Sai Kanth Dacha

Postdoctoral Research Scientist, Columbia University

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Education

Doctor of Philosophy (Ph.D.), Physics
University of Maryland, College Park *(2016 - 2022)*

- Dissertation advisor: Prof. Thomas E. Murphy

Bachelor of Technology (B.Tech.), Engineering Physics[#]
Indian Institute of Technology (IIT) Madras *(2012 - 2016)*

- Senior thesis advisor: Prof. Deepa Venkitesh

[#] *Minor stream: Nanoscience and Nanotechnology*

Professional Experience

- Postdoctoral Research Scientist at Columbia University (Prof. Alexander Gaeta) *(Sep'22-present)*
- Graduate research intern at Nokia Bell Labs (Dr. René-Jean Essiambre) *(May'21-Dec'21)*
- Summer Undergraduate Research Fellow at California Institute of Technology (LIGO Laboratory) *(May'15-Aug'15)*

Research Interests

Nonlinear integrated photonics, multimode nonlinear fiber optics, deep-space optical communication systems, optical frequency combs, thermal phenomena in high-Q microresonators, nonlinear dynamical systems, microwave photonics, orbital angular momentum (OAM) of light

Awards

- Dean's Fellowship at the University of Maryland (2016-2018)
- Summer Undergraduate Research Fellowship at the California Institute of Technology (2015)
- Merit Scholarship at IIT Madras (2012-2016)

Skills

- **Experimental**: Photonic integrated circuit (PIC) design & characterization, free-space and fiber optical experiments, high-speed detection systems, instrument control and automated data acquisition, focused-ion beam (FIB), scanning electron microscopy (SEM), single-photon detection systems
- **Numerical**: Data analysis and visualization, computational methods for nonlinear differential equations, numerical modeling and simulation of optical systems
- **Software**: MATLAB, Python, COMSOL, GDSPy, Lumerical, Adobe Illustrator & Photoshop

Publications and Presentations

Journal Articles

- **Sai Kanth Dacha**, Yun Zhao, Karl J. McNulty, Gaurang R. Bhatt, Michal Lipson, and Alexander L. Gaeta, "Ultrastable nanophotonic microcavities via integrated thermometry", Under review (2025)
- **Sai Kanth Dacha**, René-Jean Essiambre, Alexei Ashikhmin, Andrea Blanco-Redondo, Frank Kschischang, Konrad Banaszek, Yuanhang Zhang, "Communicating at a record 14.5 bits per received photon through a photon-starved channel", Under review (2025)
- Henry F. Elder, **Sai Kanth Dacha**, Thomas E. Murphy, Phillip Sprangle, "Theory of four wave mixing-based parametric amplification of spin-orbit modes", Opt. Express 32 (4), 6494-6506 (2024)
- René-Jean Essiambre, Cheng Guo, **Sai Kanth Dacha**, Alexei Ashikhmin, Andrea Blanco-Redondo, Frank R Kschischang, Konrad Banaszek, *et al.*, "Record photon information efficiency with optical clock transmission and recovery of 12.5 bits/photon over an optical channel with 77 dB loss", arXiv:2310.02191 (2023)

- **Sai Kanth Dacha**, Wenqi Zhu, Amit Agrawal, Kenneth J. Ritter, and Thomas E. Murphy, "Nonlinear rotation of spin-orbit coupled states in hollow ring-core fibers," Opt. Express 30, 18481-18495 (2022)
- **Sai Kanth Dacha** and Thomas E. Murphy, "Spatiotemporal characterization of nonlinear intermodal interference of selectively excited modes of a few-mode fiber", *Optica* 7, 1796-1803 (2020)
- **Sai Kanth Dacha**, Gabriele Vajente, Rana Adhikari, *"Ultra-precise Sensing and Control of Suspended Optics Breadboard in the Crackle Experiment"*, Caltech Undergraduate Research Journal (CURJ), 2016

