

# Patricio Becerra

## Curriculum Vitae

Space Research and Planetary Sciences  
Physikalisches Institut  
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Universität Bern  
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I am a Planetary Scientist specialized in remote sensing data analysis and modelling to study geologic processes on terrestrial bodies in the solar system, with a particular focus on the polar regions of Mars. I am currently studying the recent geologic and climatic history of Mars as it is expressed in the layered deposits found in its polar caps. I am interested in research that broadly relates to the study of planetary surface processes through the coupling of analysis of spacecraft data with numerical and laboratory-based models.

## EDUCATION

### 2016 Ph.D. Planetary Sciences (Minor in Geosciences)

The University of Arizona

Dissertation: *"The Poles of Mars, Past and Present: A high-resolution observational study of the Martian Polar Regions and their connection to climate"*

### 2015 M.S. Planetary Sciences

The University of Arizona

### 2013 Graduate Certificate in Engineering Management

The University of Arizona

### 2007 B.S. Physics

Pontificia Universidad Católica del Perú

## FELLOWSHIPS AND AWARDS

### 2019 Geosciences Travel Award

Universität Bern Young Academics Support Award

### 2017 Eos Research Spotlight Article

### 2014 Sigma Xi International Research Conference Superior Student Presentation Award

University of Arizona College of Science Galileo Circle Scholar

Lunar and Planetary Institute Career Development Award

### 2013 NASA Earth and Space Science Fellowship

### 2012 Lunar and Planetary Laboratory Graduate Teaching Excellence Award

## RESEARCH WORK EXPERIENCE

### Physikalisches Institut, Universität Bern

#### February 2017 - Present

*Postdoctoral Researcher in Space Research and Planetary Sciences*

Advisor: Prof. Dr. Nicolas Thomas, Director. PI of CaSSIS on ESA's Mars Trace Gas Orbiter and Co-I of OSIRIS on ESA's Rosetta.

- Remote sensing studies of the stratigraphy and paleoclimatology of the Martian polar regions and other ice deposits
- Laboratory-based microwave studies of planetary analog materials

**Department of Planetary Sciences, The University of Arizona**

**August 2016 – January 2017**

*Research Specialist*

Advisor: Dr. Shane Byrne, Associate Professor of Planetary Sciences. Co-Investigator (HiRISE)

- Periodicity analysis of the surface texture of the North Polar Residual Cap of Mars

**Department of Planetary Sciences, The University of Arizona**

**August 2009 – July 2016**

*Research Assistant (2009 – 2011), Research Associate (2011 – 2016), NASA Earth and Space Science Fellow (2013 – 2016)*

Advisor: Dr. Shane Byrne, Associate Professor of Planetary Sciences. Co-Investigator (HiRISE)

- Observations, image processing, and surface reflectance modelling of transient features on the south polar residual cap of Mars. Funded by Dr. Byrne's NASA Mars Data Analysis Program grant number NNX09AM01G.
- Quantitative analysis of Mars polar stratigraphy using high-resolution topographic data, spectral analysis tools (FFT and Wavelet analysis), and signal-matching algorithms (Dynamic Time Warping). Funded by NASA Earth and Space Science Fellowship award number NNX13AO55H.

**National Commission for Aerospace Research and Development (CONIDA) – Peruvian Space Agency**

**March 2007 – May 2009**

*Research Assistant: Astronomy Department*

- Photometric analysis of Saturn's F-ring from Cassini's Imaging Science Subsystem (ISS). International collaboration project. Advisor: Dr. Mark Showalter. First CONIDA investigator to do research in planetary science.
- Created a Planetary Astronomy research group within CONIDA.
- Organized the First Short Course on Planetology in October 2008.
- Observations and data reduction to evaluate sky conditions for the construction of a future National Astronomical Observatory in Moquegua, Peru. Established a working relationship with surrounding agricultural communities, contributing to their education and development.

**Gemini Observatory (Gemini South, La Serena, Chile)**

**August 2007**

*Trainee: Observational Astronomy (08/07)*

Advisor: Dr. Percy Gómez

- Image processing and photometry of star clusters

**PLANETARY EXPLORATION MISSION EXPERIENCE**

**2019 NASA Discovery Mission Proposal: Climate Orbiter for Mars Polar Atmospheric and Subsurface Science (COMPASS)**

**September 2018 – Present**

*Co-Investigator: Dual-Mode Radar (Sounder and SAR) Instrument*

**Colour and Stereo Surface Imaging System (CaSSIS) - ESA ExoMars Trace Gas Orbiter**

**February 2017 – Present**

*Science Theme Deputy Lead: Ice and Periglacial Processes*

- Management of observation campaigns, target prioritization, review of acquired images
- Image analysis for scientific objectives

*CaSSIS Targeting Lead (CaTL)*

- Selection of scientifically relevant targets for observation
- Planning of observations
- Image compression testing

## **High Resolution Imaging Science Experiment (HiRISE) - NASA Mars Reconnaissance Orbiter (MRO)**

**July 2016 – Present**

*Science Theme Lead: Climate Change*

- Management of observation campaigns, target prioritization, review of acquired images

**August 2010 – 2016**

*Junior Science Team Member*

- Image analysis for scientific objectives
- Experience with Digital Terrain Model (DTM) production

## **NASA Planetary Science Summer School**

**August 2014**

Session III. Mission: Argus - Io Observer

*Risk and Programmatics Chair*

- Analyzed risk and designed mitigation strategies for the mission proposal. Designed schedule and milestone program for the mission.

