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Activity Report Q2 2019


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Peer-Reviewed Publications (in press or published)

1. Airapetian, V.S., Barnes, R., Cohen, O., Collinson, G.A., Danchi, W.C. et al., including **Jin, M.** (2019), "Impact of Space Weather on Climate and Habitability of Terrestrial Type Exoplanets" Int. J. of Astrobiology, accepted, arXiv:1905.05093.

2. Bouma, L. G., Winn, J. N., Baxter, et al., including **Twicken, J. D., Wohler, B**. (2019) WASP-4b Arrived Early for the TESS Mission, *The Astronomical Journal*, **157**, 217, https://dx.doi.org/10.3847/1538-3881/ab189f.

3. Balmaverde, B., Capetti, A., Baldi, R.D., Baum, S., Chiaberge, M., Gilli, R., Grandi, P., Marconi, A., Meyer, E., Miley, G., O'Dea, C., **Sparks, W.,** Torresi, E., Tremblay, G., Venturi, G., 2019, A&A, in press. *The MURALES survey. II. Presentation of the observations and first results;* astro-ph/1903.10768.

4. ***Beddingfield, C.B.***, **R.A. Beyer**, K. Singer, F. Nimmo, W.B. McKinnon, J.M. Moore, K. Ennico, C.B. Olkin, P. Schenk, J.R. Spencer, S.A. Stern, H.A. Weaver, L.A. Young, and the New Horizons Team, Landslides on Charon, *Icarus*, *in press*.

5. Burgasser A, I Baraffe, M Browning, A Burrows, G Chabrier et al., **including D Huber** (2019). Fundamental Physics with Brown Dwarfs: The Mass-Radius Relation, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 214; *BAAS* **51**, Issue 3, id. 214.

6. **Cabrol, NA,** (2019), 100 Years of the IAU: Beyond the Galileo Experiment, *Nature Astromomy*, **3**:585-587 d.

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8. **Cartwright RJ**, B Holler, S Benecchi, R Juanola-Parramon, G Arney et al. (2019). Exploring the Composition of Icy Bodies at the Fringes of the Solar System with Next Generation Space Telescopes, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 132; *BAAS* **51**, id.132

9. Caudill, C.M., Pontefact, A., Osinski, G.R., **Tornabene, L.L.**, and 14 others, (2019) CanMars mission science results and review of optimization for sample selection for Mars Sample Return (MSR) based on science operations and procedures. *Planet. Space Sci.*, doi: 10.1016/j.pss.2019.04.004

10. Chanover N, MH Wong, T Greathouse, D Trilling, A Conrad et al., including **RJ Cartwright** (2019). Triggered High-priority Observations of Dynamic Solar System Phenomenon, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 340; *BAAS* **51**, id.340

11. Chontos A, **D Huber**, DW Latham, A Bieryla, V. Van Eylen et al. (2019). The Curious Case of KOI 4: Confirming Kepler's First Exoplanet Detection, AJ 157, id. 192, 14pp. 10.3847/1538-3881/ab0e8e

12. Chornock R, PS Cowperthwaite, R Margutti, D Milisavlijevic, KD Alexander et al., including **J Rho** (2019). Multi-Messenger Astronomy with Extremely Large Telescopes, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 237; *BAAS* **51**, Issue 3, id. 237

13. Cordiner MA, H Linnartz, NLJ Cox, **J Cami**, F Najarro et al. (2019). Confirming Interstellar C_{60}^+ Using the Hubble Space Telescope, *ApJL* **875**, id. L28, 7 pp. 10.3847/2041-8213/ab14e5

14. Cruikshank, Dale P., **Orkan M. Umurhan**, **Ross A. Beyer**, Bernard Schmitt, James T. Keane, et al. including **Oliver L. White**, **Cristina M. Dalle Ore**, and **Richard J. Cartwright** (2019). Recent cryovolcanism in Virgil Fossae on Pluto, *Icarus* **330**, 155-168, doi:10.1016/j.icarus.2019.04.023.

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16. **Doyle, L.R.,** "The Discovery of 'Tatooine': Kepler-16b" (2019), *New Astronomy Reviews* **84**, 101515.

17. Dragomir, D., Teske, J., Günther, M. N., et al. including **Twicken, J. D., Wohler, B.** (2019) TESS Delivers Its First Earth-sized Planet and a Warm Sub-Neptune, *The Astrophysical Journal*, **875**, L7, https://dx.doi.org/10.3847/2041-8213/ab12ed.

18. Fernández-Martínez, MA., R. dos Santos Severino, M. Moreno Paz, I. Gallardo Carreño, Y. Blanco, **K. Warren-Rhodes,** M. Garcia-Villadangos, M. Ruiz-Bermejo, A. Barberán, D. Wettergreen, **N.A. Cabrol**, and V. Parro. (2019). Prokaryotic community structure and metabolisms in shallow subsurface of Atacama Desert playas and alluvial fans after heavy rains: repairing and preparing for next dry period. *Frontiers in Microbiology, section Extreme Microbiology*, ID: 463848.