Conference Presentations & Proceedings

- [**Invited**] S.K. Dacha, R.J. Essiambre, A. Ashikhmin, A. Blanco-Redondo, F.R. Kschischang, K. Banaszek, Y. Zhang, "Whispering at the shot noise limit: communication using single photons through photon-starved channels", Proc. SPIE Photonics West 13374, 1337402 (March 2025)
- S.K. Dacha, Y. Zhao, K.J. McNulty, M. Lipson, and A.L. Gaeta, "Fully-thermally-stabilized Kerr soliton comb via integrated thermometry", in CLEO 2025, Technical Digest Series (Optica Publishing Group)
- S.K. Dacha, Y. Zhao, K.J. McNulty, M. Lipson, and A.L. Gaeta, "Thermometric Control of the Resonance Frequency of a High-Q Si3N4 Microresonator", in CLEO 2024, Technical Digest Series (Optica Publishing Group), paper STu4Q.3
- S.K. Dacha, Y. Zhao, X. Ji, G.J. Beals, S. Sanyal, M. Lipson, and A.L. Gaeta, "Self-Heating Based Locking of a Laser to a High-QSi3N4 Microcavity", in CLEO 2023, Technical Digest Series (Optica Publishing Group), paper SW4L.4
- S.K. Dacha, H.F. Elder, W. Zhu, A. Agrawal, P.A. Sprangle, and T.E. Murphy, "Observation of conjugate OAM mode generation via modulational instability in a hollow ring-core fiber", in Optica Nonlinear Optics Topical Meeting 2023, Technical Digest Series (Optica Publishing Group), paper Th3A.6
- C. Guo, S.K. Dacha, R.J. Essiambre *et al.*, "Record Photon Information Efficiency with Optical Clock Transmission and Recovery of 12.5 bits/photon After 77 dB of Optical Path Loss," 2023 IEEE Photonics Conference (IPC)
- G.J. Beals, Y. Zhao, K.J. McNulty, S. Sanyal, S.K. Dacha, M. Lipson, and A.L. Gaeta, "Generation of Low-Frequency Kerr Combs in Highly Compact Photonic Structures", in CLEO 2023, Technical Digest Series (Optica Publishing Group), paper STh4F.2
- S.K. Dacha, W. Zhu, A. Agrawal, and T.E. Murphy, "Ker-induced Rotation of Mixed Orbital Angular Momentum States in Hollow Ring-Core Fibers", in Optical Fiber Communication Conference (OFC), paper W2A.13
- S.K. Dacha and T.E. Murphy, "(2+1)D Spatiotemporal Characterization of Nonlinear Interactions between Selectively Excited Spatial Modes of a Few-Mode Fiber", Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America), paper FTh3A.6
- S.K. Dacha and T.E. Murphy, "Time-Domain Interference of Nonlinearly Interacting Spatial Modes in a Multimode Fiber", Conference on Lasers and Electro-Optics, OSA Technical Digest (online) (Optical Society of America, 2018), paper STh3K.4
- SK Dacha, AN Iyer, A Sobhanan, D Venkitesh, *"Regeneration of 10 Gbps BPSK Signals Through Phase Sensitive Amplification coupled with Injection Locking"*, 2017 Twenty-third National Conference of Communications (NCC), IEEE Xplore

International Summer Schools

- Subsea Optical Fiber Communications 2020 "Mini-Dive", organized by OSA and Google *(August 2020)*
- Inaugural Subsea Optical Fiber Communications 2019 International Summer School, organized by OSA and Google in Polvijärvi, Finland *(August 2019)*

Science & Technology Policy

- Congressional science advocacy for optics and photonics R&D via the National Photonics Initiative's Congressional Visits Day *(February 2023 and July 2021)*
- Emory Global Health Case Competition - *(UMD's first participant team; link to our case presentation)*

Teaching and Mentorship

- Currently mentoring Ph.D. students at Prof. Alex Gaeta's group at Columbia University
- Guest instructor at Columbia University's Science Honors Program (2023-present)

- Instructor at Columbia University's Girls' Science Day (2024-present)
- Student Mentor at the Graduate Student Mentorship Program at UMD's Department of Physics
- Teaching Assistant for PHYS270: General Physics III (Fall 2016). Taught and conducted tutorial sessions on a wide range of topics – from mechanics and vector algebra to electromagnetism and relativity
- Student Mentor for freshmen at IIT Madras: Mentored freshmen in academics, research and social activities
- Mentored a team of 15 students working on student-led robotics projects at the Centre for Innovation (CFI)

Service

- Member of the Plan of Organization Committee at UMD's Institute for Research in Electronics and Applied Physics (IREAP) *(Jan'22-Aug'22)*
- Founding member of the racial equity and justice committee at UMD's IREAP *(2020-2022)*
- **Student Executive Head** of the Centre for Innovation (CFI[1]): *(2015-2016)*
  - Chaired a team of 100+ students to run all aspects of the student-led innovation center that gave birth to prominent Indian startups such as Ather, HyperVerge Inc., Planys Technologies and Terero Mobility Inc.
  - Oversaw operation of 13 student clubs involving 1500+ IIT Madras students, 50+ student-driven projects and internal workshops annually, at a budget of $**85,000**
- **Founded the Physics Club** at Centre for Innovation, IIT Madras, which now attracts 500+ students annually
- Led a team of 12 to create educational science magazines for underprivileged kids via the National Service Scheme in India *(2013-2014)*

Other

- **Published and featured writer** in popular Medium journals such as 'The Faculty' and 'Being Well' *(Link to blog)*
- Chess: Self-taught player rated 2150 on chess.com
- Avid photographer: Nature, culinary, wildlife, bird and insect photography *(Link to portfolio)*

[1] *Centre for Innovation (CFI) is the student-run innovation laboratory of IIT Madras*