*Principal Investigator for the Io Global Optical Observer (IGLOO) instrument*

- Led the IGLOO (multiband imager) instrument team, decided on instrument-specific science objectives and conceived the instrument design.

## **TEACHING EXPERIENCE**

### **Department of Physics, Universität Bern**

**Fall 2018**

*Teaching Assistant in Laborkurs Moderne Physik II*

Instructor: Prof. Ingo Leya

- In charge of “Light Scattering” gonioradiometer experiment

**Spring 2018**

*Teaching Assistant in Physik Praktikum Studierende Biologie*

Instructors: Prof. Dr. Michele Weber, Prof. Dr. Saverio Braccini

**Fall 2017**

*Teaching Assistant in Laborkurs Moderne Physik I*

Instructor: Prof. Ingo Leya

- In charge of “Light Scattering” gonioradiometer experiment

### **Department of Planetary Sciences. The University of Arizona**

**Fall 2012**

*Teaching Assistant in PTYS 214: “Astrobiology: A Planetary Perspective”.*

Instructor: Dr. Ilaria Pascucci

**Spring 2012**

*Teaching Assistant in PTYS 170B1: “The Universe and Humanity: Origin and Destiny”.*

Instructor: Dr. Tamara Rogers

- Lunar and Planetary Laboratory Graduate Teaching Excellence Award

## **ADVISING AND MENTORING**

**2019 –** Camila Cesar (Ph.D. student, University of Bern. Principal advisor: Dr. Nicolas Thomas)

**2019 –** Adomas Valentinas (Ph.D. student, University of Bern. Principal advisor: Dr. Nicolas Thomas)

**2018** External advisor to The Mars Society – Chile

**2017 – 2018** Sergio Parra (B.S., Student, Georgia Institute of Technology. Co-advising during and after his Research Experience for Undergraduates at NASA Jet Propulsion Laboratory. Principal advisor: Dr. Sarah M. Milkovich)

2005 – 2007 Vocational orientation to high school students through the Office of Relations with Educational Institutions of the Pontificia Universidad Católica del Perú.

## PEER-REVIEWED PUBLICATIONS

- Smith, I.B., P.O. Hayne, S. Byrne, **P. Becerra**, M. Kahre, W. Calvin, C.S. Hvidberg, S. Milkovich, P. Buhler, M. Landis, B. Horgan, A. Kleinbohl, M. Perry, R. Obbard, J. Stern, S. Piqueux, N. Thomas, K. Zacny, L. Carter, L. Edgar, J. Emmett, T. Navarro, J. Hanley, M. Koutnik, N. Putzig, B. Henderson, J.W. Holt, B. Ehlmann, S. Parra, D. Lalich, C. Hansen, M. Hecht, D. Banfield, K. Herkenhoff, D.A. Paige, M. Skidmore, R.L. Staehle, M. Siegler (2019) The Holy Grail: A Strategy for Unlocking the Climate Record Stored within Mars' Polar Layered Deposits (submitted to Planetary and Space Science special issue on Amazonian Mars: Climate & Processes)
- Becerra, P.**, Sori, M.M., Thomas, N., Tulyakov, S., Sutton, S.S., Pommerol, A., Cremonese, G. (2019) Timescales of the climate record in the south polar ice cap of Mars (in press in *Geophys. Res. Lett.* doi:10.1029/2019GL083588)
- Sori, M.M., J. Bapst, **P. Becerra**, and S. Byrne (2018), Islands of ice on Mars and Pluto (*under review in J. Geophys. Res. Planets*)
- Brouet, Y., **Becerra, P.**, Sabouroux, P., Pommerol, A., Thomas, N., (2018), A Laboratory-based Dielectric Model for the Radar Sounding of the Martian Subsurface, *Icarus* 321: 960-973, [doi.org/10.1016/j.icarus.2018.12.029](https://doi.org/10.1016/j.icarus.2018.12.029).
- Brouet, Y., Cerubini, R., Pommerol, A., Thomas, N., Neves, L., Sabouroux, P., **Becerra, P.**, Grima, C., (2018) Dielectric spectroscopy measurements of saline aqueous solutions in the VHF-UHF bands: towards a dielectric model for icy satellites' water reservoirs. Proceedings of the 5<sup>th</sup> IEEE International Workshop on Metrology for Aerospace. [10.1109/MetroAeroSpace.2018.8453527](https://doi.org/10.1109/MetroAeroSpace.2018.8453527)
- Smith, I.B., S. Diniega, D.W. Beaty, T. Thorsteinsson, **P. Becerra**, A. M. Bramson, S.M. Clifford, C.S. Hvidberg, G. Portyankina, S. Piqueux, A. Spiga and T.N. Titus (2018), 6th international conference on Mars polar science and exploration: Conference summary and five top questions, *Icarus* 308: 2-14, [doi:10.1016/j.icarus.2017.06.027](https://doi.org/10.1016/j.icarus.2017.06.027).
- Tornabene, L.L., F. P. Seelos, A. Pommerol, N. Thomas, C.M. Caudill, **P. Becerra**, J.C. Bridges, S. Byrne, M. Cardinale, M. Chojnacki, S.J. Conway, G. Cremonese, C.M. Dundas, M.R. El-Maarry, C.J. Hansen, K. Hansen, T.N. Harrison, R. Henson, L. Marinangeli, A.S. McEwen, M. Pajola, S.S. Sutton, J.J. Wray (2018), Simulation and assessment of the colour and spatial capabilities of the Colour and Stereo Surface Imaging System (CaSSIS) on the ExoMars Trace Gas Orbiter, *Space Sci. Rev.* 214: 18. [doi:10.1007/s11214-017-0436-7](https://doi.org/10.1007/s11214-017-0436-7).
- Becerra, P.**, M. M. Sori, and S. Byrne (2017), Signals of astronomical climate forcing in the exposure topography of the North Polar Layered Deposits of Mars, *Geophys. Res. Lett.*, 44, 62–70, [doi:10.1002/2016GL071197](https://doi.org/10.1002/2016GL071197) (\*AGU Eos Research Spotlight).
- Becerra, P.**, S. Byrne, M. M. Sori, S. Sutton, and K. E. Herkenhoff (2016), Stratigraphy of the north polar layered deposits of Mars from high-resolution topography, *J. Geophys. Res. Planets*, 121, 1445–1471, [doi:10.1002/2015JE004992](https://doi.org/10.1002/2015JE004992).
- Brown, A. J., Calvin, W.M., **Becerra, P.**, Byrne, S. (2016), Martian north polar cap summer water cycle, *Icarus*, 277, 401 - 415, [doi:10.1016/j.icarus.2016.05.007](https://doi.org/10.1016/j.icarus.2016.05.007).
- Thompson, M.S., Zega, T.J., **Becerra, P.**, Keane, J.T., Byrne, S. (2016). The Oxidation State of Nanophase Fe Particles in Lunar Soil: Implications for Space Weathering. *Meteoritics and Planetary Science* 51, 6: 1082–1095. [doi: 10.1111/maps.12646](https://doi.org/10.1111/maps.12646).
- Becerra, P.**, Byrne, S., Brown A. J. (2015). Transient Bright “halos” on the South Polar Residual Cap of Mars: Implications for mass balance. *Icarus* 251: 211-225. doi: [10.1016/j.icarus.2014.04.050](https://doi.org/10.1016/j.icarus.2014.04.050).
- Pelletier, J. D., DeLong, S. B., Orem, C. A., **Becerra, P.**, Compton, K., Gressett, K., Lyons-Baral, J., McGuire, L. A., Molaro, J. L., and Spinler J. C. (2012). How do vegetation bands form in dry lands? Insights from numerical modelling and field studies in southern Nevada, USA. *J. Geophys. Res.*, 117, F04026, [doi:10.1029/2012JF002465](https://doi.org/10.1029/2012JF002465).