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20. Graham M, D Milisavlijevic, A Rest, JC Wheeler, R Chornock et al., including **J Rho** (2019). Discovery Frontiers of Explosive Transients: An ELT and LSST Perspective, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 339; *BAAS* **51**, Issue 3, id. 339.

21. Greenbaum, Alexandra Z.; Cheetham, Anthony; Sivaramakrishnan, Anand; Rantakyrö, Fredrik T.; Duchêne, Gaspard et al.; including **Marchis, F.**; (2019/04). Performance of the Gemini Planet Imager Non-Redundant Mask and spectroscopy of two close-separation binaries HR 2690 and HD 142527. eprint arXiv:1904.09006.

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23. Hanuš, J.; Marsset, M.; Vernazza, P.; Viikinkoski, M.; Drouard, A. et al.; including **Marchis, F.;** (2019/04). The shape of (7) Iris as evidence of an ancient large impact? *Astronomy & Astrophysics*, Volume 624, id.A121, 17 pp. doi: 10.1051/0004-6361/201834541.

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29. Jones, M. I., Brahm, R., Espinoza, N., et al. including **Smith, J. C., Tenenbaum, P.** (2019) HD 2685 b: a hot Jupiter orbiting an early F-type star detected by TESS, *Astronomy and Astrophysics*, **625**, A16, https://dx.doi.org/10.1051/0004-6361/201834640.

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12. **Doyle LR.,** Interview for "How the Universe Works" TV series

13. **Lee, P** April 6, 2019, cited *in Parabolic Arc*, Drone Maps Icy Lava Tube in Iceland in Preparation for Lunar and Martian Cave Exploration

14. GPI press releases describing the mid-course survey paper involving **Marchis, F. and Nielsen, E.:**
    a. SETI Institute PR: https://www.seti.org/gemini-planet-imager-planet-search-shows-giant-planets-orbiting-sun-stars-may-be-rare

b. Gemini PR: Gemini: https://www.gemini.edu/node/21206

c. Stanford PR: https://news.stanford.edu/press-releases/2019/06/12/gemini-planet-imalyzes-300-stars/

d. UC Berkeley PR: https://news.berkeley.edu/2019/06/12/jupiter-like-exoplanets-found-in-sweet-spot-in-most-planetary-systems/

e. SpaceRef: http://spaceref.com/extrasolar-planets/giant-planets-orbiting-sun-like-stars-may-be-rare.html

15. Ansdell, M.; **Marchis, F.**; Waldman, A. (06/24). *Adam Savage's Tested*: What Exoplanets Look Like in Film vs. Reality, Offworld Episode 23; discussion of exoplanet imaging and what we know about planets astronomers have detected so far

16. **Race, M.** June 2019, cited in *Discover Magazine*, Mars Doesn't Need Our Microbes: How to Keep the Red Planet Pristine

17. **Schulze-Makuch, D.** Blogs on Smithsonian Website, as listed with date on https://www.airspacemag.com/author/dirk-schulze-makuch/
Setup of website: https://www.searchforlifeintheuniverse.com/

18. **SETI Institute: Airborne Astronomy Ambassadors**
    a. News 4 San Antonio, May 24, 2019, 4 NISD Teachers Selected for NASA Program

19. **SETI Institute: SETI Artists-Residence**
    a. Scientia, May 29, 2019, The SETI Institute's Earthling Project

20. **SETI Institute: Big Picture Science**
    a. DecodeHer (April 1, 2019)
    b. Go with the Flow (April 8, 2019)
    c. Gained in Translation (April 22, 2019)
    d. Rethinking Chernobyl (May 6, 2019)
    e. Is Life Inevitable? (May 13, 2019)
    f. Skeptic Check: Worrier Mentality (May 27, 2019)
    g. Animals Like Us (June 24, 2019)

21. **SETI Institute: Explorer Magazine 2019**
    a. **Shostak S** Editor, Have Aliens Quarantined the Earth
    b. **Bourdow S** It was the Golden Record: A Profile of Board Member John Giannandrea
    c. **Busch M** Radar Astronomy and Asteroid Spacecraft Missions
    d. **Bywaters K** How to Become a Scientist
    e. **Cabrol N** the Changing Nature of Solar System Exploration
    f. **Jenniskens P** Tracking Meteorites to Their Source

g. **Showlater M** (subject) Redefining the Unknown
h. **Twicken J** On the Hunt for Planets with TESS
i. **Parr, J** (for Frontier Development Lab) Forget HAL. AI on Spacecraft is a Good Idea
j. **Marchis F** Small Scope, Large Capability
k. **Harman P** Thousands of Girl Scouts Encounter Space Science Thanks to New Badges

