Curriculum Vitae of Samuel Patrick Dennis Birch

Email: sb2222@cornell.edu
Webpage: https://geomorph-sbirch.com
Phone: 510-712-0270

Current Address:
410 Space Sciences Bldg.
Ithaca, NY 14853-6801

CURRENT AFFILIATION

Cornell Center for Astrophysics and Planetary Science, Cornell University

EDUCATION

- **Ph.D.** – *Cornell University, Ithaca NY* May 2018
  - Concentration: Planetary Science (Minors: Geophysics/Astronomy)
- **B.A. (High Honors)** – *University of California Berkeley*, *Berkeley, CA* May 2014
  - Concentration: Geophysics

ACADEMIC AWARDS AND FELLOWSHIPS

- AGU Planetary Sciences Section Student Representative *(*2018*)*
- Department of Earth and Atmospheric Sciences Excellence in Research Award *(*2018*)*
- NASA Earth and Space Science Fellowship (2015 – 2018)
- Distinguished Honors in Geophysics *(*2014*)*
- Berkeley International Undergraduate Student Tuition Grant (2013 – 2014)

PROFESSIONAL APPOINTMENTS

- Cornell University; Research Associate – May 2018 – Present
- Cornell University; *PhD Student* – August 2014 – May 2018
- Cornell University; *REU Summer Intern* – June 2013 – August 2013
- University of California Berkeley; *Geological Fluid Dynamics Laboratory Manager* – January 2013 – July 2014

CURRENT RESEARCH INTERESTS

1. Cometary (and Small Body) Geology & Surface Processes
2. Titan Geomorphology & Surface Processes
3. Numerical Landscape Evolution Modeling
4. Sublimation Erosion & Surface Processes in the Outer Solar System

JOURNAL PUBLICATIONS (*Indicates paper was led by a student advisee)

h-index: 8 i10-index: 5 Citations: 119 Researcher ID: L-1249-2017

[17] **S.P.D. Birch**, A.G. Hayes, and 10 others. Migrating Scarps on Comet 67P Reveal Large Volumes of Water Ice in Near Surface Regolith. *Nature Astronomy*, in review (2018).

[16] Y. Tang*, **S.P.D. Birch**, A.G. Hayes, R. Kirk, N. Kutsop, J-B. Vincent, and S. Squyres. Generation of Photoclinometric DTMs for Application to Transient Changes on the Surface of Comet 67P/Churyumov-Gerasimenko. *Astronomy & Astrophysics*, in review (2018).

[15] V. Poggiali, A.G. Hayes, M. Mastrogiuseppe, R. Seu, J.P. Mullen, **S.P.D. Birch**, and M.C. Raguso. Delay-Doppler and super-resolution processing applied to Cassini RADAR Altimeter. *IEEE Geoscience and Remote Sensing*, in review (2018).

[14] S.M. MacKenzie, J.W. Barnes, J.D. Hofgartner, **S.P.D. Birch**, M.M. Hedman, A. Lucas, S. Rodriguez, E.P. Turtle, and C. Sotin. The case for seasonal surface changes at Titan's lake district. *Nature Astronomy*, in review (2018).

[13] **S.P.D. Birch**, A.G. Hayes, and 7 others. Raised Rims around Titan's Sharp-Edged Depressions. *GRL*, accepted (2018).

[12] **S.P.D. Birch**, A.G. Hayes, and 9 others. Morphological evidence that Titan's southern hemisphere basins are paleoseas. *Icarus* **310**, 140-148 (2017).

[11] A.G. Hayes, **S.P.D. Birch**, and 12 others. Topographic constraints on the evolution and connectivity of Titan's lacustrine basins. *GRL* **44**, 11745-11753 (2017).

[10] P. Corlies, A.G. Hayes, **S.P.D. Birch**, R.D. Lorenz, B. Stiles, R.L. Kirk, V. Poggiali, H. Zebker, and L. Iess. Titan's topography and shape at the end of the Cassini mission. *GRL* **44**, 11754-11761 (2017).