French, R.S., Showalter, M. R., Sfair, R., Argüelles, C., Pajuelo, M., **Becerra, P.**, Hedman, M. M., Nicholson, P. D. (2012). The Brightening of Saturn's F Ring. *Icarus* 219: 181-193. doi: [10.1016/j.icarus.2012.02.020](https://doi.org/10.1016/j.icarus.2012.02.020)

## CONFERENCE ABSTRACTS

### 2019

- Becerra, P.**, D. Nunes, I. Smith, M.M. Sori, Y. Brouet, N. Thomas. Correlating Radar and Visible Stratigraphic Records in the Martian North Polar Layered Deposits. EPSC-DPS Joint Meeting 2019-1705
- Becerra, P.**, N. Thomas, A. Pommerol, M. Almeida, C. Cesar, E. Simioni, S. Tulyakov, G. Cremonese, and The CaSSIS Team. CaSSIS Observations of Polar and Circumpolar Layered Deposits on the Martian Southern Hemisphere. EPSC-DPS Joint Meeting 2019-707
- M. Almeida, M. Read, N. Thomas, G. Cremonese, **P. Becerra**, G. Borrini, M. Gruber, R. Heyd, C. Marriner, A. McEwen, A. Pommerol, C. Schaller, and the CaSSIS Science and Engineering Team. ExoMars/CaSSIS: Targeted Planning on Mars. EPSC-DPS Joint Meeting 2019-1808
- A. Valantinas, N. Thomas, A. Pommerol, **P. Becerra**, E. Hauber, L. L. Tornabene, G. Cremonese and The CaSSIS Team. CaSSIS Observations of Fresh Bright Slope Streak Candidates in Arabia Terra. EPSC-DPS Joint Meeting 2019-1720
- Byrne, S., Hayne, P.O., **Becerra, P.**, and The COMPASS Team Climate Orbiter for Mars Polar Atmospheric and Subsurface Science (COMPASS): Deciphering the Martian Climate Record. EPSC-DPS Joint Meeting 2019-912
- C. Cesar, A. Pommerol, N. Thomas, **P. Becerra**, C.J. Hansen, G. Portyankina, G. Cremonese, and The CaSSIS Team, Polar Spots on Mars Observed with the Colour and Stereo Surface Imaging System (CaSSIS). EPSC-DPS Joint Meeting 2019-697
- N. Thomas, G. Cremonese, J. Perry, M. Almeida, M. Banaszkiwicz, J.N. Bapst, **P. Becerra**, J.C. Bridges, S. Byrne, S. Conway, V. Da Deppo, S. Debei, M.R. El-Maarry, A. Fennema, E. Hauber, R. Heyd, C.J. Hansen, A. Ivanov, L. Keszthelyi, R. Kirk, W. Kofman, R. Kuzmin, A. Lucchetti, N. Mangold, C. Mar-riner, L. Marinangeli, M. Massironi, A.S. McEwen, C. Okubo, P. Orleanski, M. Pajola, A. Parkes Bowen, M.R. Patel, A. Pommerol, R. Pozzobon, M.J. Read, P.A. Tesson, L. Tornabene, S. Tulyakov, P. Wajer, P. Witek, J. Wray, and R. Ziethe. A summary of observations by the CaSSIS imaging system onboard ESA's ExoMars Trace Gas Orbiter. EPSC-DPS Joint Meeting.
- Becerra, P.**, M. M. Sori, N. Thomas, A. Pommerol, S. S. Sutton, S. Tulyakov, E. Simioni, G. Cremonese. Timescales of the Climate Record in the Martian South Polar Layered Deposits. Ninth International Conference on Mars. Abs. [6273. Oral Presentation.](#)
- N. Thomas, G. Cremonese, J. Perry, M. Almeida, M. Banaszkiwicz, J.N. Bapst, **P. Becerra**, J.C. Bridges, S. Byrne, S. Conway, V. Da Deppo, S. Debei, M.R. El-Maarry, A. Fennema, E. Hauber, R. Heyd, C.J. Hansen, A. Ivanov, L. Keszthelyi, R. Kirk, W. Kofman, R. Kuzmin, A. Lucchetti, N. Mangold, C. Mar-riner, L. Marinangeli, M. Massironi, A.S. McEwen, C. Okubo, P. Orleanski, M. Pajola, A. Parkes Bowen, M.R. Patel, A. Pommerol, R. Pozzobon, M.J. Read, P.A. Tesson, L. Tornabene, S. Tulyakov, P. Wajer, P. Witek, J. Wray, and R. Ziethe. The Effects of Past and Current Geologic Processes Observed by the CaSSIS Imager on board ESA's ExoMars Trace Gas Orbiter. Ninth International Conference on Mars. Abs. 6156. Print Only.
- C. Cesar, A. Pommerol, N. Thomas, P. Becerra, C.J. Hansen, G. Portyankina, G. Cremonese, and The CaSSIS Team, Polar Spots on Mars Observed with the Colour and Stereo Surface Imaging System (CaSSIS). Ninth International Conference on Mars. Abs. 6253. Poster.
- A. Valantinas, N. Thomas, A. Pommerol, **P. Becerra**, E. Hauber, L. L. Tornabene, G. Cremonese and The CaSSIS Team. CaSSIS Observations of Fresh Bright Slope Streak Candidates in Arabia Terra. Ninth International Conference on Mars. Abs. 6259. Poster
- Byrne, S., Hayne, P.O., **Becerra, P.**, and The COMPASS Team Climate Orbiter for Mars Polar Atmospheric and Subsurface Science (COMPASS): Deciphering the Martian Climate Record. Ninth International Conference on Mars. Abs. 6450. Poster.