22. **SETI Institute: Facebook Live**
    a. **Gillum E** April 3, 2019 Laser SETI (interviewed by **Diamond B**)
    b. **Lee P** April 4, 2019 Mapping Ice Cave in Iceland with a Drone (interviewed by **Tiscareno MS**)
    c. **Marchis F** April 8, 2019 interviewed Emily Lakdawalla of the Planetary Society
    d. **Marchis F** April 18, 2019 interviewed Ariel Waldman
    e. **Cabrol N** April 25, 2019 Marsquakes (interviewed by **Diamond B**)
    f. **Marchis F** May 1, 2019 Live from the Planetary Defense Conference
    g. **Fenton L** May 2, 2019 Dust Devil Formation (interviewed by **Diamond B**)
    h. **Shostak S** May 8, 2019 interview with Drake Award recipient Jason Wright
    i. **Beyer R, White, O, Umurhan O** May 23, 2019, Ultima Thule (interviewed by **Shostak S**)
    j. **Dalle Ore C** June 6, 2019 Detection of Ammonia on Pluto (interviewed by **Shostak S**)
    k. **Tiscareno MS** June 13, 2019 Cassini Data and Saturn's Rings (interviewed by **Shostak S**)
    l. **Shostak S** June 19, 2019 interview with Breakthrough Listen Researchers
    m. **Diamond B** June 25, 2019 Live from AbSciCon

23. **SETI Institute: Reddit AMA**
    a. Wright, J May 8, 2019 I am Jason Wright, the winner of the SETI Institute's 2019 Drake Award. AMA!
    b. **Shostak S** June 6, 2019 I'm Seth Shostak, Senior Astronomer at the SETI Institute and host of Big Picture Science, and I'm looking for aliens. AMA!

24. **SETI Institute: SETI Talks**
    a. Where is the Origin of Life on Earth? (April 17, 2019) with David Deamer, Lynn Rothschild and Bruce Damer
    b. https://www.seti.org/event/back-moon-time-stayBack to the Moon: This Time to Stay? (June 26, 2019) with Greg Schmidt, Michael Sims and David Morrison

25. **Shostak S.** "Why Alien Megastructures May Hold Key to Making Contact with Extraterrestrials," *NBC News*, April 20, 2019, https://www.nbcnews.com/mach/science/why-alien-megastructures-may-hold-key-making-contact-extraterrestrials-ncna994996.

26. **Shostak S.** "Space Aliens are Breeding with Humans, University Instructor Says. Scientists Say Otherwise." *NBC News*, May 25, 2019. https://www.nbcnews.com/mach/science/space-aliens-are-breeding-humans-university-instructor-says-scientists-say-ncna1008971

27. **Shostak S.** "Extraterrestrial life is out there and SETI is busy looking for it," *Metro, U.K.* Jun 12, 2019. https://metro.co.uk/2019/06/12/extraterrestrial-life-is-out-there-and-seti-is-busy-looking-for-it-9790842/

28. **Shostak S.** "Why alien moons might be a great place to find extraterrestrial life," *NBC News*, June 15, 2019. https://www.nbcnews.com/mach/science/why-alien-moons-may-be-great-place-find-extraterrestrial-life-ncna1017391

29. **Shostak S.** "Search for space aliens comes up empty, but extraterrestrial life could still be out there," *NBC News*, June 26, 2019. https://www.nbcnews.com/mach/science/search-space-aliens-comes-empty-extraterrestrial-life-could-still-be-ncna1021716

30. **Shostak S.** Apr 1, interview for "Midnight in the Desert" podcast

31. **Shostak S.** Apr 2, interview for podcast by Josh Clark, U.K.

32. **Shostak S.** April 11, by Colorado University radio podcast.

33. **Shostak S.** Apr 17, interview by Rod Pyle, U.K. radio show

34. **Shostak S.** Apr 25, interview on "Signal Hunters" podcast

35. **Shostak S.** Apr 26, KGO radio, San Francisco on Navy's new protocols

36. **Shostak S.** April 30, 2019, cited by Denise Chow in *MSN.com*, U.S. Navy is Revising Rules to Encourage Pilots to Report Unusual Sightings

37. **Shostak S.** May 1, cited by Paul Sonne, in *Washington Post*, Navy: No Public Release of UFO Data is Expected

38. **Shostak S.** May 2, John Burke, TV shoot

39. **Shostak S.** May 2, Laura Geggel, Associate Editor, *Live Science*, regarding new Navy protocols

40. **Shostak S.** May 4, Interview at Zipcode Wilmington event by for local publication

41. **Shostak S.** May 6, 2019, cited in *Fox News*, Navy Plans to Document UFO Sightings, but Keep Them Confidential

42. **Shostak S.** May 8, Quotes for Tom Metcalfe about Hubble deep field photo, *NBC Mach*

43. **Shostak S.** May 9, Interview with WLS radio, Chicago about SETI

44. **Shostak S.** May 16, 2019, interview by Mićo Tatalović for BBC magazine

45. **Shostak S.** May 16, 2019, cited in *Smithsonian.com*, Yes, the United States Certainly DID Land Humans on the Moon

46. **Shostak S.** May 22, Ben Lindbergh, writer for The Ringer, doing story about SETI@home

47. **Shostak S.** May 23, Adam Hadhazy, "Aerospace America," about Navy UFO guidelines.

