

Ishir Dutta

PhD Student • Earth, Atmospheric, and Planetary Sciences
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Education

- Massachusetts Institute of Technology** Cambridge, MA • September 2019 - present
- Graduate student affiliated with the Atmospheric Chemistry and Composition Modeling Group.
- Colgate University** Hamilton, NY • May 2017
- A.B. Physics, Mathematics, *summa cum laude*

Research

- The Evolution of the Galápagos Mantle Plume** Colgate University • July 2017 - October 2017
Mentor: Karen S. Harpp
- Prepared rock samples from different islands for geochronological and geochemical analysis, including X-ray fluorescence, ICP-MS, and Ar-Ar dating, to characterize mantle sources of volcanic material in the Galápagos Archipelago.
- Biogenic Nanoparticles in Municipal Wastewater Treatment** Colgate University • August 2016 - June 2017
Mentor: Linda Y. Tseng
- Analyzed water quality data from two Southern California wastewater treatment plants. Compared findings with existing hypotheses about nanoparticle behavior to inform better treatment process design and to maximize efficiency in reuse and recycling of water.
- Möbius Polarization of Light** Colgate University • January 2016 - August 2016
Mentor: Enrique J. (Kiko) Galvez
- Designed a workflow that created 3D printed objects from 2D surface plots to easily visualize and communicate electric field patterns of interfering Laguerre-Gauss beams.
- Discriminatory Forces on Chiral Molecules** Colgate University • June 2015 - August 2015
Mentor: Enrique J. (Kiko) Galvez
- Self-taught introductory optics. Assembled and operated an apparatus that used Poincaré beams and a path-displacement interferometer to detect optical forces on chiral molecules in solution.

Publications and Presentations

Peer-Reviewed Journal Articles

- E. J. Galvez, I. Dutta, K. Beach, J. J. Zeosky, J. A. Jones, and B. Khajavi, "Multitwist Möbius strips and twisted ribbons in the polarization of paraxial light beams," *Scientific Reports*, 7(1), 13653 (2017). <https://doi.org/10.1038/s41598-017-13199-1>

Conferences

- E. J. Galvez, I. Dutta, and S. Zhang, "Möbius polarization of non-collinear Poincaré superpositions," *Latin America Optics and Photonics Conference, OSA Technical Digest*, Optical Society of America, paper Tu3D.2. Lima, Peru (November 13, 2018). <https://doi.org/10.1364/LAOP.2018.Tu3D.2>
- J. Smeraldi, L. Y. Tseng, I. Dutta, and D. Rosso, "Naturally occurring nanoparticles in water resource recovery facilities and their potential impact on water reuse and reclamation," IWA ecoSTP18 Conference. London, Ontario (June 26, 2018).
- E. J. Galvez, and I. Dutta, "Deducing 3-dimensional polarization fields from projective measurements," *Proceedings of SPIE 10120, Complex Light and Optical Forces XI*, 101200B. San Francisco, CA (February 27, 2017). <http://dx.doi.org/10.1117/12.2253281>
- J. A. Jones, B. Regan, J. Painter, J. Mills, I. Dutta, et al., "Searching for the helical-gradient force on chiral molecules," *Proceedings of SPIE 10120, Complex Light and Optical Forces XI*, 101200M. San Francisco, CA (February 27, 2017). <http://dx.doi.org/10.1117/12.2253268>
- E. J. Galvez, K. Beach, J. J. Zeosky, I. Dutta, J. A. Jones, and B. Khajavi, "Möbius polarization in non-collinear Poincaré-beam superpositions," *Frontiers in Optics, OSA Technical Digest*, Optical Society of America, paper JTh2A.111 (October 17, 2016). <https://doi.org/10.1364/FIO.2016.JTh2A.111>

Posters (Presenting Author)

- J. Smeraldi, L. Y. Tseng, I. Dutta, and D. Rosso, "Naturally occurring nanoparticles in water resource recovery facilities," Association of Environmental Engineering and Science Professors (AEESP). Ann Arbor, MI (June 20-22, 2017).
- I. Dutta, and L. Y. Tseng, "Biogenic nanoparticles in wastewater treatment," Undergraduate Research Day, Syracuse University Physics Department. Syracuse, NY (November 12, 2016).
- I. Dutta, E. J. Galvez, J. J. Zeosky, and K. Beach, "Möbius polarization of light," *Frontiers in Optics/Laser Science*, The Optical Society. Rochester, NY (October 18, 2016).

In Process

J. Smeraldi, L. Y. Tseng, I. Dutta, G. Rajagopalan, and D. Rosso, "Naturally occurring nanoparticles in biological wastewater treatment," Manuscript in preparation (2019).