- Becerra, P.**, M. M. Sori, N. Thomas, S. Tulyakov, S. S. Sutton, A. Pommerol, G. Cremonese, The HiRISE Team, The CaSSIS Team. Climate Record Signals in the South Polar Cap of Mars from HiRISE and CaSSIS Stereo Imaging. Lunar and Planetary Science Conference L. Abs. 1283. Oral Presentation
- Thomas, N., G. Cremonese, M. Almeida, M. Banaszekiewicz, J.N. Bapst, **P. Becerra**, J. Bridges, S. Byrne, S. Conway, V. Da Deppo, S. De-bei, M.R. El-Maarry, E. Hauber, C.J. Hansen, A. Ivanov, L. Keszthelyi, R. Kirk, R. Kuzmin, A. Lucchetti, N. Mangold, C. Marriner, L. Marinangeli, M. Massironi, A.S. McEwen, C. Okubo, P. Orleanski, M. Pajola, M.R. Patel, J. Perry, A. Pommerol, R. Pozzobon, M.R. Read, L. Tornabene, S. Tulyakov, P. Wajer, P. Witek, J. Wray, and R. Ziethe. CaSSIS: Overview of imaging in the first 9 months of the prime mission. Lunar and Planetary Science Conference L. Abs.
- N. Thomas, G. Cremonese, M. Almeida, J. Backer, **P. Becerra**, G. Borrini, S. Byrne, M. Gruber, P. Gubler, R. Heyd, A. Ivanov, L. Keszthelyi, C. Marriner, G. McArthur, A.S. McEwen, C. Okubo, M.R. Patel, J. Perry, A. Pommerol, C. Re, M.R. Read, C. Schaller, S. Scheidt, E. Simioni, S. Sutton, S. Tulyakov, and C. Zimmermann. CaSSIS: Operational approach. Lunar and Planetary Science Conference L. Abs.
- Sori, M.M., Bapst, J., **Becerra, P.**, Byrne, S. The Paleoclimate Record of Outlier Ice Deposits Near the Martian Poles. Lunar and Planetary Science Conference L. Abs. 1181.

