

Brato Chakrabarti

Flatiron Institute, Simons Foundation

Research Fellow: Center for Computational Biology
Biophysical Modeling
162 5th Avenue, NY 10010
Web: <https://www.bratochakrabarti.com/>

Mailing address

15 East, 11th Street
Apt 4A, NY 10003
(540)838-1590

RESEARCH INTEREST

Soft-matter Physics	Dynamical Systems	Slender Structures
Fluid-structure Interaction	Chaotic Advection	Complex Fluids
Scientific Computing	Biophysics	Hydrodynamic Stability

EDUCATION

Research Fellow

Center for Computational Biology Flatiron Institute, Simons Foundation Mentor: Professor Michael J Shelley	March 2020-Ongoing
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Doctor of Philosophy, Applied Mechanics

Department of Mechanical and Aerospace Engineering Thesis: Problems on Viscous Dynamics of Passive and Active Microfilaments Advisor: Professor David Saintillan GPA: 4.0/4.0	Fall 2015-Fall 2019
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Master of Science, Engineering Mechanics

Biomedical Engineering and Mechanics (BEAM), Virginia Tech Thesis: Catenaries in visocous fluid Advisor: Professor James Hanna GPA: 4.0/4.0	Fall 2013-Spring 2015
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Bachelor of Engineering, Mechanical Engineering

Jadavpur University, India GPA: 8.9/10	2009-2013
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RESEARCH EXPOSURE

Microscale flow modeling, Saintillan research group

MAE, UC San Diego	Fall 2015-ongoing Graduate research assisatant
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- Bending, buckling and coiling of actin filaments in shear and extensional flow.
- Spontaneous oscillations of filaments and hydrodynamic synchronization.
- Shear dispersion in peristaltic flow and bacterial suspension.
- Mixing, transport and drift due to swimming microorganisms.

Complex suspensions, Anke Lindner Research Group

ESPCI, Paris	Fall 2017-ongoing Visiting student
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- Dynamics of suspension of flexible filaments.
- Buckling and fluctuation dynamics of actin filaments.

Engineering Science and Mechanics, Virginia Tech

Biomedical Engineering and Mechanics (BEAM)	Fall 2013-Spring 2015 Graduate research assistant
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- Dynamics and geometry of towed catenaries in viscous fluids.
- Geometric phase and chaotic advection in journal bearing flow: relation to swimming microorganisms.

PUBLICATIONS (* denotes equal contribution)

1. **Brato Chakabarti**, Sebastian Fürthauer and Michael J Shelley, “A multiscale biophysical model gives quantized metachronal waves in a lattice of cilia”, in review, [arXiv:2108.01693](#), 2021.
2. **Brato Chakabarti**, Yanan Liu, Olivia du Roure, Anke Lindner, and David Saintillan, “Signatures of elastoviscous buckling in the dilute rheology of stiff polymers”, *Journal of Fluid Mechanics*, **919** A12 (2021).
3. **Brato Chakrabarti**, and David Saintillan, “Shear-induced dispersion in peristaltic flow”, *Physics of Fluids*, **32** 11302 (2020). **Invited:** “Contributions from Early Career Researchers 2020” and selected as a **featured** article.
4. **Brato Chakrabarti**, Charles Gaillard, and David Saintillan, “Trapping, gliding, vaulting: Transport of semiflexible polymers in periodic post arrays”, *Soft Matter*, **16** 5534 (2020).
5. **Brato Chakrabarti**, Yanan Liu, John Lagrone, Ricardo Cortez, Lisa Fauci, Olivia du Roure, David Saintillan, and Anke Lindner, “Flexible filaments buckle into helicoidal shapes in strong compressional flow”, *Nature Physics*, (2020).
6. **Brato Chakrabarti** and David Saintillan, “Hydrodynamic synchronization of spontaneously beating filaments”, *Physical Review Letters*, **123** 208101 (2019).
7. **Brato Chakrabarti** and David Saintillan, “Spontaneous oscillations, beating patterns and hydrodynamics of active filaments”, *Physical Review Fluids*, **4** 043102 (2019).
8. Roberto Alonso Matilla, **Brato Chakrabarti** and David Saintillan, “Transport and dispersion of active particles in periodic porous media”, *Physical Review Fluids*, **4** 043101 (2019).
9. Yanan Liu*, **Brato Chakrabarti***, David Saintillan, Anke Lindner and Olivia du Roure, “Tumbling, buckling, snaking: Morphological transitions of flexible filaments in shear flow”, *Proceedings of the National Academy of Sciences of the USA*, **115** 9438 (2018).
10. **Brato Chakrabarti** and James Hanna “Catenaries in Viscous Fluid”, *Journal of Fluids and Structure*, **66** 490–516 (2016).

In preperation

1. Chenji Li, **Brato Chakrabarti**, Achal Mahajan, and David Saintillan, “Hydrodynamics of swimming sperm cells powered by active filaments”.
2. **Brato Chakrabarti**, Sebastian Fürthauer and Michael J Shelley, “Phase synchronization in oriented active gels”.
3. **Brato Chakrabarti**, Sebastian Fürthauer and Michael J Shelley, “Continuum theory and phase dynamics of oscillators with steric interactions”.
4. Francesco Bonacci, **Brato Chakrabarti**, David Saintillan, Olivia du Roure, and Anke Lindner “Dynamics of semiflexible polymers in oscillatory shear flows”.

