

TUSHAR MITTAL

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EDUCATION & EMPLOYMENT *Penn State University,*
Assistant Professor
Department of Geosciences - **Fall 2022-Present**

Massachusetts Institute of Technology,
MIT Crosby Postdoctoral Fellow
Department of Earth, Atmospheric and Planetary Sciences - **Spring 2020-2022**

University of California, Berkeley,
PhD
Advisor : Mark Richards
Earth & Planetary Science Department - **Fall 2013-Feb 2020**

Johns Hopkins University, Baltimore, MD
B.S (With Honors) in Physics **Fall 2009- Fall 2012**

PUBLICATIONS

42. *Timelines of plume characteristics of the Hunga Tonga-Hunga Ha'apai eruption sequence from 19 December 2021 to 16 January 2022: Himawari-8 observations*, Ashok Gupta, Ralf Bennartz, Kristen Fauria, **Tushar Mittal**, Nature Communications (accepted) **2022**
41. *Simultaneous creation of a large vapor plume and pumice raft by the 2021 Fukutoku-Oka-no-Ba shallow submarine eruption*, Kristen Fauria, Martin Jutzeler, **Tushar Mittal**, Ashok Gupta, Liam Kelly, John Rausch, Ralf Bennartz, Brent Delbridge, Lise Retailleau, AGU Advances (in review) **2022**
40. *Microscopic Defect Dynamics of a Brittle-to-Ductile Transition*, Matej Pec, Hamed Ghaffari, **Tushar Mittal**, Ulrich Mok, Hillary Chang, Brian Evans, Science Advances (in review) **2022**
39. *Long-term eruption forecasting*, **Tushar Mittal** Nature Geoscience, 15(7), 516-517 **2022**
38. *Dynamics of Geysers and tracer transport over the south pole of Enceladus*, Wanying Kang, John Marshal, **Tushar Mittal**, and Suyash Bire Monthly Notices of the Royal Astronomical Society (in revision) **2022**
37. *Mayotte 2018 Eruption likely sourced from a magmatic mush*, **Tushar Mittal**, Jacob S. Jordan, Lise Retailleau, Francois Beauducel, and Aline Peltier, Earth and Planetary Science Letters 590, 117566 **2022**
36. *Deccan volcanism at K-Pg time. In From the Guajira Desert to the Apennines, and from Mediterranean Microplates to the Mexican Killer Asteroid: Honoring the Career of Walter Alvarez*, **Tushar Mittal**, Courtney J. Sprain, Paul R. Renne, and Mark A. Richards. Geological Society of America Special Publications Paper 557 **2022**