## 2018

- Pommerol, A., Thomas, N., Yoldi, Z., Roloff, V., Almeida, M., **Becerra, P.**, Tulyakov, S., Tornabene, L., Seelos, F., Hansen, C.J., Portyankina, G., Cremonese, G. Ices, frosts and clouds on Mars observed by CaSSIS during the first months of TGO's primary science mission. European Planetary Science Congress 2018-272.
- Becerra, P.**, Nunes, D., Smith, I., Sori, M.M., Brouet, Y., Thomas, N. The Radar and Visible Stratigraphic Records of Mars' North Polar Layered Deposits. European Planetary Science Congress 2018-1171.
- Becerra, P.**, Sori, M.M., Thomas, N., Pommerol, A., Cremonese, G., Almeida, M., and The CaSSIS Team. Stereo-topographic mapping of the Stratigraphy of Mars' South Polar Layered Deposits. European Planetary Science Congress 2018-225.
- Thomas, N., Cremonese, G., Almeida, M., Banaszekiewicz, M., **Becerra, P.**, Borrini, G., Gruber, M., Gubler, P., Heyd, R., Ivanov, A., Keszthelyi, L., Marriner, C., McArthur, G., McEwen, A.S., Okubo, C., Patel, M., Pommerol, A., Re, C., Schaller, C., Scheidt, S., Simioni, E., Sutton, S., Tulyakov, S., Zimmermann, C. CaSSIS – Targeting, Operations, and Data Reduction. European Planetary Science Congress 2018-145.
- Thomas, N., Cremonese, G., Almeida, M., Banaszekiewicz, M., **Becerra, P.**, Bridges, J., Byrne, S., Da Deppo, V., Debei, S., El-Maarry, M.R., Hauber, E., Hansen, C.J., Ivanov, A., Keszthelyi, L., Kirk, R., Kuzmin, R., Mangold, N., Mariangeli, L., Markiewicz, W., Massironi, M., McEwen, A.S., Okubo, C., Orleanski, P., Patel, M., Pommerol, A., Roloff, V., Tulyakov, S., Wajer, P., Wray, J., Ziethe, R. CaSSIS – First Images from Science Orbit. European Planetary Science Congress 2018-141.
- Pajola, M., Tornabene L.L., Seelos, F.P., Marzo G.A., Lucchetti, A., Cremonese, G., Pommerol, A., **Becerra, P.**, and Thomas, N. Spectral clustering applied on the ExoMars/CaSSIS simulated imagery dataset. European Planetary Science Congress 2018-171.
- Becerra, P.**, Sori, M.M., Thomas, N. The Exposed Stratigraphy of the Martian South Polar Layered Deposits. Lunar and Planetary Science Conference XLIX. Abs. 2445.
- Becerra, P.**, Nunes, D., Smith, I., Sori, M.M., Brouet, Y., Thomas, N. Correlation of the Visible and Radar Stratigraphic Records of Mars' NPLD. Lunar and Planetary Science Conference XLIX. Abs. 1888.
- Nunes, D.C., **Becerra, P.**, Smith, I.B. Local variability of radar stratigraphy at the North Polar Layered Deposits, Mars. Lunar and Planetary Science Conference XLIX. Abs. 2486.
- Molaro, J.L., **Becerra, P.**, Herny, C., Marschall, R., El-Maarry, M.R., Thomas, N., Pommerol, A., Theologou, P. Thermally-driven Formation of Fractures on Comet 67P/Churyumov-Gerasimenko. Lunar and Planetary Science Conference XLIX. Abs. 2881.

Parra, S.A., Milkovich, S.M., Byrne, S., Russell, P.S., and **Becerra, P.** Variations in Texture of the North Polar Residual Cap of Mars. Lunar and Planetary Science Conference XLIX. Abs. 2272.

## 2017

Molaro, J.L., **Becerra, P.**, Herny, C., Marschall, R., El-Maarry, M.R., Thomas, N., Pommerol, A., Theologou, P. Thermally-driven Formation Mechanisms for Fractures on Comet 67P/Churyumov-Gerasimenko. European Planetary Science Congress. Vol. 11, EPSC2017-374.

**Becerra, P.**, Nunes, D., Smith, I., Sori, M.M., Brouet, Y., Pommerol, A., Thomas, N., Guallini, L. Correlation of Radar and Visible Data of Mars' North Polar Layered Deposits. European Planetary Science Congress. Vol. 11, EPSC2017-660-1.

**Becerra, P.**, Sori, M.M., Byrne, S. Signals of Astronomical Climate Forcing in the Exposure Topography of the North Polar Layered Deposits of Mars. Lunar and Planetary Science Conference XLVIII. Abs. 1638.

## 2016

**Becerra, P.**, Byrne, S. Sori, M.M. Searching for a Climate Signal in the Polar Deposits of Mars. Oral Presentation. Sixth International Conference on Mars Polar Science and Exploration. Abs. 6037.

Brown, A. J., Calvin, W.M., **Becerra, P.**, Byrne, S. The Martian north polar summer water cycle. Sixth International Conference on Mars Polar Science and Exploration. Abs. 6044.

Byrne, S., Sori, M.M., Russell, P.S., Pathare, A.V., **Becerra, P.**, Molaro, J.L., Sutton, S., Mellon, M.T., HiRISE Team. Why Icy Polar Cliffs are Stressed Out and Falling to Pieces. Sixth International Conference on Mars Polar Science and Exploration. Abs. 6022.

**Becerra, P.**, Byrne, S., Sori, M., Sutton, S., Herkenhoff K.E. Stratigraphy of the North Polar Layered Deposits of Mars from High-Resolution Topography. Oral Presentation. Lunar and Planetary Science Conference XLVII. Abs. 1325.

**Becerra, P.**, Byrne, S., Sori, M. Searching for a Climate Signal in Mars' North Polar deposits. Poster. Lunar and Planetary Science Conference XLVII. Abs. 1732

Brown, A.J., Calvin, W.M., **Becerra, P.**, Byrne, S. The Martian north polar water cycle. Lunar and Planetary Science Conference XLVII. Abs. 1753.