48. **Shostak S.** May 24, Phone interview with Mark Medley, Toronto writer, working on project about long-term projects

49. **Shostak S.** May 28, CBS radio interview, Jon Schlosburg

50. **Shostak S.** Jun 5, Trace Dominquez video podcast interview

51. **Shostak S.** Jun 6, Interview for article Christophe Plummer, Switzerland

52. **Shostak S.** Jun 11, X Zone radio interview, Canada

53. **Shostak S.** Jun 11, Radio interview from Helsinki magazine writer, Markus Hotakainen

54. **Shostak S.** Jun 12, KPPC radio interview

55. **Shostak S.** Jun 14, Elizabeth Fernandez, contributing editor to *Forbes.com*, for article

56. **Shostak S.** Jun 16, Howard Hughes radio interview, U.K.

57. **Shostak S.** Ju 17. Kelly Kowalski, TV maker, for discussion of SETIsodes, etc.

58. **Shostak S.** Jun 18, Florian Schmitt, on-line magazine, from Bavaria, Germany for article

59. **Shostak S.** Jun 19, Miriam Kramer, *Axios*, interview for print https://www.axios.com/life-space-breakthrough-listen-645ac6cc-1c47-45a5-94d0-fbd20380a6a3.html

60. **Shostak S.** June 20, 2019. Rob Breakenridge, Alberta radio, 15 minute interview about Breakthrough Listen SETI presser. CHQR, Calgary.

61. **Siemion A., Tarter J.** June 20, 2019 cited in *Gizmodo*, An Ambitious Search for Aliens Comes up Short, So Astrobiologists are Thinking Bigger

62. **Tiscareno MS** continued to advise filmmakers from the American Museum of Natural History (AMNH) in New York NY, on the planning of their next major planetarium show.

63. **Tiscareno MS** was mentioned (with reference to the institute) in an article profiling his student Jakayla Robinson, entitled "Student explores mysterious shapes in Saturn's rings," which appeared on 4/10/19 in the newspaper of Robinson's institution, the University of Alabama at Birmingham.

64. **Tiscareno MS** April 30, 2019, interviewed for and quoted in *Axios*, Skimming Saturn's rings

65. **Tiscareno MS** helped to prepare and was quoted (with reference to the institute) in a NASA/JPL press release entitled "NASA's Cassini reveals new sculpting in Saturn's rings," which appeared 6/13/19. A companion SETI Institute press release appeared the same day. Many media outlets picked up the story.

66. **Tiscareno MS** was interviewed for and quoted (with reference to the institute) in the article "The past and promise of Cassini's legacy," which appeared in *Cosmos Magazine* on 6/13/19.

67. **Tiscareno MS** was interviewed for and quoted (with reference to the institute) in the article "Saturn's rings — and their propellers, waves, speckles and secrets — come into focus with Cassini's final images," which appeared on the Australian Broadcasting Corporation website on 6/13/19.

68. **Tiscareno MS** was interviewed for and quoted (with reference to the institute) in the article "Saturn's moons may have 'sculpted' its famous rings, new study suggests," which appeared in *USA Today* on 6/13/19.

69. **Tiscareno MS** was interviewed by Seth Shostak on the SETI Institute's Facebook Live segment on 6/13/19.

70. **Tiscareno MS** 6/14/19 cited in *Tech Times*, Cassini Mission Dives Deep into Inner Workings of Saturn's Rings

71. **Tiscareno MS** 6/17/19 cited in *ValueWalk*, Final Cassini Images Shed Light on Origin of Saturn's Rings

72. **Tiscareno MS** cited in *EarthSky* 6/28/19 *See Super-Detailed Images of Saturn's Rings*

73. **Tiscareno MS** was "interviewed" by Reddit users in an Ask Me Anything segment on 7/10/19.

74. **Warren-Rhodes, K.,** "Astrobiology" in *Scientific American-China* magazine, June 2019. Interview in Mandarin about Astrobiology, Mars and research in extreme environments.

75. **White O.** Interviewed by Ryan Mandelbaum of Gizmodo in early June on geological diversity across Pluto.

Invitation to Speak (Professional and Public)

1. **Andersen, D. T.** (2019), Invited Lecture: *Lake Untersee, An Oasis in a Frozen Desert*, 30 May, 2019, Shimoda Ocean Research Center, Tsukuba University, Shimoda City, Tokyo.

2. **Backman, DE.** *Airborne Astronomy Ambassadors: High School Teachers Onboard a NASA Flying Observatory,* Career Day Esther B. Clark School 7th grade class (12 students), Palo Alto, CA.

3. **Bishop JL** (April/4). *Coordinated Analyses of Lab, Field and Remote Observations for Understanding Surface Processes on Mars.* Planetary Geoscience Institute Brown Bag Lunch Seminar, Department of Earth and Planetary Sciences, University of Tennessee, Knoxville.

4. **Bishop JL** (April/4). *Clues about the Early Martian Climate from the Phyllosilicate Record: How Warm is Warm?* Klepser Seminar Series, Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN.

5. **Bishop JL** (April/9). *The Places You'll Go…The Things You Can Do: Planning Missions to Mars.* Presentation and demonstration to 5th grade students at Alto International School about the planet Mars, Menlo Park, CA.

6. **Bishop JL** (April/23). *Constraints on the Climate of Early Mars from the Phyllosilicate Record.* Colloquium, Department of Geology and Geophysics, Louisiana State University, Baton Rouge.

