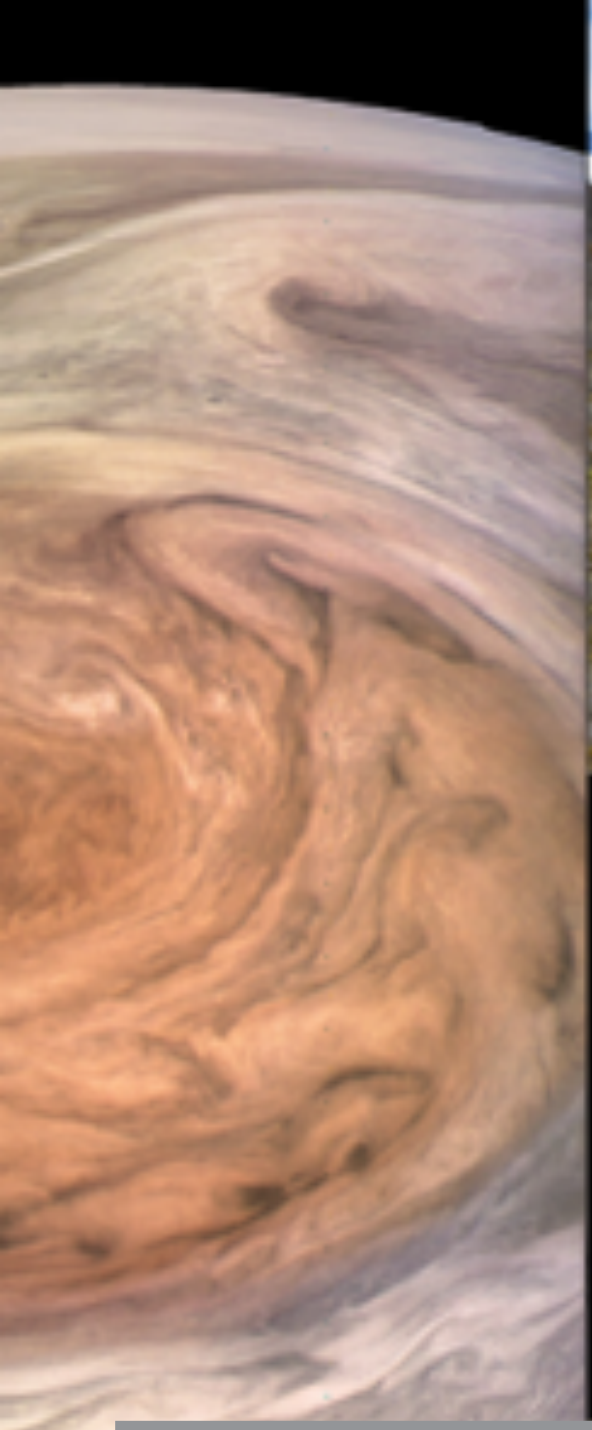



# CARL SAGAN CENTER

## Activity Report July 2017
## Dr. Nathalie A. Cabrol, Director

Cover images. Left: Jupiter's Great Red Spot from only 9,000 km away by Juno, NASA. Captured during the 7th Perijove; Right: Top – Dale Andersen and the SETI Institute Expedition Flag#1 at the McGill Arctic Research Station – Middle: LASER SETI, a new approach to searching for ET. Bottom – In Saturn's Rings…Cassini, NASA.

## Peer-Reviewed Publications

Al-Samir M, S Nabhan, J Fritz, A Winkler, **JL Bishop**, et al., (2017) The paleolacustrine evolution of Juventae Chasma and Maja Valles and its implications for the formation of interior layered deposits on Mars. *Icarus*, **292**, 125-143.

Cordiner MA, Cox NLJ, Lallement R, Najarro F, **Cami J** et al. (2017). Searching for Interstellar Using a New Method for High Signal-to-noise HST/STIS Spectroscopy. Astrophys. J. Lett. 843, id. L2, 6pp.