## 2015

**Becerra, P.**, Byrne, S., Sori, M., Sutton, S., Pelletier, J.D., Herkenhoff K.E., HiRISE Team. Martian Polar Stratigraphy from HiRISE Stereo Topography. Oral presentation. Lunar and Planetary Science Conference XLVI. Abs. 1729.

Thompson, M.S., Zega, T.J., Keane, J.T., **Becerra, P.**, Byrne, S. The oxidation state of Fe nanoparticles in Lunar soil: Implications for space weathering processes. Lunar and Planetary Science Conference XLVI. Abs. 2932.

Byrne, S., Hayne, P.O., **Becerra, P.** Evolution and stability of the southern residual CO<sub>2</sub> Ice Cap of Mars. Lunar and Planetary Science Conference XLVI. Abs. 1657.

Marcucci, E., Hays, L.E., Holstein-Rathlou, C., Keane J.T., **Becerra, P.**, Basu, K., Davis, B., Fox, V., Herman, J.F.C., Hughes, A.C.G., Mendez-Ramos, Nelessen, A., E., Neveu, M., Parrish, N.L., Scheinberg, A., Wrobel, J.S. Argus: A concept study for an Io observer mission from the 2014 NASA/JPL Planetary Science Summer School. Lunar and Planetary Science Conference XLVI. Abs. 2624.

## 2014

**Becerra, P.**, Byrne, S., Mattson, S., Pelletier, J.D., Herkenhoff K.E., The HiRISE Team. Martian Polar Stratigraphy from HiRISE Stereo Topography. Poster. Sigma Xi International Research Conference.

Holstein-Rathlou, C., Hays, L.E., **Becerra, P.**, Basu, K., Davis, B., Fox, V., Herman, J.F.C., Hughes, A.C.G., Keane J.T., Marcucci, E., Mendez-Ramos, Nelessen, A., E., Neveu, M., Parrish, N.L., Scheinberg, A., Wrobel, J.S. Argus: An Io observer mission concept study from

the 2014 NASA/JPL Planetary Science Summer School. Poster ID P43B-3977. American Geophysical Union Fall Meeting.

**Becerra, P.**, Holstein-Rathlou, C., Hays, L.E., Keane J.T., Neveu, M., Basu, K., Davis, B., Fox, V., Herman, J.F.C., Hughes, A.C.G., Marcucci, E., Mendez-Ramos, Nelessen, A., M., Parrish, N.L., Scheinberg, A., Wrobel, J.S. Argus: A concept study for an Io observer mission from the 2014 NASA/JPL Planetary Science Summer School. Poster. Abs. 2071168. 46<sup>th</sup> Annual Meeting of the AAS Division for Planetary Sciences.

**Becerra, P.**, Byrne, S., Brown A.J. Transient Bright “Halos” on the South Polar Residual Cap of Mars: Implications for Mass Balance. Oral presentation. European Planetary Science Congress. Abs. 634.

**Becerra, P.**, Byrne, S., Mattson, S., Pelletier, J.D., Herkenhoff K.E., The HiRISE Team. Polar Stratigraphy from HiRISE Stereo Topography. Poster. European Planetary Science Congress. Abs. 647.

**Becerra, P.**, Byrne, S., Brown A.J. Transient Bright “Halos” on the South Polar Residual Cap of Mars: Implications for Mass Balance. Eighth International Conference on Mars. Abs. 1013.

**Becerra, P.**, Byrne, S., Mattson, S., Pelletier, J.D., Herkenhoff K.E., The HiRISE Team. Polar Stratigraphy from HiRISE Stereo Topography. Eighth International Conference on Mars. Abs. 1183.

Byrne, S., Russell, P.S., Pathare, A.V., **Becerra, P.**, Molaro, J.L., Mattson, S., Mellon, M.T., HiRISE Team. Icy Polar Cliffs: Stressed Out and Falling to Pieces. Eighth International Conference on Mars. Abs. 1257.

Byrne, S., Hayne, P.O., **Becerra, P.**, HiRISE Team. “Evolution and Stability of the Residual CO<sub>2</sub> Ice Cap”. Eighth International Conference on Mars. Abs. 1252.

**Becerra, P.**, Byrne, S., Brown A.J. Transient Bright “Halos” on the South Polar Residual Cap of Mars: Implications for Mass Balance. Oral presentation. Lunar and Planetary Science Conference XLV. Abs. 1388.

**Becerra, P.**, Byrne, S., Mattson, S., Herkenhoff K.E., HiRISE Team. Martian Polar Stratigraphy from HiRISE Stereo Topography. Poster. Lunar and Planetary Science Conference XLV. Abs. 2408

## 2013

**Becerra, P.**, Byrne, S., Brown, A.J. Dust-Driven Halos on the Martian South Polar Residual Cap. Poster ID P41A-1913. American Geophysical Union Fall Meeting.

Byrne, S., **Becerra, P.**, Diniega, S., Dundas, C.M., Geissler, P., Hansen, C.J., McEwen, A.S., Russell, P.S., Thomas, N. Mars: Cold, windy and occasionally unstable. ID P31C.05B. American Geophysical Union Fall Meeting.

**Becerra, P.**, Byrne, S., Brown, A.J. Frost Halos on the South Polar Residual Cap of Mars. Poster. Lunar and Planetary Science Conference XLIV Abs. 1284.

Byrne, S., Russell, P., Pathare, A.V., **Becerra, P.**, Molaro, J., Matson, S., Mellon, M.T. Fracturing the Icy Polar Cliffs of Mars. Lunar and Planetary Science Conference XLIV Abs. 1659.