7. **Bishop JL** (April/29). *Exploring Mars Using a Rover.* Presentation and demonstration to 7th grade students at Alto International School about martian rovers, Menlo Park, CA.

8. **Bishop JL** (June/13). *The Surface of Mars: Mineralogy as an indicator of water, geochemistry and surface processes*, Presentation to the SETI Institute REU Program, Mountain View, CA.

9. **Cabrol NA** was invited in Antofagasta, Chile (April 13-15) as a keynote lecturer at the Puerto de Ideas science festival. Presentation Title: *Searching for Life Beyond Earth.* About 500 people attended the talk

10. **Cabrol NA**. Two invited talks at the 2019 AbSciCon conference in Seattle: (a) 20th Anniversary of the NASA Astrobiology Institute and (b) Terrestrial Analog Sessions.

11. **Cabrol NA.** (6/21) Presentation to the 2019 REU Students at the SETI Institute: *Astrobiology: Habitability & Life Beyond Earth*.

12. **Cartwright RJ** (06/27). *The Dark and Icy Surfaces of the Large Moons of Uranus: Modified by System-wide Processes?* Goleta, CA, Las Cumbres Observatory seminar.

13. **Cartwright RJ** (04/11). *Radiative Transfer Modeling of Icy Satellite Regoliths: Evidence for Compositional Stratification*. Pasadena, CA, Jet Propulsion Laboratory SVCP seminar.

14. **Diamond WH** (June 4, 2019) Private lecture to faculty and students in the departments of Physics, Astronomy and Astrophysics at Oxford University, "Research and Education Programs at the SETI Institute"

15. **Diamond WH** (June 6, 2019) Harwell Science and Technology Laboratory at the Atomic Energy Research Establishment, Harwell, UK, "Research and Education Programs at the SETI Institute"

16. **Diamond WH** (June 6, 2019) Public lecture at the Department of Theoretical Physics, Oxford University, "Finding Aliens – The Search for Life in the Universe"

17. **Jin, M.** (April 11, 2019) Public talk at Stockton Astronomical Society, "Heliophysics: Science for Living with a Star"

18. **Marchis, F**. (06/29). *Studying Other Blue Dots and the Heart of Exoplanet Research*, Star's Up event in Meudon, France; talk about exoplanet research at SETI Institute.

19. **Marchis, F**. (05/17). StartOut, Demo Day, Unistellar eVscope, San Francisco, CA

20. **Marchis, F**. (05/09). NightLife in Space: *Other Earths*, California Academy of Sciences (CAS); talk on what is involved in detecting and characterizing exoplanets.

21. **Marchis, F**. (04/15). Rose City Astronomy (RCA) General Meeting: *Another Pale Blue Dot — Inside the SETI Institute's Search for Exoplanets*, Rose City Oregon; event discussion of new and sophisticated projects which aim to image exoplanets directly, followed by a scientific demonstration of SETI Institute partner Unistellar eVscope technology.

22. **Race MS** (April 4, 2019). *Astrobiology and Missions to Mars*. Invited speaker at Super Stars Literacy Program, Palo Alto, CA.

23. **Race MS** (May/10 and June/7). *Moderator of two programs on Space Exploration featuring ISS Astronaut Daniel Bursch*. The Pleasant Hill and Danville Libraries, Contra Costa County, CA.

24. **Race MS** (June/14). *Our Place in the Universe—and Searching for ET*. Speaker in After-School Astronomy Program, Burkhalter School, East Oakland, CA.

25. **Schulze-Makuch D.** Ancient Life on the Moon? Invited Talk at the Seattle Museum of Flight, Seattle, Washington State, USA; 29 June 2019.

26. **Shostak S.** Apr 1, "Introduction to Life in Space," OLLI course, Santa Clara University

27. **Shostak S.** Apr 9-13, eight panels, various topics, Conference on World Affairs, Boulder, CO

28. **Shostak S.** Apr 20-21, two talks on SETI, Querencia, Cabo, Mexico

29. **Shostak S.** May 6-7, four talks on SETI, Wilmington, Delaware

30. **Shostak S.** May 13, talk for Explorer Scouts, San Jose, CA

31. **Shostak S.** May 16, talk for Nightlife, California Academy of Sciences

32. **Shostak S.** May 20, talk on SETI for Priory School, Woodside, CA

33. **Shostak S.** Jun 22-23, three talks at AlienCon, Los Angeles, CA

34. **Showalter MR** (6/17/19 to 7/6/19), was the invited lecturer on a tour of Chile in association with the July 2 eclipse. He gave lectures about SETI news, the giant planets, the New Horizons mission, and the eclipse.

35. **Skok JR** (May 29, 2019) San Jose Astronomy on Tap

36. Slater, G., **D. T. Andersen**, and A. Brady (2019), *Isotopic Depletion of Methanotroph Biomarker Lipids in Lacustrine Systems*, in *2019 Astrobiology Science Conference*, Seattle, Washington.

37. **Smith, J. C.,** (06/15) "Exploring Beyond Earth's Atmosphere with Human-Machine Teams," GEOINT 2019 conference, San Antonio, TX.