35. *How does salinity shape ocean circulation and ice geometry on Enceladus and other icy satellites?*, Wanying Kang, **Tushar Mittal**, Suyash Bire, Jean-Michel Campin, and John Marshal, *Science Advances*, 8(29), eabm466 **2022**
34. *Pumice Raft Detection Using Machine-Learning on Multispectral Satellite Imagery*, Maggie Zheng, **Tushar Mittal**, Kristen Fauria, Ajit Subramaniam, Martin Jutzeler *Front. Earth Sci., Sec. Volcanology* **2022**
33. *Towards Understanding Deccan Volcanism : A Volcanological Perspective*, Stephen Self, **Tushar Mittal**, Gauri Dole, Loyc Vanderkluysen, *Annual Review of Earth and Planetary Sciences* 50 (2022): 477-506. **2022**
32. *Magmatic architecture of continental flood basalts I : Observations from Deccan Traps*, **Tushar Mittal**, Mark Richards, Isabel Fendley, *JGR:Solid Earth* 126(12), e2021JB021808 **2021**
31. *Magmatic architecture of continental flood basalts II : A new conceptual model*, **Tushar Mittal**, and Mark Richards, *JGR:Solid Earth* 126(12), e2021JB021807 **2021**
30. *Cooling history and emplacement dynamics within rubbly lava flows, southern Deccan Traps: insights from textural variations and crystal size distributions*, Aristle Monteiro, Raymond A. Duraiswami, **Tushar Mittal**, Shrishail Pujari, Upananda Low, Ahsan Absar, *Bulletin of Volcanology*, 83(11), 1-23 **2021**
29. *Calcium isotope evidence for early Archaean carbonates and subduction of oceanic crust*, Michael Antonelli, Jillian Kendrick, Chris Yakymchuck, Martin Guitreau, **Tushar Mittal**, Frdric Moynier, *Nature Communications* **2021**
28. *Thickness characteristics of phoehe lavas in the Deccan Province, Western Ghats, India, and in continental flood basalt provinces elsewhere*, Stephen Self, **Tushar Mittal**, Anne Jay, *Frontiers in Earth Science*, doi: 10.3389/feart.2020.630604 **2020**
27. *No CretaceousPaleogene Boundary in Exposed Rajahmundry Traps: A Refined Chronology of the Longest Deccan Lava Flows From $^{40}\text{Ar}/^{39}\text{Ar}$ Dates, Magnetostratigraphy, and Biostratigraphy*, Isabel M. Fendley, Courtney J. Sprain, Paul R. Renne, Ignacio Arenillas, Jos A. Arz, Vicente Gilabert, Stephen Self, **Tushar Mittal**, *Geochemistry, Geophysics, Geosystems*, 21(9), e2020GC009149 **2020**
26. *Bristle-state' friction: How to simulate high-velocity rupture experiments using rate and state dependent constitutive relations, towards a loading-independent 'universal' friction*, Seth Saltiel, **Tushar Mittal**, Jorge Crempien; Jaime Campos. *Frontiers in Earth Science*, 8, 373 **2020**
25. *Assessing the environmental consequences of the generation and alteration of mafic volcanoclastic deposits during Large Igneous Province emplacement*, Benjamin Black, **Tushar Mittal**, Francesca Lingo, Jeff Karson, Kristina Walowski, Andres Hernandez, Ellen Gales, *Large Igneous Provinces: A Driver of Global Environmental and Biotic Changes* 255: 117, Book - AGU Publications. **2020**
24. *Precipitation of multiple light elements to power Earth's early dynamo*, **Tushar Mittal**, Nicholas Knezek, Sarah M. Arveson, Chris P. McGuire, Curtis D. Williams, Timothy D. Jones, and Jie Li. *EPSL* 532 116030. **2020**
23. *Ongoing Dispersal of the August 7, 2019 Pumice Raft from the Tonga Arc in the Southwestern Pacific Ocean*, Martin Jutzeler, Erik Van Sebille, Robert Marsh, **Tushar Mittal**, Rebecca Carey, Kristen Fauria, Michael Manga, Jocelyn McPhie. *Geophysical Research Letters* (47.5), e2019GL086768. **2020**

