA* **38**, 12.03
Tiscareno, M.S., et al. 2006. Density wave metamorphosis. *DPS* **38**, 38.07
Tiscareno, M.S., et al. 2006. Sampling Saturn’s rings with weak density waves. *DDA* **37**, 14.06
Tiscareno, M.S., et al. 2006. Disk response to variable forcing: The rings and co-orbital satellites of Saturn,
DDA **37**, 8.04
Tiscareno, M.S., et al. 2005. Cassini ISS observations of the Encke and Keeler Gaps in Saturn’s rings.
Fall AGU, P33B-0245
 Burns, J.A., and **M.S. Tiscareno** 2005. Saturn’s ring images/dynamics by Cassini. *Fall AGU*, P31D-01
Tiscareno, M.S., et al. 2005. Wavy edges and other disturbances in Saturn’s Encke and Keeler Gaps. *DPS* **37**, 64.02
Tiscareno, M.S., et al. 2004. Faint rings and things according to Cassini. *Fall AGU*, P35A-1461
Tiscareno, M.S., and R. Malhotra 2004. Chaotic diffusion of resonant Kuiper Belt objects. *DPS* **36**, 17.08
 Burns, J.A., **M.S. Tiscareno, et al.** 2004. Weak waves and wakes in Saturn’s rings: Observations by Cassini ISS.
DPS **36**, 19.12
Tiscareno, M.S., and R. Malhotra 2003. The dynamics of known Centaurs. *DDA* **34**, 2.06
Tiscareno, M.S., and R. Malhotra 2003. The effects of planet-size resonant KBOs. *DPS* **35**, 39.22
Tiscareno, M.S., and R. Malhotra 2002. Centaurs: The transition between the Kuiper Belt and Jupiter-family
 comets. *DPS* **34**, 9.02
Tiscareno, M.S., and P.E. Geissler 2002. Re-distribution of material on the surface of Europa via sputtering.
LPSC **33**, 1978
Tiscareno, M.S., and C.C. Porco 2001. Cassini ISS search for inner satellites of Jupiter. *DPS* **33**, 37.09

Press Releases and other Media-Related Activities

Discovery of signatures of individual disk-embedded moonlets ('propellers'). *Nature* article, *Nature* podcast interview, NASA and Cassini press release, broad media coverage, March 2006.

Discovery that 'propellers' are confined to three narrow belts, one of Cassini's "Top 10 Science Highlights of 2008" Saturn equinox observations, including discovery of impact clouds, shadows cast by moonlets. NASA and Cassini press release, broad media coverage, September 2009.

Migrating moonlets in Saturn's rings reflect solar system beginnings. One-slide "nugget" released internally by the Cassini Project to NASA Headquarters and the White House, June 2010.

Cassini images rule out rings around Rhea. Cornell press release, media coverage, July 2010.

Orbital evolution of disk-embedded 'propeller' moons reflects solar system origins. NASA and Cassini press release, one-slide summary sent by NASA to White House Science Advisor, broad media coverage, July 2010.

Propellers in Saturn's Rings. A Discoveries in Planetary Science presentation released by the AAS/DPS Education Subcommittee, April 2011.

Refereed review chapter on planetary rings was reviewed on *The Planetary Society Blog*, 15 December 2011: "What do we know about planetary rings? Quite a lot, actually!" (<http://planetary.org/blog/article/00003302>)

Teaching Experience

External Examiner at the University of Maryland, College Park MD. Sat on PhD dissertation committee for Randall Perrine, August 2011

Visiting Lecturer at Wells College, Aurora NY, for Fall 2010 semester. Designed and taught a 3-credit lecture/lab course for undergraduate non-science majors, PHYS 106, "Introductory Astronomy"

Guest Lecturer, Planetary Physics graduate course, Cornell University (Fall 2009, Fall 2011)

Guest Lecturer, Celestial Mechanics graduate course, Cornell University (Spring 2007)

Guest Lecturer, Intermediate Dynamics graduate course, Cornell University (Fall 2011)

Guest Lecturer, Planetary Formation graduate course, Cornell University (Spring 2012)

Guest Lecturer, Space Exploration undergraduate course, Cornell University (Fall 2006, Fall 2007, Spring 2011)

Graduate Teaching Assistant, Planetary Science for undergraduate non-science majors, University of Arizona (six semesters, Fall 1999 through Spring 2003), includes several occasions as a Guest Lecturer

Undergraduate Teaching Assistant, Geology for undergraduate non-majors, California Institute of Technology (Spring 1998)

Undergraduate Teaching Assistant, Introduction to Planetary Science for undergraduate geology/planetary majors, California Institute of Technology (Spring 1997)

Mentoring of Students

I have been the primary research advisor for the following students, under the supervision of Professor J.A. Burns

2010 –	Neil N. Sexton '11, M.Eng. '12, Applied & Engineering Physics, Rings research
2009 – 2011	Breanna M. Byington '11, Physics and Education, Rings research Placement: M.A. student, Education, University of Michigan
2007 – 2008	Paul A. Torrey '08, Astronomy, Rings research, Placement: Ph.D. student, Astronomy, Harvard University

In addition, I have played a significant supporting role in mentoring five other undergraduate students and four graduate students in the Burns/Nicholson research group.

Education and Public Outreach

Presentation of recent Cassini results to the Buffalo Astronomical Association, Buffalo NY, 13 May 2011

Taught a class ("Introduction to the Solar System") to twelve Ithaca-area middle-school and high-school students, 10 sessions from 2/2009 to 5/2009

Heavily involved (including selecting images and writing captions) in preparing an exhibit of Cassini images that appeared at the American Museum of Natural History, New York City; Johnson Museum of Art, Ithaca NY; National Air and Space Museum, Washington DC; and continues to appear at museums nationwide, 2007-08

Presentation of recent Cassini results to Ithaca-area students, 11/2008

Taught a class ("Science and Faith") at New Life Presbyterian Church, Ithaca NY, 21 sessions from 9/06 to 5/07

Presentation of recent Cassini results to visiting summer undergraduates at Cornell – 6/10, 6/11

Presentation of recent Cassini results to high-school students visiting Cornell – 6/05, 7/05, 5/07, 6/07, 4/08, 3/09, 3/10, 4/10

Presentation of recent Cassini results to K-12 teachers visiting Cornell for an Educator Workshop – 2/05, 3/07, 11/07, 2/09
Presentation of recent Cassini results to Cornell alumni, 5/2005
Presentation (“Rockets”) given to Ithaca-area students, 10/2007
Presentation (“What is a planet? Pluto and its place in the solar system”) given to Ithaca-area students, 9/2006
Presentation of Student Showcase research to state legislators in Phoenix, 2/2003
Science Fair Judge, St. Michael’s Elementary School, Tucson – 2000, 2001, 2003

Memberships

American Astronomical Society (AAS)
AAS Division for Planetary Sciences (DPS)
AAS Division on Dynamical Astronomy (DDA)
International Astronomical Union (IAU)
American Geophysical Union (AGU)
American Scientific Affiliation (ASA)

Awards and Fellowships

NASA Group Achievement Award, 2009 (co-recipient as part of the Cassini Imaging Science Team)
UA Graduate Teaching Award, 2002
LPL Graduate Teaching Award, 2002
National Science Foundation (NSF) Graduate Research Fellowship, 2000-2003
UA Graduate College Fellowship, 1999-2000
McLean Brothers Scholarship, 1994-1998