Etcherverria, A., et al. (including **N. A. Cabrol**) Discrepancies in microbial and limnological response to climate change of close-related Andean oligotrophic lakes triggered by watershed characteristics. *Geobiology*, 2017 (submitted).

Follette, K.B. et al., including **F. Marchis (**2017). Complex Spiral Structure in the HD 100546 Transitional Disk as Revealed by GPI and MagAO. *The Astronomical Journal, Volume 153, Issue 6, article id. 264, 15 pp. (2017).*, 153. Available at: http://arxiv.org/abs/1704.06260

Hanuš, J. et al., including **F. Marchis (**2017). Spin states of asteroids in the Eos collisional family. *eprint arXiv:1707.05507*. Available at: http://arxiv.org/abs/1707.05507

Koo H, Mojib N, Hakim JA, Hawes I, Tanabe Y, **Andersen DT**, Bej AK, 2017. Microbial communities and their predicted metabolic functions in growth laminae of a unique large conical mat from Lake Untersee, *Frontiers in Microbiology.* East Antarctica In Press, Accepted**:** 03 Jul 2017. doi: 10.3389/fmicb.2017.01347.

Rameau, J. et al., including **F. Marchis (**2017). An Optical/near-infrared investigation of HD 100546 b with the Gemini Planet Imager and MagAO. *The Astronomical Journal, Volume 153, Issue 6, article id. 244, 9 pp. (2017).*, 153. Available at: http://arxiv.org/abs/1704.06317

Parro, V., Y. Blanco, F. Puente-Sánchez, L. A. Rivas, M. Moreno-Paz, A. Echeverria, G. Chong-Diaz, C. Demergasso, and **N. A. Cabrol**, (2017). Biomarkers and metabolic patterns in the sediments of evolving glacial lakes as a proxy for planetary lake exploration. *Astrobiology*, V. 17., doi: 10.1089/ast.2015.1342.

Rappaport S, Swift J, Levine A, Joss M, Sanchis-Ojeda R, et al., including **Huber D**, (2017). VizieR Online Data Catalog: Detection of Kepler multiple M-star systems. VizieR On-line Data Catalog: J/ApJ/788/114.

Ruffio, J.-B. et al., including **F. Marchis** (2017). Improving and Assessing Planet Sensitivity of the GPI Exoplanet Survey with a Forward Model Matched Filter. *The Astrophysical Journal, Volume 842, Issue 1, article id. 14, 22 pp. (2017).*, 842. Available at: http://arxiv.org/abs/1705.05477

Vijayarangan, S., D. Kohanbash, G. Foil, D. Thompson, A. Wang, K. Zacny, **N. Cabrol**, and D. Wettergreen, (2017) Robotic subsurface exploration and science with long duration autonomy, submitted.

## Conferences: Abstracts and Proceedings

Brozovic, M., LAM Benner, SP Naidu, JD Giorgini, **MW Busch**, JS Jao, CG Lee, LG Snedeker, MA Silva, MA Slade, KJ Lawrence (2017). Goldstone radar images of near-Earth asteroids (469896) 2007 WV4, 2014 JO25, 2017 BQ6, and 2017 CS. 2017 Division for Planetary Sciences Meeting, Provo, Utah, USA.

Cuadros J, C Mavris, JR Michalski, **JL Bishop** and JM Nieto. (2017) Kaolinite from diverse acidic alterations in Earth analogues for Mars, *XVI International Clay Conference*, p.171.

**Ertem G** (2017). Role of Minerals in the Formation and Preservation of RNA Oligomers in the Events Leading to the Origin of Life, *International Society for the Study of the Origin of Life (ISSOL)*, SanDiego, CA, July 16-21, 2017

**Fenton, LK**, H Carson, **TI Michaels** (2017), Characterizing Ripple Migration Timing During the Last 400ky, *MCMC/ARC GCM Extended Group Meeting.*

**Glines N.H. and V.C. Gulick (**July 2017). Evolution of Noachian Channels and Valleys in the Corozal Crater Region. Submitted to the Fourth Conference on Early Mars: Geologic, Hydrologic, and Climatic Evolution and Implications for Life. October 2-6, 2017, Flagstaff, AZ.