[9] M. Mastrogiuseppe, A.G. Hayes, V. Poggiali, J.I. Lunine, R.D. Lorenz, R. Seu, A. Le Gall, C. Notarnicola, K. Mitchell, M. Malaska, and **S.P.D. Birch**. Bathymetry and Composition of Titan's Ontario Lacus derived from Monte Carlo-based waveform inversion of Cassini RADAR altimetry data. *Icarus* **300**, 203-209 (2017).

[8] **S.P.D. Birch**, Y. Tang, A.G. Hayes, and 10 others. Geomorphology of Comet 67P/Churyumov-Gerasimenko. *MNRAS* **469**, S50-S67 (2017).

[7] **S.P.D. Birch**, A. Hayes, and 19 others. Geomorphologic Mapping of Titan's polar terrains: Constraining Surface Processes and Landscape Evolution. *Icarus*, **282**, 214-236 (2017).

[6] V. Poggiali, M. Mastrogiuseppe, A.G. Hayes, R. Seu, **S.P.D. Birch**, R. Lorenz, C. Grima, and J.D Hofgartner. Liquid-filled canyons on Titan. *Geophysical Research Letters*, **43**, 7887-7894 (2016).

[5] M.J. Malaska, R.M.C. Lopes, D.A. Williams, C.D. Neish, A. Solominidou, J. Soderblom, A.M. Shoenfeld, **S.P.D. Birch**, A.G. Hayes, A. Le Gall, M.A. Janssen, T.G. Farr, R.D. Lorenz, J. Radebaugh, and E. Turtle. Geomorphologic map of the Afekan Crater region, Titan: Terrain relationships in Titan's blandlands. *Icarus* **270**, 130-161 (2016).

[4] **S.P.D. Birch**, A. Hayes, A.D. Howard J. Moore, and J. Radebaugh. Alluvial Fan Morphology, Distribution and Formation on Titan. *Icarus* **270**, 238-247 (2016).

[3] Radebaugh, J., D. Ventra, R.D. Lorenz, T. Farr, R. Kirk, A. Hayes, M.J. Malaska**, S. Birch**, Z. Y-C. Liu, J. Lunine, J. Barnes, A. Le Gall, R. Lopes, E. Stofan, S. Wall and P. Paillou. Alluvial and fluvial fans on Saturn's moon Titan reveal processes, materials and regional geology. *In, Ventra, D. & Clarke, L. E. (eds) Geology and Geomorphology of Alluvial and Fluvial Fans: Terrestrial and Planetary Perspectives. Geological Society, London, Special Publications* **440** (2016).

[2] R.M.C. Lopes, M. J. Malaska, A. Solomonidou, A. Le Gall, M. A. Janssen, C.D. Neish, E.P. Turtle, **S.P.D. Birch**, A. G. Hayes, J. Radebaugh, A. Coustenis, B. W. Stiles, R. L. Kirk, K.L. Mitchell, and K. J. Lawrence. Nature, Distribution, and Origin of Titan's Undifferentiated Plains, *Icarus* **270**, 162-182 (2015).

[1] **S.P.D. Birch**, M. Manga, B. Delbridge, and M. Chamberlain. Penetration of spherical projectiles into wet granular media, *Physical Review E* **90**, 032208 (2014).

INVITED TALKS & COLLOQUIA

[2] **S.P.D. Birch**. Sediment Transport and Landscape Evolution on Comet 67P/Churyumov-Gerasimenko. PICS Seminar, Massachusetts Institute of Technology, Cambridge, MA, April 2018.

[1] **S.P.D. Birch**. Investigating the Morphology and Topography of Titan's Polar Lacustrine Features. PALS Seminar, University of Maryland, College Park, MD, March 2018.

SELECTED CONFERENCE ABSTRACTS

[10] **S.P.D. Birch**. Raised Rims around Titan's Small Lakes. COSPAR 2018, Pasadena, CA, July 2018.