CONFERENCE ARTICLES AND PRESENTATIONS

(Presenter underlined)

- Brato Chakabarti, Yanan Liu, Olivia du Roure, Anke Lindner, and David Saintillan, *Signatures of elastoviscous buckling in the dilute rheology of stiff polymers*, at the 73rd Annual Meeting of the APS Division of Fluid Dynamics, November 2020 (online).
- David Saintillan, and Brato Chakrabarti, *Hydrodynamic synchronization of spontaneously beating filaments*, at the 72nd Annual Meeting of the APS Division of Fluid Dynamics, November 2019, Seattle, USA.
- Brato Chakrabarti, Yanan Liu, John Lagrone, Ricardo Cortez, Lisa Fauci, Olivia du Roure, David Saintillan, and Anke Lindner *Helical buckling of flexible filaments in viscous flow*, at the 72nd Annual Meeting of the APS Division of Fluid Dynamics, November 2019, Seattle, USA.
- Anke Lindner, Brato Chakrabarti, Yanan Liu, Olivia du Roure and David Saintillan, *The dynamics of flexible Brownian fibers in viscous flows* at The Annual European Rheology Conference, Slovenia, April 8-11, 2019.

- Brato Chakrabarti and David Saintillan, *Spontaneous oscillations and hydrodynamics of active micro-filament* at the 71st Annual Meeting of the APS Division of Fluid Dynamics, November 2018, Atlanta, USA.
- Roberto Alonso Matilla, Brato Chakrabarti and David Saintillan, *Asymptotic transport and dispersion of active particles in periodic porous media* at the 71st Annual Meeting of the APS Division of Fluid Dynamics, November 2018, Atlanta, USA.
- Brato Chakrabarti, Yanan Liu, David Saintillan, Anke Lindner and Olivia du Roure, *The dynamics of flexible and Brownian filaments in viscous flows* at the 71st Annual Meeting of the APS Division of Fluid Dynamics, November 2018, Atlanta, USA.
- Brato Chakrabarti, Yanan Liu, David Saintillan, Anke Lindner and Olivia du Roure, *Buckling and migration of semi-flexible filaments* at the 70th Annual Meeting of the APS Division of Fluid Dynamics, November 2017, Denver, USA.
- David Saintillan and Brato Chakrabarti, *Shear dispersion in peristaltic pumping* at the 70th Annual Meeting of the APS Division of Fluid Dynamics, November 2017, Denver, USA.
- James Hanna and Brato Chakrabarti, *Catenaries in viscous fluid*. 24th ICTAM, Montreal, August 2016.
- Brato Chakrabarti and David Saintillan. *Drift, Mixing and Diffusivity in Stokes Flow*. Presented at the Southern California (SoCal) Fluids X, April 2016, UC Irvine, California, USA.
- Brato Chakrabarti and James Hanna. *Catenaries in viscous fluid*. At the 68th Annual Meeting of the APS Division of Fluid Dynamics, November 2015, Boston, USA.
- Brato Chakrabarti and James Hanna. *Catenaries in Drag*. Presented at the 67th Annual Meeting of the APS Division of Fluid Dynamics, November 2014, San Francisco, USA.

AWARDS AND HONORS

- **Powell Fellow, UCSD** by Jacobs school of Engineering, Fall 2015
- **Pratt Presidential Graduate Fellowship** by Virginia Tech to the incoming outstanding graduate students, 2013-2014.
- **Awarded Gold Medal** for best performance in Fluid Mechanics in Bachelor of Engineering (Mechanical Engineering, Jadavpur University), 2013.
- **Awarded a Summer Research Fellowship** by the Indian Academy of Sciences for undertaking a research project during May–July 2012.
- **National Merit Scholarship** for outstanding performance in school leaving examination, 2009.

REVIEWER FOR ARCHIVED JOURNALS

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|---|---------------------------|
| • Journal of Fluid Mechanics | • Physical Review E |
| • Physical Review Fluids | • Physical Review Letters |
| • Journal of Mathematical Fluid Mechanics | • Soft Matter |

COMPUTER SKILLS

- **Programming skills:** Fortran 90/95, Python
- **Scientific software:** Matlab, Mathematica, Simulink
- **Documentation/graphics:** L^AT_EX, Beamer, Igor-Pro, Adobe illustrator

TEACHING EXPERIENCE

At Virginia Tech

- Fall 2013: Teaching Assistant, Statics (ESM 2104)
- Spring 2014: Teaching Assistant, Dynamics (ESM 2204)
- Fall 2014: Teaching Assistant, Analytical mechanics (ESM 3214)
- Spring 2015: Teaching Assistant, Vibrations (ESM 3134)

At UCSD

- Winter 2017: Teaching Assistant, Fluid mechanics (MAE 210 A)
- Fall 2018: Teaching Assistant, Introduction to mathematical physics (MAE 105).
- Spring 2019: Teaching Assistant, Hydrodynamic stability (MAE 210 C)

REFERENCES

1. Prof. David Saintillan
Professor
Department of Mechanical and Aerospace Engineering, UCSD
E-mail: dsaintillan@eng.ucsd.edu Web: <http://stokeslet.ucsd.edu/>
2. Prof. Michael Shelley
Lilian and George Lyttle Professor of Applied Mathematics
The Courant Institute of Mathematical Sciences
Director, Center for Computational Biology
The Flatiron Institute, Simons Foundation
E-mail: mshelley@simonsfoundation.org Web: <https://math.nyu.edu/faculty/shelley/>
3. Prof. Anke Lindner
Professor
Department of Physics, University Paris Diderot
E-mail: anke.lindner@espci.fr Web: <https://blog.espci.fr/alindner/>
4. Prof. Stefan Llewellyn Smith
Professor
Department of Mechanical and Aerospace Engineering, UCSD
E-mail: sllewellynsmith@ucsd.edu Web: <https://sites.google.com/a/eng.ucsd.edu/sxls/>
5. Prof. James Hanna
Associate Professor
Department of Mechanical Engineering, University of Nevada, Reno
E-mail: jhanna@unr.edu Web: <https://cmag.neocities.org/index.html>