22. *Volatile Degassing From Magma Chambers as a Control on Volcanic Eruptions* **Tushar Mittal**, MA Richards, J. Geophys. Res Solid Earth, 124(8), 7869-7901. **2019**
21. *Ca isotopes record rapid crystal growth in volcanic and sub-volcanic systems* Michael A Anontelli, **Tushar Mittal**, Anders McCarthy, Barbara Tripoli, James M. Watkins, and Donald J. DePaolo., PNAS 116 (41), 20315-20321 2019
20. *Detection of submarine eruptions using Argo floats and its implications for ocean dynamics*, **Tushar Mittal**, and Delbridge, Brent, EPSL 511, 105-116 **2019**
19. *Shell Structure of Enceladus from Satellite Gravity and Topography*, Doug Hemingway and **Tushar Mittal**, Icarus 332, 111-131 **2019**
18. *Kinetic and equilibrium Ca isotope effects in high-T rocks and minerals*, Antonelli, Michael A., Martin Schiller, Edwin A. Schauble, **Tushar Mittal**, Donald J. DePaolo, Thomas Chacko, Edward S. Grew, and Barbara Tripoli, EPSL 517, 71-82 **2019**
17. *Mercury Chemostratigraphy Records for Terrestrial Deccan Volcanism* Isabel Fendley, **Tushar Mittal**, Courtney Sprain, Mark Marvin Di Pasquale, Paul Renne, EPSL 524, 115721 **2019**
16. *The Eruptive Tempo of Deccan Volcanism in Relation to the Cretaceous-Paleogene Boundary*, Courtney Sprain, Paul Renne, Loyc Vanderkluisen, Kanchan Pande, Steve Self, **Tushar Mittal**, Science 363 (6429), 866-870 **2019**
15. *An ExoKuiper Belt with an Extended Halo around HD 191089 in Scattered Light*. Ren, B., Choquet, E., Perrin, M. D. ... **Tushar Mittal** et al. The Astrophysical Journal, 882(1), 64. **2019**
14. *Plume-ridge interaction via melt channelization at Galpagos and other near - ridge hotspot provinces* **Tushar Mittal**, MA Richards, Geochemistry, Geophysics, Geosystems 18 (4), 1711-1738 **2017**
13. *The demise of Phobos and development of a Martian ring system* BA Black, **T Mittal**, Nature Geoscience 8 (12), 913 - **2015**
12. *Fast Modes and Dusty Horseshoes in Transitional Disks*, **T Mittal**, and E Chiang; The Astrophysical Journal Letters 798 (1), L25 21 **2014**
11. *The Spitzer infrared spectrograph debris disk catalog. II. Silicate feature analysis of unresolved targets*, **T Mittal**, CH Chen, H Jang-Condell, P Manoj, BA Sargent, DM Watson; The Astrophysical Journal 798 (2), 87 25 **2014**
10. *The Spitzer infrared spectrograph debris disk catalog. I. Continuum analysis of unresolved targets* CH Chen, **T Mittal**, M Kuchner, WJ Forrest, CM Lisse, P Manoj, The Astrophysical Journal Supplement Series 211 (2), 25 22 **2014**
9. *Experimental measurements and bristle friction modeling of nonlinear hysteresis loops and harmonic generation in rock fractures*, Seth Saltiel, B Bonner, **T Mittal**, B Delbridge, J Ajo-Franklin, Journal of Geophysical Research: Solid Earth - **2017**
8. *Infrared Spectroscopy of HR 4796A's Bright Outer Cometary Ring+ Tenuous Inner Hot Dust Cloud*, Carey Lisse, ML Sitko, ..., **T. Mittal**, The Astronomical Journal 154 (5), 182 - **2017**
7. *Spectral Evidence for an Inner Carbon-rich Circumstellar Belt in the Young HD 36546 A-star System*, CM Lisse, ML Sitko, ..., **T Mittal**, The Astrophysical Journal Letters 840 (2), L20 - **2017**

6. *IRTF/SPEX Observations of the HR 4796A Cometary Ring System*, CM Lisse, ML Sitko, ..., **T. Mittal**, *Astron. J* - **2017**
5. *Discovery and spectroscopy of the young jovian planet 51 Eri b with the Gemini Planet Imager*, B Macintosh, JR Graham, ... **T. Mittal** *Science* 350 (6256), 64-67 169 **2015**
4. *IRS Spectra of Debris Disks in the Scorpius-Centaurus OB Association*, H Jang-Condell, CH Chen, **T. Mittal**, P Manoj, D Watson, CM Lisse, *The Astrophysical Journal* 808 (2), 167 13 **2015**
3. *Discovery of resolved debris disk around HD 131835*, LW Hung, MP Fitzgerald, CH Chen, **T. Mittal**, PG Kalas, JR Graham *The Astrophysical Journal* 802 (2), 138 8 **2015**
2. *Polarimetry with the Gemini planet imager: methods, performance at first light, and the circumstellar ring around HR 4796A* MD Perrin, G Duchene, ..., **T. Mittal** *The Astrophysical Journal* 799 (2), 182 68 **2015**
1. *Five debris disks newly revealed in scattered light from the Hubble space telescope NICMOS archive*, R Soummer, MD Perrin, ..., **T. Mittal**; *The Astrophysical Journal Letters* 786 (2), L23 39 **2014**