## 2012

**Becerra, P.**, Byrne, S., Brown, A.J. CO<sub>2</sub> Frost Halos on the South Polar Residual Cap of Mars. Oral presentation. First iPLEX Conference on Ices and Organics in the Inner Solar System. UCLA, Los Angeles, California, U.S.A.

**Becerra, P.**, and Byrne, S. CO<sub>2</sub> Frost Halos on the South Polar Residual Cap of Mars. Oral presentation. Lunar and Planetary Science Conference XLIII Abs. 2513.

## 2011

**Becerra, P.**, and Byrne, S. Modeling the Formation of CO<sub>2</sub> Frost Halos on the South Polar Residual Cap of Mars. Oral presentation. Fifth International Conference on Mars Polar Science and Exploration Abs. 6024.



**Becerra, P.**, and Byrne, S. Investigating Trigger Mechanisms of Martian North Polar Avalanches. Oral presentation. Fifth International Conference on Mars Polar Science and Exploration Abs. 6034.

**Becerra, P.**, and Byrne, S. Mars' South Polar Halos and Triton's Aureoles: Sublimation-Driven Models of Formation. Poster. New Horizons Workshop on Icy Surfaces. Lowell Observatory, Flagstaff, AZ. [http://www2.lowell.edu/workshops/aug2011/workshop\\_abstracts/becerra.pdf](http://www2.lowell.edu/workshops/aug2011/workshop_abstracts/becerra.pdf)

**Becerra, P.**, and Byrne, S. Modeling the Formation of CO<sub>2</sub> Frost Halos on the South Polar Residual Cap of Mars. Oral presentation. Lunar and Planetary Science Conference XLII Abs. 2252.

Ferradas-Alva, C., Ferrero, G., Huamán, M., Guevara-Day, W., Meza, E., Samanes J., **Becerra, P.** Seeing measurement on Sasahuine mountain, Moquegua, Perú. Proceedings of the International Astronomical Union, 7, 448-451. doi:10.1017/S174392131200525X.

## 2010

**Becerra, P.**, and Byrne, S. Modeling the Formation of CO<sub>2</sub> Frost Halos on the South Polar Residual Cap of Mars. Poster. Lunar and Planetary Science Conference XLI Abs. 2097.

Showalter, M. R., French, R. S., Sfair, R., Argüelles, C., Pajuelo, M., **Becerra, P.**, Hedman, M. M., Nicholson, P. D. The Brightening of Saturn's F Ring. European Planetary Science Congress. Abs. 317.

## 2009

Showalter, M. R., French, R. S., Sfair, R., Argüelles, C., Pajuelo, M., **Becerra, P.**, Hedman, M. M., Nicholson, P. D. The Brightening of Saturn's F Ring. Vol. 41. p. 896. 40<sup>th</sup> Annual Meeting of the AAS Division for Planetary Sciences.

## OTHER NON-REFEREED PUBLICATIONS

Smith, I.B., Hayne, P.O., Byrne, S., **Becerra, P.**, Kahre, M., Calvin, W., Hvidberg, C., Milkovich, S., Buhler, P., Landis, M., Horgan, B., Kleinbohl, A., Perry, M., Obbard, R., Stern, J., Piqueux, S., Thomas, N., Zacny, K., Carter, L., Edgar, L., Emmet, J., Navarro, T., Hanley, J., Koutnik, M., Putzig, N., Henderson, B.L., Holt, J.W., Elhman, B., Parra, S., Lalich, D., Hansen, C., Hecht, M., Banfield, D., Herkenhoff, K., Paige, D.A., Skidmore, M., Stahle, R.L., Siegler, M. (2018) Executive Summary of the Keck Institute for Space Science Workshop "Unlocking the Climate Record Stored within Mars' Polar Layered Deposits".

**Becerra, P.** "Gutta" encyclopaedia entry in: Hargitai and Kereszturi (2014). Encyclopedia of Planetary Landforms. Springer Science and Business Media New York. ISBN: 978-1-4614-9213-9 (Online).

## INVITED TALKS

**2019** *Estudios de la superficie de Marte con el Colour and Stereo Surface Imaging System (CaSSIS) a bordo de Trace Gas Orbiter de ESA – Curso de Geomorfología de la Patagonia Argentina, Universidad de la Patagonia Austral, Río Gallegos, Argentina*

**2018** *Imaging of the Martian surface by the Colour and Stereo Surface Imaging System (CaSSIS) of ExoMars Trace Gas Orbiter – Center for Space Habitability Lunch Seminar, Universität Bern*

**2018** *The Icy Polar Deposits of Mars and their Connection to Climate – Earth and Atmospheric Sciences Seminar Series, Georgia Institute of Technology, Atlanta, GA, USA.*

**2017** *Polar Stratigraphy – Short Course Lecture for the Keck Institute for Space Science Workshop "Unlocking the Climate Record Stored within Mars' Polar Layered Deposits I". California Institute of Technology, Pasadena, CA, USA.*

- 2016** *Decifrando el Récord Climático de los Polos de Marte* – Department of Physics. Pontificia Universidad Católica del Perú. San Miguel, Lima, Perú.
- 2014** *Halos en el Polo Sur de Marte* – Comisión Nacional de Investigación y Desarrollo Aeroespacial. San Isidro, Lima, Perú.