Teaching

Divisions of Natural Sciences and Social Sciences

Colgate University • August 2014 - May 2017

Peer Tutor

- Led weekly collaborative and one-on-one problem-solving sessions to increase student proficiency and confidence.
- Provided regular feedback to faculty about student progress and common student questions to address pacing of course.
- Assisted students in finding research opportunities and connecting with upperclassmen, faculty, and alumni.
 - PHYS 131: Atoms and Waves (Fall 2014, Fall 2015, Fall 2016)
 - PHYS 232: Introduction to Mechanics (Spring 2015, Spring 2016, Spring 2017)
 - MATH 214: Linear Algebra (Fall 2015)
 - MATH 250: Number Theory and Mathematical Reasoning (Spring 2016)
 - GEOG 328: Sustainability and Natural Resources (Spring 2017) [[Tehri Dam paper](#), Spring 2016]

edX Online Education Initiatives

Colgate University • November 2014 - December 2015

Course Developer

- Designed and implemented two innovative, online courses on the edX platform:
 - [CORE 138S: Advent of the Atomic Bomb](#) (Spring 2015): Focused on constructing new mechanisms to increase engagement with the material and with other users, as well as building modules about atomic physics and special relativity for a general audience. ([Peer-reviewed paper](#))
 - [FSEM 144: Emerging Global Challenges](#) (Fall 2015): FSEM 144 involved implementing the first-ever online course designed for children by university students taking a course designed, in turn, by an all-student team.

Division of Natural Sciences

Colgate University • September 2013 - June 2017

Science Outreach Coordinator

- Developed and conducted [demonstrations](#) to explore physical phenomena ranging from rocket launches to volcanic eruptions at different levels of complexity tailored for students from Pre-K to Grade 11.

Awards and Honors

Phi Beta Kappa National Honor Society (May 2017)

Physics and Astronomy Alumni Award (May 2017): Awarded to students majoring in physics and astronomy who have made the most significant progress in the study of their major subject and the relations of this science to other fields of learning.

Benton Scholar Award (May 2017): Awarded to recognize graduating Benton Scholars who have demonstrated outstanding contributions in the areas of global awareness, leadership, and academic achievement. Scholars are invited to join upon admission to Colgate University and are high-achieving, motivated students committed to global leadership.

Dean's Award for Academic Excellence [Distinction] (August 2013 - May 2017): This award is presented each term to students who achieve a term grade point average of 3.30 [3.60] or higher while successfully completing at least 3.75 course hours.

Lila and Curtiss '25 Frank Scholarship (2016-2017): This award recognizes academic achievement, excellent character, and promise of salutary leadership in constructive phases of American life.

Smith Family Scholarship (2016-2017)

Sigma Pi Sigma National Physics Honor Society (October 2016)

George W. Cobb Award (April 2016): Recognition of outstanding leadership and effective influence among fellow students on campus, as well as among prospective students in developing interest in Colgate.

Justus '43 and Jayne Schlichting Student Research Fund (June 2015, June 2016): Funding to conduct student-initiated research over the summer.

Charles A. Dana Scholar (April 2015): Selected in recognition of superior academic achievement as well as demonstrated leadership in the college community.

Elizabeth and Michael Klein '80 Endowed Scholarship Fund (2014-2016)

Phi Eta Sigma National Academic Honor Society (November 2014)

Dodge Prize (April 2014): Awarded to the two students who achieve the highest academic record during their first year.

Work Experience

Big Switch Networks

Santa Clara, CA • October 2017 - August 2019

Research Assistant, Office of the Founder

- Collaborated with Product Management, R&D, and Systems Engineering teams to design, build, and test Big Switch's [networking](#) and monitoring products for public clouds (AWS, and Azure), and to position the company pre-IPO.

Development Alternatives

New Delhi, India • June 2014 - July 2014

Intern

- Assessed marketing models and distribution channels for Aqua+, a chlorine-based solution for water purification, for feasibility of use in the slums of Delhi. Created numerical simulations of profitability, refining the existing models.
- Tested the capacity and efficiency of flexipump, a low-cost hand pump, and developed a training toolkit and protocol for further testing at partner farms across India.

CanSupport

New Delhi, India • March 2012 - May 2013

Volunteer

- Conducted outreach to corporate donors, schools, and colleges in New Delhi to raise funds for and secure participation in the annual Walk for Life.

Leadership Experience

Office of Admission

Colgate University • February 2014 - present

Volunteer

- Met and corresponded with school counselors and prospective students. Expanded Colgate outreach by connecting with the United States-India Educational Foundation (USIEF) and the US Embassy in New Delhi.

Office of International Student Services

Colgate University • March 2014 - May 2017

Core Group Leader

- Designed improved methods for integrating incoming international students to campus, served as mentor, and assisted staff in organizing orientation for the classes of 2018-2020.

Leadership and Faculty Recruitment

Colgate University • March 2014 - June 2016

Student Representative

- Selected by senior staff to serve as a member of hiring committees for faculty and cabinet-level staff positions.

Skills & Interests

Computing: Matlab, LaTeX, edX (advanced); Python, Netfabb, MakerBot (intermediate); Java, C, R (elementary)

Interests: Education, science outreach, crossword puzzles, baking, hiking, dogs, paddleboarding

Languages: English, Hindi (fluent); French (working proficiency); Spanish, Bengali (beginner)

Off-Campus Study:

- Seoul, South Korea (Summer 2014) - FSEM 119: Korea; RELG 101: The World's Religions
- San Francisco, CA (Spring 2015) - FSEM 144: Emerging Global Challenges
- Southwest United States (Spring 2016) - CORE 138S: Advent of the Atomic Bomb
- Dallas, TX; Houston, TX (Spring 2017) - CORE 147S: Global Challenges (Science, Tech, Culture)