**Marchis F.** et al., A Large Program to derive the shape, cratering history and density of the largest main-belt asteroids, 49th DPS/AAS

**McGrath MA,** WB Sparks, KB Hand, BE Schmidt, JR Spencer, et al., (2017). Update on Plumes at Europa, Division for Planetary Sciences meeting, #2615695, **https://www.dropbox.com/sh/5nf6rp6wtnzuwua/AADbFssH1XsIJqPHcpHESl2xa?dl=0**

**Michaels, TI** (2017), Modernizing the Standard GCM, *MCMC/ARC GCM Extended Group Meeting.*

**Race MS,** B Siegel, C Conley, and H Thronson **(**2017). Developing Planetary Protection Requirements for Human Missions Beyond Earth Orbit: Recent Progress Integrating Science, Technology & Policy Considerations, *SSERVI Exploration Forum*, NASA Ames Research Center, July 17-19, 2018.

**Race MS** (2017). Using Astrobiology & Space Mission Planning to Bring STEM Challenges to Audiences of All Ages, *International Conf. on Environmental Systems (ICES)*, Charleston, SC, July 16-20, 2017.

**Spry JA, J Rummel, MS Race**, C Conley, B Siegel, and G Kminek (2017). Putting Planetary Protection parameters in Place Ahead of the Human Exploration of Mars, *International Conf. on Environmental Systems (ICES)*, Charleston, SC, July 16-20, 2017.

**Showalter MR**, de Pater I, Lissauer JJ, **French RS**. Ongoing Dynamics and Evolution of Neptune's Ring-Moon System. Presentation at Division of Dynamical Astronomy meeting #48, London, UK.

**Tiscareno MS** (9/22). Imaging of Saturn's main rings during the Cassini Ring-Grazing Orbits and Grand Finale (invited). *European Planetary Science Congress*, **11,** 996 (link).

**Tiscareno MS** (October). High-resolution imaging of Saturn's main rings during the Cassini Ring-Grazing Orbits and Grand Finale (invited). *AAS Division for Planetary Sciences*, submitted.

**Tiscareno MS** (December). High-resolution imaging of Saturn's main rings during the Cassini Ring-Grazing Orbits and Grand Finale (invited). *American Geophysical Union*, submitted.

Tran L, G Sgarlato, L Yip, **O Marcu**, C Ling, et al., (2017). Expansion of Capabilities for RNA purification and Real-Time Gene Expression Analyses on the ISS*, ISS R&D Conference*, Washington, D.C., July 17-20, 2017.

## Technical Reports & Data Releases

McNutt R, Gaddis L, Law E, Beyer R, Crombie K, Ebel D, Ghosh A, Grayzeck E, Morgan T, Paganelli F, Powell K, Raugh A, Stein T, **Tiscareno M,** Weber R. Planetary Data System Roadmap Study for 2017–2026. This detailed report discusses the present status of the PDS and a strategy for moving forward in planetary data archiving. It was released by NASA on July 5 (link).

Thronson HA, J Baker, D Beaty, C Carberry, J Cassady, et al. (including **M Race**) (2017). Report of The Fourth Community Workshop on Achievability and Sustainability of Human Exploration of Mars (AM IV), 97 pp., posted 2017 by Explore Mars at *https://www.exploremars.org/wp-content/uploads/2017/04/AM-IV-Report-FINAL_2.pdf*

## Popular Publications/Web Stories/ Other Media / Interviews

**Beyer, R.A.** (July 17). There's Growing Evidence That Pluto's Largest Moon Had a Massive Ocean, Gizmodo, **https://gizmodo.com/theres-growing-evidence-that-plutos-largest-moon-had-a-1796948118**

Nelson, R.C., **V.C. Gulick,** P. Morkner (July 2017). Building a Raman Spectra Sample Library for Autonomous Rock Identification in Support of Future Mars Rover. NASA Ames Summer Student Poster Symposium, August 10, 2017.