[9] **S.P.D. Birch**. Numerical Landscape Evolution Simulations Applied to Comet 67P. Rosetta SWT 49, Rhodes, Greece, June 2018.

[8] **S.P.D. Birch**, A.G. Hayes, and J.D. Hofgartner. The Raised Rims of Titan's Small Lakes. *LPSC, Abstract #2076*, Woodlands TX, March 2018

[7] **S.P.D. Birch**, O.M. Umurhan, A.G. Hayes, Y. Tang, J.M. Moore, and O.L. White. Sediment Transport and Landscape Evolution on Comet 67P/Churyumov-Gerasimenko. *AGU Fall Meeting,* San Francisco, CA, December 2017.

[6] **S.P.D. Birch**, Y. Tang, A Hayes, et al. Geomorphology of Comet 67P/Churyumov-Gerasimenko. *LPSC, Abstract #2036*, Woodlands TX, March 2017

[5] **S.P.D. Birch**, A. Hayes, W. Dietrich, A. Howard, et al. Geomorphology of Titan's polar terrains. *Titan Surface Workshop,* Paris, France, November 2016.

[4] **S.P.D. Birch**, A. Hayes, W. Dietrich, A. Howard, et al. Geomorphology of Titan's polar terrains: Using the landscape's topographic form to constrain surface processes. *AGU Fall Meeting,* San Francisco, CA, December 2015.

[3] **S. Birch**. Titan Hydrology: Past, Present and Future. *Planetary Systems: A Synergistic View,* Quy Nhon, Vietnam, July 2015.

[2] **S. Birch**, A. Hayes, W. Dietrich, M. Malaska, R. Kirk and A. Lucas. Geomorphology of Titan's Polar Regions. *AGU Fall Meeting,* San Francisco, CA, December 2014.

[1] **S. Birch**, M. Manga, B. Delbridge, A. Patel, E. Knappe, and J. Dufek. Scaling Laws for Impacts into Wet Substrates, Applied to the Bomb Sag at Home Plate, Mars. *AGU Fall Meeting,* San Francisco, CA, December 2013.

TEACHING EXPERIENCE

Cornell University; *Lead Lecturer*

- EAS/Astro3150: "Geomorphology" (Spring 2019)

Cornell University; *Guest Lecturer*

- Astro1102: "Our Solar System" (2x Spring 2018)
- Astro2202: "A Spacecraft Tour of the Solar System" (2x Fall 2016, 3x Fall 2017/2018)
- Astro2212: "The Solar System: Planets, Small Bodies and New Worlds" (1x Fall 2017)
- Astro6577: "Planetary Surface Processes" (2x Spring 2017)

Cornell University; *Teaching Assistant*

- Astro1102: "Our Solar System" (Spring 2015 & 2016)
- Astro6577: "Planetary Surface Processes" (Spring 2017)

University of California Berkeley; *Grader*

- EPS 3: "The water planet" (Spring 2014)
- EPS 20: "Earthquakes in your backyard" (Fall 2013)

ADVISING

Graduate (*on auxillary projects related to work with their primary advisor):

- Ishan Mishra; Cornell University; 08/2018 – Present
  - Quantifying Grain Size Evolution of 67P's Smooth Terrains using Pre- and Post-Perihelion Observations
- Abhinav Jindal; Cornell University; 06/2018 – Present
  - Measuring Fallback on Comet 67P using High Resolution Topography

Undergraduate:

- Samantha Moruzzi; Cornell University; 07/2018 – Present
  - SAR Backscatter Modeling on Titan

