

Pathikrit Bhattacharya

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Indian Institute of Technology, Bhubaneswar
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CURRENT POSITION Visiting Assistant Professor,
School of Earth, Ocean and Climate Sciences,
Indian Institute of Technology, Bhubaneswar.

PAST APPOINTMENTS Postdoctoral Fellow (Dec. 2016 – Sept. 2018)
Dept. of Civil and Environmental Eng.,
Tufts University, Medford, MA.

EDUCATION

Princeton University, Princeton, NJ, USA

Ph.D., Department of Geosciences, November 2016

- Thesis: *Examination of the rate-state friction equations under large perturbations from steady sliding: A theoretical and experimental study*
- Adviser: Dr. Allan Rubin

University of Western Ontario, London, Ontario, Canada

M.S., Department of Earth Sciences, September 2011

- Thesis: *Statistical Analysis of Aftershocks Triggered by Supershear Ruptures.*
- Adviser: Dr. Robert Shcherbakov

Indian Institute of Technology, Roorkee, Roorkee, Uttarakhand, India

M. Tech. in Geophysics, Department of Earth Sciences, May 2009

- Thesis: *Fractal Modeling of Earthquake Dynamics and Aftershock Statistics: Simple Complexity*
- Adviser: Dr. Kamal

Banaras Hindu University, Varanasi, Uttar Pradesh, India

B. Sc. in Physics (with Hons.), Department of Physics, May 2006

AWARDS

Arnold Guyot Teaching Award, Department of Geosciences, Princeton University for excellence in contribution to instruction, contribution to curriculum,

and overall contribution to the teaching mission of the department.

Ontario Graduate Scholarship (2012), Province of Ontario, Canada (declined).

All-India Rank 2 (99.73 percentile) in the **Graduate Admission Test in Engineering (GATE)**, Geophysics (April 2009).

Awarded **Visiting Student Fellowship** at the **Saha Institute of Nuclear Physics** for the periods June-July 2007 and May-July 2008 for work on the 'Two Fractal Overlap Model' of earthquakes and related studies of global and regional seismicity.

Central Board of Secondary Education (CBSE) 0.1% Merit Certificate for obtaining 100 in Science in the All India Secondary Examination. (May 2001).

CO-WRITTEN
FUNDED
PROPOSALS

Wrote, in collaboration with PI Viesca, **USGS National Earthquake Hazard Reduction Program** grant (2018): *Aseismic slip pulses and rupture arrest due to transient fluid sources: Modeling and insight from field scale experiments*, PI: Robert Viesca (we declined the grant since I left for IIT Bhubaneswar).

Wrote, in collaboration with PI Viesca, **Southern California Earthquake Center** funded external research grant (2018): *Inversion of fault hydro-mechanical properties from borehole observations of fluid flow and fault slip* - Grant no. 18043.

PI: Robert Viesca.

Wrote portions of the first draft of a successful collaborative **NSF Earth Science Program** grant (2016-2019): *Collaborative Research: Laboratory and Theoretical Investigations of the Micro-Mechanical Origins of Rate and State Friction on Tectonic Faults* - NSF EAR Grant No. 1547286.

PIs: Allan M. Rubin (Princeton University), Chris J. Marone (Penn State)

Wrote portions of the first draft of a successful collaborative **USGS National Earthquake Hazard Reduction Program** grant (2016): *Ultrasonic Imaging of Laboratory Faults to Illuminate the Micro-Mechanical Origins of Rate and State Friction: Collaborative Research with Princeton University and Pennsylvania State University* - USGS NEHRP Grant No. G16AP00028.

PIs: Allan M. Rubin (Princeton University), Chris J. Marone (Penn State)

Wrote first drafts of a successful **USGS National Earthquake Hazard Reduction Program** grant (2014 - 2015): *Ultrasonic investigations of the micro-*

mechanical origin of rate and state friction - USGS NEHRP Grant No. G14AP00026, G15AP00037.

PI: Allan M. Rubin.

EXPERIENCE

10/2018-Present: Visiting Assistant Professor, IIT Bhubaneswar.

12/2016-10/2018: Post-Doctoral Scholar, Tufts University.

09/2011-11/2016: Research Assistant, Princeton University.

06/2009-08/2011: Research Assistant, University of Western Ontario.

01/2008-05/2009: Research Assistant, Indian Institute of Technology, Roorkee.

05/2008-07/2008: Visiting Student Fellow, Saha Institute of Nuclear Physics.

TEACHING EXPERIENCE

IIT, Bhubaneswar

Courses taught:

11/2018-present

a) ES5L105 - Computational Geosciences

b) ES5P105 - Computational Geosciences Lab

c) ES6L203 - Borehole Geophysics

d) ES5L401 - Reservoir Characterization

e) ES5L204 - Engineering Geology and Rock Mechanics

U. of Western Ontario

TA for courses:

09/2009-05/2011

a) ES 1089G - Earth, Art and Culture

b) ES 1083F - Life on Planet Earth

Princeton University

AI for courses:

09/2012-05/2016

a) GEO 255 – Life in the Universe

b) GEO 103 – Natural disasters

PROFESSIONAL SERVICE

2010-present: Member, American Geophysical Union.

Reviewer for: Geophysical Journal International

Bulletin of Seismological Society of America

Journal of Geophysical Research, Solid Earth

Geophysical Research Letters

Scientific Reports (Nature Group)

Nonlinear Processes in Geophysics

Internal Reviewer for publications, U. S. Geological Survey

PUBLICATIONS

Refereed Publications

S. Shreedharan, J. Rivière, **Bhattacharya, P.**, Marone, C. (2019), *Frictional state evolution during normal stress perturbations probed with ultrasonic waves*, accepted in J. Geophys. Res. Solid Earth.