Paladino, T., **V.C. Gulick**, and **N.H. Glines** (July 2017). The Role Of Water On Mars: Observations Of Gullies In Asimov Crater, Mars. NASA Ames Summer Student Poster Symposium, August 10, 2017.

**Marchis F.** is featured in Astronomy on Tap, in *Quantum Science News*.

SETI Institute and Unistellar Partnership with **Franck Marchis** (CSO of Unistellar and Senior researcher at SETI Institute) on the development of a new telescope for amateur astronomers and the public (July 19). Press releases in English, French and Spanish

Morkner, P., **V.C. Gulick, P. Freeman, and T. Johnsen** (July 2017). Building a Biosignature and Rock Sample Library and Developing Automated Classifiers to Support Future Mars Surface Missions. NASA Ames Summer Student Poster Symposium, August 10, 2017.

**Shostak, S.** "The Roswell Incident and the Kardashians Have Something in Common," *NBC News*, July 7, 2017. https://www.nbcnews.com/mach/science/roswell-incident-kardashians-have-something-common-ncna780556

**Shostak, S.** "Looks can be deceiving," *Sky's Up*, July-September, 2017, p. 8. https://view.joomag.com/skys-up-july-september-2017/0420713001499372612

**Shostak, S.** "Unsharp Masking Unmasked," *Shutterbug Magazine*, July, 2017, p. 28.

**Shostak, S. "**There Goes the Sun," SETI Institute web site, July 27, 2017.

**Shostak, S.** "Signals from a Nearby Star System," SETI Institute web site, July 21, 2017.

**Skok J. R.** is quoted in *Science News* about Martian hot springs.

**Tiscareno MS** (7/12) helped Matt Russo and Dan Tamayo of the University of Toronto to create videos that use sound and animation to communicate concepts about resonances in Saturn's rings.

**Tiscareno MS** (7/18) worked with producers and technical staff from PBS *Nova* to develop graphics for their upcoming documentary about Cassini. The documentary will likely appear in September.

**Tiscareno MS** (7/24) was interviewed via video link by Andy LaMora of TopCoder, answering questions about Cassini that had been submitted by TopCoder patrons. The edited video will be released in the next month or two, partly as a reward for TopCoder patrons who have participated in a Cassini-related research project.

**Tiscareno MS** (7/27) was interviewed via phone by Lisa Grossman of *Science News*, who is working on a retrospective article about Cassini. The article will likely appear in September.

**Tiscareno MS** (7/31) wrote a pictorial retrospective article about Cassini for *American Scientist* magazine. The article will likely appear in the November-December issue.

**Zalucha, A.** (July 2). Contamination: Mars! Denver Comic Con (public talk).

**Tiscareno MS** (7/31) was interviewed via phone by Lee Hotz of the *Wall Street Journal*, who is working on a retrospective article about Cassini. The article will likely appear in August or September.

There are two research announcements in *Science Letters*. The first is for **Lori Fenton** (with co-authors **Janice Bishop and Philippe Sarrazin**) on aeolian grains. The other is from **Peter Jenniskens** on meteor showers.

## Invitation to Speak (Professional and Public)

**Marchis F.** was invited to talk about:

Laser SETI at AoT (July 25), San Francisco

La Recherche d'une Nouvelle Terre: Un defi pour SETI" at the Observatoire de Marseille, France on July 1

La Recherche d'une Nouvelle Terre: Un projet phare pour SETI" (June 23) at the Observatoire De Paris, OCAV.

**Shostak, S.** Moderator, Jill Tarter and Sarah Scoles, SETI Institute event, Palo Alto, CA, July 12, 2017. "How to Give a Good Science Talk," NASA Ames, July 17, 2017.

**Tiscareno MS** (9/15) is helping to plan an event at the SETI Institute to mark the end of the Cassini mission. He will likely speak at this event.