38. **Tiscareno MS** (7/13/19) will speak about Cassini as the Wonderfest speaker at Mount Tamalpais State Park in Mill Valley CA.

39. Vanderwilt, M., N. Wagner, **D. T. Andersen**, and S. S. Johnson (2019), *Soil Microbial Communities in an Antarctic Water Track: Identifying Potential Ecological Optimums in a Hyperarid Mars-analog Environment* in *2019 Astrobiology Science Conference*, Seattle, Washington. Poster.

40. **White O.** Interviewed by Ryan Mandelbaum of Gizmodo in early June on geological diversity across Pluto.

41. **White O.** Invited to speak at the Geological Society of America 2019 meeting in Phoenix, AZ on comparative geology of Pluto, Charon, and MU69, and at the 2019 AGU Fall Meeting in San Francisco, CA on the geology of MU69.

Highlights/ Significant Events and Activities

1. **Backman, DE Clark, C, Harman, PK,** (4/11 – 13) *NASA SciAct Exhibit, AAA Recruitment,* NSTA, St. Louis, MO.

2. **Cabrol NA**. The NV "Beyond the Galileo Experiment" published by *Nature Astronomy* on July 5, 2019 remains in the top 5% of all research outputs scored by Altmetric.

3. **Cartwright RJ** (06, 3 nights). Observing time. Remote observing of Callisto with the DeVeny spectrograph on the Discovery Channel telescopes.

4. **Cartwright RJ** (05, 2 nights). Queue mode observing of Callisto with the Near-Infrared Integral Field spectrograph on Gemini North.

5. **Harman, PK**, *Education* Girl Scout Volunteer and Staff Astronomy Training May 9 – 12, Tucson, AZ

6. **Harman, PK**, *Education* Girl Scout Astronomy Club Training June 10 – 14, GSFC, MD

7. **Hinson D.** See below the QR code of a short movie of water ice clouds on Mars.

8. **Marchis, F**. (07/10 – 07/11). NASA iTech: *Initiative to Find Innovative Ideas*; scientific demonstration of SETI Institute partner Unistellar eVscope technology and Cycle I Semifinalist recipient.

9. **Marchis, F**. (06/28 – 06/29). *Star's Up* event in Meudon France; scientific demonstration of SETI Institute partner Unistellar eVscope technology.

10. **Marchis, F**. (05/11). California Academy of Sciences: *Astronomy Day 2019*; scientific demonstration of both VR2 Planets and SETI Institute partner Unistellar eVscope technology.

11. **Marchis, F**. (05/08). SETI Institute: *2019 Drake Awards*; event celebrates exemplary contributions to astrobiology through scientific research and exploration of space.

12. **Marchis, F**. (04/29 – 05/03). IAA: *Planetary Defense Conference*; event on the discussion of the threat posed by asteroids and comets and actions that might be taken to deflect a threatening object from Earth.

13. **The PDS Ring-Moon Systems Node** (Showalter MR, French RS, Stopp DJ, Chang YJ, Gordon MK, Tiscareno MS, Evans MW) released OPUS 3.0, a major update to our popular on-line search engine. See https://pds-rings.seti.org/search.

14. **Race MS, S Shostak, JL Bishop, P Lee, F Marchis & M Busch** (Mondays, April 1-29, 2019). Adult Education Course: *Astrobiology: The Search for Life in the Universe- It's More than Science Fiction.* Osher Lifelong Learning Institute, Santa Clara University, Santa Clara, CA.

15. **Race MS, & JA Spry,** LM Pratt and G Kminek (May 14-16, 2019). Organized session at 3rd COSPAR Iinternational Workshop on Refining Planetary Protection Requirements for Human Missions. Houston TX.

16. **Race, M, Busch, M, Shostak, S, Bishop, J** (4/1, 8, 15, 22, and 29)*Astrobiology: The Search for Life in the Universe- It's More than Science Fiction,* Osher Lifelong Learning Institute, Santa Clara, CA.

17. **Race, M,** STAR Program Mentorship, June 10 – August 9, Mountain View, CA.

18. Ricca A, **J Roser**, E Peeters & C Boersma 2019. Co-author of contributed poster, *Zigzag and armchair PAH subpopulations as probes of the local radiation environment*, Seventh Annual Jamboree, NASA-Ames Space Science and Astrobiology Division.

19. **Roser J**, A Ricca, C Dalle Ore & D Cruikshank 2019. Contributed poster, *Ammonia Ices in the Outer Solar System and Laboratory Complex Index of Refraction Determinations*, Seventh Annual Jamboree, NASA-Ames Space Science and Astrobiology Division.

20. **Rummel JD**, R Mogul, R McCauley, T Errigo & JA Spry (2019). Planetary Protection for Astrobiology: Progress and Challenges in Science and Policy. *Primary Organizer, Oral and Poster Sessions* in AbSciCon 2019, Bellevue, WA.

21. **Schulze-Makuch D.** Invited Attendee at Breakthrough Discussion Meeting of the Breakthrough Initiative in Berkeley, CA, April 11-12, 2019.