- Alexandra Dobbs (Summer REU); 05/2018 – 08/2018
    - Photometric modeling of smooth terrains on 67P
- Andrew Nowak (Summer REU); 05/2018 – 08/2018
    - SAR Backscatter Modeling of Representative Terrains on Titan
- Julia Miller; Cornell University; 08/2017 – Present
    - A Complete Mapping of Titan's Hydrology
- Harry Tang; Cornell University; 04/2015 – 08/2018
    - Photoclinometry on 67P to Understand Transient Changes
    - Published a paper in *Astronomy & Astrophysics* in August 2018
- Ian Cullings; Cornell University; 01/2017 – 12/2018
    - The longevity of the Jezero crater delta using DTMs
- Ryan de Freitas Bart; Cornell University; 04/2015 – 04/2017
    - Generating a fully 3-dimensional model of Comet 67P/C-G

High School:

- Leslie Young; Ithaca High School; New Visions Program; 11/2014 –05/2015
    - Hydraulic mapping on Titan

MISSION PARTICIPATION

- CAESAR [NASA New Frontiers Phase A] – Science Team; *Graduate Student Co-I*
- Cassini [NASA/ESA/ASI] – RADAR Team; *Associate Team Member*
- Rosetta [ESA] – OSIRIS; *Graduate Student Collaborator*
- Mars 2020 Rover [NASA Flagship] – MastcamZ; *Landing Site Selection Working Group*
- Oceanus (Not Selected) [NASA New Frontiers 4] – Science Team; *Graduate Student Co-I*

PROFESSIONAL SERVICE

Journal Reviewer:

- Monthly Notices of the Royal Astronomical Society (2)
- Planetary and Space Science (1)
- Journal of Geophysical Research (1)

PUBLIC OUTREACH & EDUCATION

- Keynote speaker at *AstroFest*, Kopernik Observatory, Vestal NY (October 2018)
- Creator of the *Winnipeg Planet Walk* in Winnipeg MB, Canada (in development)
- Cornell Astronomy "Ask an Astronomer" Team Member (January 2015 – Current)
- Volunteer with Cornell's Spacecraft Planetary Imaging Facility (August 2014 – Current)
- Volunteer with "Focus for Teens" (Summer 2015)
- Named "Winnipeg Lacus" on Titan

SELECTED FIELD EXPERIENCE

- **Mojave Desert / Death Valley, CA** (2015/2017) [Student/Teaching Assistant]
  Research Objective: Ground truth of remote sensing data and planetary analogs (Cornell Class Astro6577).
- **Eel River / Angelo Coast Range Reserve, CA** (2014) [Student]
  Research Objective: Morphology and Dynamics of Eel River Tributaries (UC Berkeley Class EPS217).

REFERENCES

- Professor Alexander Hayes, Cornell University
  Relationship: Ph.D. Thesis Advisor
  Email: hayes@astro.cornell.edu
- Professor Steven Squyres, Cornell University
  Relationship: Ph.D. Co-Advisor
  Email: squyres@astro.cornell.edu
- Dr. Rosaly Lopes, Jet Propulsion Lab
  Relationship: Collaborator
  Email: rosaly.m.lopes@jpl.caltech.edu
- Dr. Jeffrey Moore, NASA Ames Research Center
  Relationship: Collaborator
  Email: jeff.moore@nasa.gov
- Dr. Michael Malaska, Jet Propulsion Lab
  Relationship: Collaborator
  Email: michael.j.malaska@jpl.nasa.gov
- Dr. Steven Wall, Jet Propulsion Lab
  Relationship: Collaborator
  Email: swall@jpl.caltech.edu
- Professor Jani Radebaugh, Brigham Young University
  Relationship: Collaborator
  Email: janirad@byu.edu
- Professor Dennis Bodewits, Auburn University
  Relationship: Collaborator
  Email: dennis@auburn.edu
- Professor Jonathan Lunine, Cornell University
  Relationship: Collaborator
  Email: jlunine@astro.cornell.edu
- Dr. Orkan Umurhan, NASA Ames Research Center
  Relationship: Collaborator
  Email: orkan.umurhan@gmail.com
- Dr. Jason Soderblom, MIT
  Relationship: Collaborator
  Email: jms4@mit.edu
- Additional references are available upon request.