## PROFESSIONAL SERVICE

### Involvement in Conferences and Workshops

- 2020** 7<sup>th</sup> International Conference on Mars Polar Science and Exploration: Co-Lead Organizer and Convener (to be held at the Centro Austral de Investigaciones Científicas, Ushuaia, Argentina)
- 2019** Ninth International Conference on Mars: Session Chair
- 2017** Keck Institute for Space Science Workshop “Unlocking the Climate Record Stored within Mars' Polar Layered Deposits I and II”: Invited lecturer and workshop participant
- 2017 – 2018** Lunar and Planetary Science Conference: GSA Dornik Award Judge
- 2016** 6<sup>th</sup> International Conference on Mars Polar Science and Exploration: Session chair
- 2016** Lunar and Planetary Science Conference: Session chair
- 2010 – 2012** Lunar and Planetary Laboratory Conference: Co-organizer
- 2008** First Short Course on Planetology (CONIDA, Lima, Peru). Organizer and Convener

### Journal Review

- 2019** Icarus, Planetary and Space Science
- 2015 - 2018** Icarus (Certificate of Outstanding Contribution in Reviewing)

### Proposal Review

- 2019** NASA ROSES Program: External Reviewer
- 2018** NASA NESSF Program: Panelist
- 2018** NASA Mars Data Analysis Program: External Reviewer
- 2017** NASA Cassini Data Analysis Program: External Reviewer
- 2017** NASA Mars Data Analysis Program: External Reviewer
- 2016** NASA Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO): Executive Secretary

## LABORATORY EXPERIENCE

### EpsiMu Coaxial Microwave Tool for the Measurement of Dielectric Properties

- Microwave vector network analyzer that measures the dielectric properties (permittivity and permeability) of wet and granular samples (Sabouroux and Ba, 2011, Progress In Electromagnetics Research B, Vol. 29, 191{207})
- Received training at the University of Bern by the instrument designers and manufacturers

### University of Bern PHIRE1 Gonoradiometer

- Measures the reflectance of solid, granular, and wet samples
- Received training in order to teach undergraduate and masters students to use the instrument to learn about optics and remote sensing

## FIELD EXPERIENCE

### Volcanoes National Park, Hawai'i

#### Spring 2014

#### Student Researcher

- Field activity: Roughness measurements of lava flows from Kilauea and Mauna Ulu

## **Southern Nevada**

### **Spring 2012**

#### *Student Researcher*

- Research Objective: Understand formation of vegetation bands in dry lands
- Field activities: Terrestrial Laser Scanning, soil shear strength and infiltration rate

## **Various locations throughout the Southwestern United States**

### **Fall 2009 – Spring 2014**

#### *Student*

- Educational field trips as part of a Planetary Geology Field Practicum class
- Focus on comparing terrestrial geology to landforms on other planetary surfaces

## **OUTREACH AND COMMUNITY SERVICE**

- Astronomy on Tap – Bern: “Listening to Mars’ Polar Climate Record”
- Management of CaSSIS social media accounts (Instagram, Twitter, Facebook)
- Interview in Radio Capital in Lima, Peru to promote the study of planetary science within the Peruvian student community. M. Delta
- Outreach [Interview](#) for Punto edu (Pontificia Universidad Católica del Perú). D. Grimaldo
- Public Outreach Presentation for the Students for the Exploration of Space (SEDS) University of Arizona Chapter
- Outreach presentations on planetary science in Tucson, AZ, USA and Lima, Peru
- Lunar and Planetary Laboratory Mission Seminar Series Organizer. 2014, 2015

## **PROFESSIONAL MEMBERSHIPS**

- European Geosciences Union
- American Astronomical Society, Division of Planetary Sciences
- American Geophysical Union
- Europlanet Society
- The Planetary Society

## **COMPUTER SKILLS AND TRAINING**

- Programming:
  - Interactive Data Language (IDL) – Intermediate/Advanced level
  - Matlab – Basic level
  - C – Basic level
- ESRI ArcGIS
- Java Mission-planning and Analysis for Remote Sensing (JMARS)
- ENVI Image Processing and Analysis
- USGS Integrated Software for Imagers and Spectrometers (ISIS3): User
- NASA NAIF SPICE Toolkit (Domestic training class, Columbia, MD. October 2014)
- Photogrammetric Processing of Planetary Stereo Imaging with SOCET SET®
- Unix/Linux, Mac OSX, MS Windows, MS Office, MS Project, and Internet tools

## **LANGUAGES**

- Spanish/English Bilingual
- Italian: Upper-intermediate (B2). Completed course at Istituto Italiano, Firenze, Italia
- German: Pre-Intermediate (A2). Inlingua Language School, Bern, Switzerland.

## EXTRACURRICULAR ACTIVITIES

- SCUBA and Free Diving
  - 74 logged SCUBA dives
  - PADI Rescue Diver (Emergency First Responder)
  - PADI Peak Performance Buoyancy Specialty Diver
  - PADI Dry suit Specialty Diver
  - PADI Freediver
  
- Volunteering
  - University of Arizona Health Network (Jun – Dec 2013): Volunteer in Pediatric Chronic Diseases Wing
  - Census aid after the 2008 Earthquake in Pisco, Peru.
  
- Sports:
  - Triathlon (University of Arizona Triathlon Club Alumnus)
  - Cycling (Category 4 USAC Road. University of Arizona Cycling Club Alumnus)
  - Climbing (Lead indoor up to 6a+/5.10c, outdoor up to 5c/5.9+), Ice Climbing (top rope up to 4l).
  - Snowboarding

Age: 33  
Current Swiss Immigration Status: **Peruvian National. Ausweis B: Residence permit for non-EU nationals**  
June 21<sup>st</sup>, 2019