SELECT ORAL
PRESENTATIONS

Dynamics of Hydrothermal Plumes on Icy-ocean worlds, **Talk**, Penn State Astronomy Department Seminar Aug 2022

Understanding the magmatic architecture of volcanic systems : A magma dynamics perspective, **Talk**, Princeton Geosciences Department Seminar April 2022

Understanding the magmatic architecture of volcanic systems : A magma dynamics perspective, **Talk**, Stanford Earth Sciences Department Seminar April 2022

Mayotte 2018-2021 Eruption likely sourced from a magmatic mush, **Talk** AGU Fall Meeting Dec 2021

Hydrothermal Plume dynamics on Icy-ocean worlds, **Talk**, Lamont Earth Sciences Seminar Nov 2021

Understanding the magmatic architecture of volcanic systems : A magma dynamics perspective, **Talk**, UC Davis Earth Sciences Department Seminar Oct 2021

Understanding the magmatic architecture of volcanic systems : A Flood Basalt perspective, **Talk**, UCLA Earth Sciences Department Seminar Oct 2021

Deccan Volcanism at K-Pg Time, **Talk** GSA Fall Meeting Oct 2021

Earth's largest volcanic systems : Understanding Large Igneous Province eruptions, **Talk**, University of Florida Earth Sciences Department Seminar & NC State Earth Sciences Department Seminar March 2021

Remote Detection of Pumice Rafts and Discolored Water from Submarine Volcanic Eruptions Using Satellite Imagery , Maggie Zheng, Tushar Mittal, Kristen Fauria **Student Talk**, AGU Fall Meeting Meeting 2020

Magmatic Architecture of Continental Flood Basalts A New Deccan Traps Perspective, **Talk**, AGU Fall Meeting Meeting 2020

Development of an open source, machine learning based toolset for the identification of dikes in satellite images through semantic segmentation, Ryan Gray, Tushar Mittal **Student Talk**, GSA Meeting 2020

Development of an open source, machine learning based toolset for the identification of dikes in satellite images through semantic segmentation, Matthew Bogumil, Tushar Mittal, Carolina Lithgow-Bertelloni, **Student Talk**, GSA Meeting 2020

Magmatic Architecture of Continental Flood Basalts A Deccan Traps Perspective, **Talk**,

Godschmidt Meeting 2020

Podcast: Et tu, Etna? Lisa Lester, Eos, 101 (Discussing work done by student Rafael Castro, Tushar Mittal, et al., presented at AGU Fall Meeting 2019) **AGU Press Conference and Podcast**- <https://eos.org/articles/podcast-et-tu-etna>, 2020

The eruptive timescale and magmatic architecture of the Deccan Traps flood basalt, **Talk**, UC Berkeley Department Seminar 2019

Melt transport through the mantle lithosphere - Challenges of a dike based mode, **Talk**, RCN Fluid and melt Transport, Invited Talk 2019

The eruptive timescale and magmatic architecture of the Deccan Traps flood basalt, **Talk**, UCLA Invited Talk 2019

Detection of submarine eruptions using Argo floats and its implications for ocean dynamics, **Talk**, Harvard Invited Talk 2018

Submarine eruption detection using Argo floats, **Talk**, WHOI Invited Talk 2018

Submarine Volcanism : How to detect it ?, **Talk**, Columbia-Lamont Invited Talk 2018

Influence of volatile degassing on eruptibility of LIP magmatic systems, **Talk**, American Geophysical Union, Fall Meeting 2017

Volatile degassing as a control on volcanic eruptions, **Talk**, IAVCEI 2017

Volatile degassing as a control on the magnitude and frequency of volcanic eruptions, **Talk**, USGS Menlo Park - Volcano Science Seminar April 2017

A Future Martian Ring System? **Talk**, Mars Institute "Asaph Hall Best Student Paper Award" Talk - Third International Conference on the Exploration of Phobos and Deimos, Nasa Ames, June 2016

Spitzer IRS Spectroscopy of Debris Disks : A comprehensive Survey, **Talk**, Department Seminar/Journal Club, Earth and Planetary Sciences Department, JHU - May 2012