22. **Sobron P.** attended international planetary libs meeting with NASA, ESA, JAXA, and Chinese Space - discussed astrobiology applications of Libs, manuscripts and EPSC abstract being drafted.

23. **Sparks W.** Participated in the AbSciCon 2019, useful as a forum for nurturing collaboration and staying abreast of develepments in the field.

24. **Sparks W.** We continued programs to seek plumes on Europa using the Hubble Space Telescope (HST), and SOFIA. Our SOFIA flight took place in April 2019, and executed flawlessly. We obtained high resolution mid infrared spectroscopy of Europa with the goal of

detecting or placing useful limits on the strength of water vapor molecular vibrational emission lines, and hence on the quantitative parameters for plumes on Europa.

The Jupiter opposition period was May-July 2019, hence there was substantial work planning and executing the HST observations. Each visit required individual treatment, since complex moving target specifications and timing are needed. The observations completed successfully.

We have been acquiring laboratory data on the circular polarization properties of anoxygenic phototrophs over recent years. Our goal is to assess the degree to which measurements of this type can be used as a biosignature, and their potential utility in remote sensing as well as in situ instrumentation. During this quarter, we began the process of consolidating the results and bringing the work to publication.

25. **Tiscareno, M,** Research Experience for Undergraduates, June 10 – August 16, Mountain View, CA.

26. **Twicken, J. D.** (4/29.2019) Organized tour of NASA/Ames Research Center for Hillsdale High School GATE program on 4/29/19. There were 27 students and two adults in attendance. The tour included: (1) Unitary Wind Tunnel (11'x11' transonic wind tunnel), (2) NASA Advanced Supercomputing division Pleiades supercomputer and Hyperwall, and (3) MicroGravity Test Facility and Astrobee robot

27. Yesilbas M. was awarded an NPP Fellowship to become a postdoc with **Janice Bishop** at the SETI Institute on Mars remote sensing and lab spectral analyses supporting the NAI project.

Projects with Interns

1. **Bishop JL & JR Skok** (June, 2019) Organizing and processing spectral library files for archives at the SETI Institute, Brown University's RELAB, and NASA's Planetary Data Server with interns Z Brandt, K Gruendler, M Gruendler, and M Stone. (Work to continue through August).

2. **Race MS** and STAR intern K Duenas (June, 2019) Updated and developed new website materials for NASA Planetary Protection Office and NASA Office of Safety and Mission Assurance. Began work on a Middle School book on Astrobiology and Mission Planning linked with Next Generation Science Standards (Work to continue through August).

Field Work

1. **K. Warren-Rhodes** returned to Salar de Pajonales (Chile) to complete the sample collection started in November 2018 as part of the SETI Institute NAI team biosignature detection project.

Observing Time

1. **Marchis, F**. (05/29), Unistellar eVscope, observation attempt of UCAC4-363-062477 in constellation of Corvus and successful observation of M67 in constellation of Cancer with the Unistellar eVscope

2. **Showalter M.** is observing the Pluto system using the Hubble Space Telescope on ten occasions during April–September, 2019.

3. **Sparks W.** As part of a major campaign targeted at Europa's plumes, our program HST GO#15424 to observe transits of Europa across the face of Jupiter using far ultraviolet time resolved imaging with the Hubble Space Telescope executed through the 2019 opposition period, for completion in July 2019. A major effort for observational planning at phase 2 was undertaken in preparation for this high profile data acquisition phase, and basic data processing of the new observations is underway. All observations were completed successfully following a rescheduled visit lost to a guide star acquisition problem.

4. We acquired observations of Europa using EXES on SOFIA, flight "SUSAN" April 24/25 to seek direct evidence of water vapor from plumes, targeting mid infrared water vapor molecular vibrational emission lines, with the very high spectral resolution offered by EXES. Sparks participated in the flight. All data were successfully acquired and have been processed using the SOFIA pipeline. However, customized treatment of the observations is required in order to generate spectra with optimal sensitivity, yet to be carried out.

Contribution to ongoing/planned missions

1. **Bishop JL** (2002-ongoing). Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), Visible/near-infrared (VNIR) imager in orbit at Mars on the Mars Reconnaissance Orbiter (MRO) and mapping surface composition at scales as fine as 18 meter per pixel.

2. **ExoMars:** Sobron P, Tornabene, L. (ongoing). *ExoMars 2020 rover mission Science Team member*, RLS instrument development and operation.

3. **Marcu O** (2017-ongoing). WetLab2, First facility to provide gene expression in space, on the International Space Station. Developing protocols and workflow for plant automated extraction and processing.

4. **Mars 2020:** Sobron P (ongoing). *NASA Mars 2020 rover mission Science Team member*, SHERLOC and SuperCam instrument development and operation.

5. **MRO CRISM:** Bishop JL (2002-ongoing). Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), Visible/near-infrared (VNIR) imager in orbit at Mars on the Mars Reconnaissance Orbiter (MRO) and mapping surface composition at scales as fine as 18 meter per pixel.