## Significant Events and Activities

**Andersen D.** returned from one month of field work in the Canadian High Arctic (Axel Heiberg and Ellesmere Islands).

**Coughlin J.** has officially started a new position as K2 Science Office Directory on July 1st.

**Race M** (July 3). Appointed Field Editor, Section on Planetary Protection. Encyclopedia of Astrobiology, Springer.

**Race M** (July 6). Appointed Associate Editor, Astrobiology journal-- organizer and editor of new journal Commentary feature on "Astrobiology in the Real World—Societal Issues in Astrobiology.

**Summers D** (June 1). A proposal entitled "Microbial Detection at Low Levels by [125]I Radiolabeling" was selected by the Planetary Protection Program. This study seeks to detect microbial contamination at low levels by radiolabeling of protein biosignatures, which are present at high levels in many types of cells.

**Astrobiology:** Franck Marchis is featured in Astronomy on Tap, in *Quantum Science News*. Franck was also invited to the CNES, Salon du Bourget (June 19-23) with the company VR2Planets to present a VR environment of Mars based on the Curiosity rover data.

**J. R. Skok** is quoted in *Science News* about Martian hot springs. There are two research announcements in *Science Letters*. The first is for Lori Fenton (with co-authors Janice Bishop and Philippe Sarrazin) on aeolian grains. The other is from Peter Jenniskens on meteor showers.

## Highlights

**Cabrol, N.A.** Received the final reviews for the SETI White Papers and is now in the process of organizing the follow-up workshop that will likely take place in January 2018.

**LaserSETI** crowdfunding campaign on Indiegogo. At the time of this writing, raised $80k, generated hundreds of new donors, tens of thousands of social media impressions in addition to 27k campaign page views.

**Gulick, V.C.** Formulated research projects for four summer interns and helped them with their abstracts and posters.

- Khanh Luu, SETI REU Summer intern from CSU-SB.
    - HiRISE and CRISM Studies of Northwestern Palikir Crater Gullies, Mars
- Tyler Paladino, USRA Summer intern from UCSC

    - HiRISE and CRISM Studies of Gullies in the Eastern Central Pit Region of Asimov Crater, Mars.
- Richard Nelson, USRA Summer Intern from UCSB
    - Building a Raman Spectra Sample Library for Autonomous Rock Identification in Support of Future Mars Rover
- Paige Morkner, Cal Space Grant Intern, returning intern
    - Building a Biosignature and Rock Sample Library and Developing Automated Classifiers to Support Future Mars Surface Missions

**Gulick, V.C.** is on the scientific organizing committee for the Fourth Conference on Early Mars: Geologic, Hydrologic, and Climatic Evolution and Implications for Life. October 2-6, 2017, Flagstaff, AZ.

**Tiscareno MS**. Member of the AAS DPS Subcommittee on Professional Culture and Climate, which works towards making the community of planetary scientists an environment in which professional merit is the only criterion that determines each person's success.

**Tiscareno MS**. Co-chair of the Local Organizing Committee for the 2018 meeting of the AAS Division on Dynamical Astronomy, which will take place next April in San Jose CA.

## Where on Earth is the Flag?

The flag has returned from the Canadian Arctic and making its way back to the SETI Institute!

## *Carl Sagan Center Science Council*

| *Research Division* | *Chair* | *Co-Chair* |
|---|---|---|
| *Astronomy & Astrophysics* | Paul Estrada | Uma Gorti |
| *Astrobiology* | Janice Bishop | Nathalie A. Cabrol |
| *Climate & Geoscience* | Dale Andersen | |
| *Exoplanets* | Franck Marchis | Doug Caldwell |
| *Planetary Exploration* | Virginia Gulick | Lori Fenton |
| *SETI* | Gerry Harp | Eliot Gillum |

*Advisors to the Science Council*
Mark Showalter
Margaret Race
*Young Scientist Representative*
Michael Busch