Analysis of Dust Mineralogy using Spitzer IRS Spectroscopy of Debris Disks, **Talk**, Signposts of Planets Conference, 2011

PROFESSIONAL ACTIVITY

1. *Review Editor : Frontiers in Earth Sciences (Volcanology) : 2020 - Present*
2. *Reviewer for GRL, JGR, EPSL, Frontiers, Nature Geosciences, Geosciences, Astrophysical Journal, Lithos, GSA Bulletin, NSF, and NASA Review Panel*
3. *Panelist on AGU Podcast : Third Pod from the Sun, March 2020 - Featuring work by student Rafael Castro* <https://thirdpodfromthesun.com/2020/03/24/et-tu-etna/>
4. *Submarine Volcanism: Advances in Observations, Methods, and Models I*, **Session Chair**, AGU Fall Meeting 2020 - Lise Retailleau, Tushar Mittal, Adam Soule
5. *Environmental Effects and Eruptive Dynamics of Large Igneous Provinces: A Multidisciplinary Perspective*, **Session Convener and Chair**, AGU Fall Meeting 2019 - Fendley, Isabel; Mittal, Tushar; Schmidt, Anja; Hull, Pincelli M;
6. *Environmental Effects and Eruptive Dynamics of Large Igneous Provinces: A Multidisciplinary Perspective II Posters*, **Session Convener**, AGU Fall Meeting 2019 - Fendley, Isabel; Mittal, Tushar; Schmidt, Anja; Hull, Pincelli M;
7. *Hydrovolcanic, Submarine, and Subglacial Eruptions: Exploring Hydrosphere-Volcano Interactions III*, **Session Chair**, AGU Fall Meeting 2019 - Kristen Fauria, Tushar Mittal et al.

AWARDS

- MIT Crosby Postdoctoral Fellow, EAPS MIT, 2020
- George D. Louderback Graduate Student Award, EPS Department, UC Berkeley 2018
- Mars Institute “Asaph Hall Best Student Paper Award” - Third International Conference on the Exploration of Phobos and Deimos, Nasa Ames, Summer 2016
- Financial funding and travel award for 2016 Newton Workshop - Melts in the Mantle, Summer Workshop
- Graduate Student Internship, STScI : February 2013 - July 2013
- Summer internship at the Department of Mineral Sciences as part of Smithsonian Natural History Museum Summer Research Experience program, May - July 2012
- Financial funding and travel award for 2012 Sagan Exoplanet Summer Workshop
- Space Telescope Science Institute Summer Internship program, May - July 2011
- Sigma Pi Sigma National Physics Honor Society

SOFTWARE SKILLS

- Programming experience in Julia, Python, MATLAB, IDL, C + +, C, Java, UNIX shell scripting, SQLite, ImageJ, LaTeX as well as cloud computing (Google Cloud computing).
- Expertise in doing Large-Scale Numerical Simulations and analysis of large datasets (oceanographic, astronomical, remote sensing).
- Machine Learning and time-series analysis

TEACHING
EXPERIENCE

- | | |
|--|--------------------------|
| <i>Teacher - PSU</i> | Fall 2022-Present |
| <ul style="list-style-type: none"> • Course: Geodynamics (GEO5C 203) | |
| <i>Graduate Student Instructor, UCB</i> | Fall 2015-16 |
| <ul style="list-style-type: none"> • Course: Geodynamics (EPS 108, Lecture) | |
| <i>Teaching Assistant, JHU</i> | Fall 2011-12 |
| <ul style="list-style-type: none"> • Course: Freshman Seminar: Conversation with the Earth (AS.270.102, Lecture) | |
| <i>Class Lectures, JHU</i> | |
| <ul style="list-style-type: none"> • Course: Nature of the Solid Planets (AS.270.340, 4 Lectures - Planet Formation Theory; Fall 2011-12) • Course: Freshman Seminar: Conversation with the Earth (AS.270.102, 1 Lecture - Scientific Method; Fall 2011-12) | |