Bhattacharya, P., Viesca, R. (2019), *Fluid-induced aseismic fault slip outpaces pore-fluid migration*, Science, **364**, 6439, 464–468.

Bhattacharya, P., Rubin, A. M., and Beeler, N. (2017), *Does fault strengthening in laboratory rock friction experiments really depend primarily upon time and not slip?*, J. Geophys. Res. Solid Earth, **122**, 6389–6430.

Bhattacharya, P., Rubin, A. M., Bayart, E., Savage, H. and Marone, C. (2015), *Critical evaluation of state evolution laws in rate and state friction: Fitting large velocity steps in simulated fault gouge with time-, slip- and stress-dependent constitutive laws*, J. Geophys. Res. Solid Earth, **120**, 6365–6385.

Bhattacharya, P., and Rubin, A. M. (2014), *Frictional response to velocity steps and 1D fault nucleation under a state evolution law with stressing-rate dependence*, J. Geophys. Res. Solid Earth, **119**, 2272–2304.

Nagare, R. M., **Bhattacharya, P.**, Khanna, J., and Schincariol, R. A. (2014), *Coupled cellular automata for frozen soil processes*, SOIL Discussions, **1**, 1, 119–150.

Bhattacharya, P., Shcherbakov, R., Tiampo, K. F. and Mansinha, L. (2012), *Anomalous statistics of aftershock sequences generated by supershear ruptures*, Res. Geophys., **2**, 1, e6.

Bhattacharya, P., Phan, M. and Shcherbakov, R. (2011), *Statistical analysis of the 2002 Mw 7.9 Denali earthquake aftershock sequence*, Bull. Seismol. Soc. Am., **101**, 6, 2662–2674.

Bhattacharya, P., Chakrabarti, B. K. and Kamal (2011), *A fractal model of earthquake occurrence: Theory, simulations and comparisons with the aftershock data*, J. Phys.: Conf. Ser., **319**, 012004.

Book Chapters

Bhattacharya, P., Chakrabarti, B. K., Kamal and Samanta, D. (2009), *Fractal models of earthquake dynamics*, pp. 107 - 158 in Schuster, H. G., (Ed.), *Reviews of Nonlinear Dynamics and Complexity: Vol. 2*, Wiley-VCH, Berlin.

Under Preparation

Beeler, N., **Bhattacharya, P.**, Rubin, A. M., Tullis, T. (2019), *Apparent age dependence of the fault weakening distance in rock friction*.

Bhattacharya, P., Rubin, A. M., Tullis, T., Okazaki, K. and Beeler, N. (2019), *The response of rate-state friction to variable normal stresses: a new state evolution prescription based on a micro-mechanical model.*

Bhattacharya, P., Rubin, A. M., Tullis, T., Okazaki, K. and Beeler, N. (2019), *Where did the time go? Friction evolves with slip following extreme velocity step decreases and holds*, under preparation for **PNAS**.

Conference Presentations

Bhattacharya, P., Viesca, R. (2018), *Fluid-induced aseismic slip can outpace pore-fluid migration: evidence from in situ data*, Annual Meeting of the Southern California Earthquake Center.

Bhattacharya, P., Viesca, R. (2018), *Fluid-induced aseismic slip can outpace pore-pressure diffusion! – evidence from in situ data*, Gordon Research Conference (Rock Mechanics).

Bhattacharya, P., Viesca, R. (2017), *Data-driven fault mechanics: Inferring fault hydro-mechanical properties from in situ observations of injection-induced aseismic slip*, AGU Fall Meeting.

Bhattacharya, P., Rubin, A. M., Tullis, T., Okazaki, K. and Beeler, N. M. (2016), *Where did the time go? Friction evolves with slip following large velocity steps, normal stress steps, and (?) during long holds*, AGU Fall Meeting.

Bhattacharya, P., Rubin, A. M., Tullis, T., Okazaki, K. and Beeler, N. M. (2016), *Where did the time go? Friction evolves with slip following large velocity and normal stress steps*, Gordon Research Conference (Rock Mechanics).

Bhattacharya, P., Rubin, A. M., Ryan, K., Riviere, J., and Marone, C. (2015), *Is frictional healing slip-dependent?*, AGU Fall Meeting.

Bhattacharya, P., Rubin, A. M., Scuderi, M. M., Leeman, J., Ryan, K., and Marone, C. (2014), *The role of stressing-rate in state evolution under rate and state friction*, AGU Fall Meeting.

Bhattacharya, P., Rubin, A. M., and Beeler, N. (2014), *Do laboratory slide-hold-slide experiments really provide evidence for time-dependent healing in rock?*, SCEC Annual Meeting.

Bhattacharya, P., Rubin, A. M., Bayart, E., Savage, H., Marone, C. and Beeler, N. (2013), *Experimental and Analytical Evaluation of Stressing-Rate State Evolution in Rate-State Friction Laws*, AGU Fall Meeting.

Bhattacharya, P., and Rubin, A. M. (2012), *Numerical and analytical study of rupture nucleation on 1D and 2D faults under a new state evolution law*, AGU Fall Meeting.

Bhattacharya, P., Shcherbakov, R, Tiampo, K. F. and Mansinha, L. (2011), *Variation of the Gutenberg-Richter b-value with material strength*, AGU Fall Meeting.

Bhattacharya, P., Shcherbakov, R, Tiampo, K. F. and Mansinha, L. (2010), *Statistical signatures of aftershock sequences generated by supershear mainshocks*, AGU Fall Meeting.