6. **MRO HiRISE**: Ginny Gulick, Ross Beyer, Livio Tornabene

7. **New Horizons:** Mark Showalter, Ross Beyer, Cristina Dalle Ore, Oliver White, Orkan Umurhan, and Chloe Beddingfield

8. **OSIRIS-REx:** John Marshall, Chloe Beddingfield

9. **Spry JA** (2015-ongoing) Mission support to the NASA Office of Planetary Protection for missions/ projects including New Horizons, OSIRIS-Rex, InSight, MarCO, Solar Orbiter, Artemis-1, Artemis-1 secondary payloads (cubesats), Gateway, NASA's Exploration Capability Development activity, Discovery proposals, etc.

Contribution to mission planning/concepts

1. **Jin, M.,** Co-I for a SMEX mission planning for submission in 2019

2. **Marcu O** (April-ongoing). WetLab2, 1) demonstrating feasibility in SPM (Sample Prep Module); 2) providing justification for future support of plant missions on the ISS; 3) provided science input for the need for hardware development for deep space mission.

3. **Showalter MR**, **Beyer RA**, and **Tiscareno MS** are participating in a Discovery Mission proposal for a centaur reconnaissance mission.

4. **Sparks W.** I contributed to a couple of mission concepts and mission proposals.

Strategic Planning/Official Committees/Working Groups

1. **Beyer R.** DPS Publications Subcommittee Chair (continuing).

2. **Beyer R.** MAPSIT Steering Committee (continuing).

3. **Cabrol NA.** NASA Astrobiology Institute Executive Council.

4. **Cabrol NA.** NASA Astrobiology Institute Biosignature Detection Working Group.

5. **Cabrol, NA.** Science Advisory Board member, OrbitBeyond (NASA/CLPS company).

6. **Cabrol, NA**. Fellow, California Academy of Sciences.

7. **Clark, C**. Member of the NASA SciAct Education Technology Working Group .

8. **Harman, P.K.**. Member of the NASA SciAct Women in STEM Affinity Group

9. Crampton, D.; Christou, J.; Andersen, D.; Davies, R.; Marois, C. et al.; including **Marchis, F.**; (June/19-21), Gemini North Adaptive Optics (GNAO), workshop to discuss advanced

optics progress and potential applications at Gemini North with future planned meetings.

10. **Marcu O** (April-ongoing). Speakers Committee, Palo Alto Rotary Club, purpose is to provide community engagement of business and professional advocates.

11. **Race MS** (ongoing). *International Encyclopedia of Astrobiology*, Editor, 3rd Edition, Planetary Protection Section.

12. **Race MS** (ongoing). *Astrobiology in the Real World.* Assoc. Editor, Astrobiology journal, Commentary section.

13. **Rummel JD** (2017-Present). The Hague International Space Resources Governance Working Group. *Leiden, The Netherlands* (COSPAR Representative).

14. **Rummel JD** (2016-Present). Chair, Science Advisory Board, SETI Institute.

15. **Showalter, M.** National Academies study of NASA/SMD's Science Activation Program.

16. **Sobron P** (ongoing). ISSI/ISSI-BJ International Teams in Space and Earth Sciences. Member in: Cross-calibration of Laser-Induced Breakdown Spectroscopy (LIBS) instruments for planetary exploration.

17. **Sobron P** (ongoing). NASA's Network For Life Detection (NFoLD) Research Coordination Network.

18. **Sparks W.** Various decadal survey white papers requested input.

19. **Spry JA** (Ongoing to May 2019) Co-organizer (with G Kminek, **M Race** & B Siegel) of the 4th COSPAR Workshop on Refining the Planetary Protection Requirements for Human Extraterrestrial Missions, to be held in Houston TX.

20. **Spry JA** (Nov 2018 - ongoing) Participant/Executive Secretary in the Planetary Protection Technology Brainstorm Group.

21. **Spry JA** (Sept 2018 - ongoing) Member of the NASA working groups for revision of the Documents NPR8020.12 Planetary Protection Provisions for Robotic Extraterrestrial Missions, and (with **A Baker**) NASA STD 6022 Implementing Planetary Protection Requirements for Robotic Space Flight.

22. **Spry JA** (July 2018 – ongoing) Member of the AIAA Life Sciences & Systems Technical Committee

23. **Spry JA** (June 2018 – ongoing); Member – MSR Sterilization Working Group.

24. **Tiscareno MS** (continuing) is a 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.

Honors and Awards

1. **Beyer RA** (May/31). Recognized by the AGU as an outstanding reviewer. https://eos.org/agu-news/in-appreciation-of-agus-outstanding-reviewers-of-2018

2. **Cabrol NA** was invited by May Chiao, Editor-in-Chief of Nature, to write a commentary in Nature Astronomy on the Sagan et al.(1993) Nature paper entitled A Search for Life on Earth from the Galileo Spacecraft.

3. **Marchis F**. (2019). South by Southwest: 2019 Interactive Innovation Award Finalist, scientific demonstration of SETI Institute partner Unistellar eVscope technology.

4. **Sparks W.** 2019 AURA outstanding achievement award (team) for TESS Data Management and Archive (W. Sparks was TESS project lead at STScI for the development and implementation of the TESS data archive, which is located at STScI. The award is to the entire team).