

Sai Kanth Dacha

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Education

Doctor of Philosophy (Ph.D.), Physics

University of Maryland, College Park

(2016 - present)

Bachelor of Technology (B.Tech.), Engineering Physics[#] (GPA: 8.52/10)

Indian Institute of Technology (IIT) Madras

(2012 - 2016)

[#] Minor stream: Nanoscience and Nanotechnology

Publications, Conference Presentations and Summer Schools

Journal Articles.....

- **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.....

- **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, 2020), 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)

Skills & Expertise

- **Topics of Expertise:** Nonlinear optics, multimode fibers, orbital angular momentum of light, spatial multiplexing
- **Experimental:** Design and implementation of optical experiments, operation of high-speed detection systems, instrument control and automated data acquisition, free-space and fiber optics, focused-ion beam, scanning electron microscopy
- **Numerical:** Data analysis and visualization, numerically solving coupled nonlinear differential equations, modeling and simulation of optical systems and processes using MATLAB and Python
- **Software:** MATLAB, Mathematica, Lumerical MODE Solutions, Adobe Illustrator, Adobe Photoshop

Awards & Fellowships

- Recipient of the Dean's Fellowship at University of Maryland
- Awarded the prestigious Summer Undergraduate Research Fellowship at the California Institute of Technology
- Merit-cum-Means Scholarship awardee at IIT Madras (2012-2016)

Research Experience

1. Nonlinear Optics in Multimode Optical Fibers (Jan'17-present)

Graduate Research | Advisor: Prof. Thomas E. Murphy, University of Maryland

- Pioneered a novel spatiotemporal measurement technique that brings together near-field scanning optical microscopy and high-speed detection
- Demonstrated the first-reported complete spatiotemporal measurements of multimode nonlinearity
- Developed a new FIB milling-based method for selective mode excitation using direct-written phase masks
- Numerically modeled nonlinear mode interactions using the multimode nonlinear Schrödinger equations on MATLAB
- Currently investigating nonlinear interactions between orbital angular momentum (OAM) modes

2. Phase Sensitive Amplification in Semiconductor Optical Amplifiers (Sep'15-May'16)

Senior Thesis | Advisor: Dr. Deepa Venkitesh, IIT Madras

- Developed a phase sensitive amplification (PSA) scheme based on a semiconductor optical amplifier
- Numerically demonstrated, using MATLAB, PSA-based quadrature phase squeezing for 10 Gbps BPSK modulated signals
- Designed a compact PSA module that, when coupled with an injection locking stage, is capable of achieving active squeezing of optical amplitude and phase noise in long haul optical communication systems

3. Sensing and Control of Suspended Optics Breadboard in the Crackle Experiment (May-Aug'15)

Summer Undergraduate Research Fellowship (SURF), LIGO Laboratory, Caltech

- Worked on the Crackling Noise detection experiment, aimed at detecting crackling noise arising in Maraging Steel blade springs used in the **Advanced LIGO**¹ suspension systems
- Spearheaded the design, development and implementation a feedback damping control system for the suspended optics breadboard
- Enhanced the sensitivity of the crackling noise measurement setup by a factor of 10

4. Pentacene-based Organic Field Effect Transistors (May-Aug'14)

Summer Research Internship, Defence Research and Development Organization, Govt. of India

- Designed, simulated and studied Pentacene-based organic field effect transistors for underwater applications
- Demonstrated transfer and drain characteristics of the designed transistor, paving way for further development

5. Design and Development of Semi-Autonomous Transwheel Omnidirectional Robot (Apr'13-Mar'14)

Student-led Project at Centre for Innovation (CFI²), for IIT Madras' ABU Robocon³ team

- Designed and developed robotic system with sensors, actuators and omnidirectional wheels, capable of performing complex tasks while moving in any direction without changing its orientation
- Designed and implemented integrated electronics circuitry for integration of microcontrollers, rotary encoders, actuators, motor controllers and power electronics
- Devised algorithms for and achieved autonomous omnidirectional motion

Technical Competitions

1. ABU Robocon 2014 - (Participant)

- Represented IIT Madras as part of a team of 20. Designed, built and operated a semi-autonomous robot capable of performing complex tasks defined in the competition's problem statement

2. Texas Instruments India Design Challenge (IDC) 2015 - (Semi-finalist)

- As part of a team of 5, developed a portable, low cost 12-lead ECG machine using solely TI components

3. LG Industry Defined Problem (IDP) Event 2013, at IIT Madras - (Finalist)

- Studied the feasibility of and proposed a novel solution for reducing water usage in washing machines manufactured by LG

¹ [LIGO](#): Laser Interferometer Gravitational-Wave Observatory

² [Centre for Innovation \(CFI\)](#) is the student-run innovation laboratory of IIT Madras

³ ABU Robocon is a prestigious Robotics competition for undergraduate students in the Asia-Pacific Region

Teaching and Mentorship

- **Student Mentor** as part of 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 a set of 8 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)

Leadership & Social

- Founding member of the **racial equity and justice committee** at UMD's Institute for Research in Electronics and Applied Physics (2020-present)
- **Student Executive Head** of the Centre for Innovation (CFI²): (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**
- **Head of Workshops** department at **Shaastra**⁴, IIT Madras (2014-2015):
 - Orchestrated a team of 60+ students to conduct 26 workshops on topics ranging from biotechnology to aerial robotics, to a footfall of over 2500 undergraduate students from across India
 - Generated a revenue exceeding **\$55,000**
- Served as a member of the **Core Managerial Team** at the Centre for Innovation (2014-2015)
- **Founded the Physics Club** at Centre for Innovation, IIT Madras, which now attracts 500+ students annually
- Avid photographer⁵: Primarily interested in nature, culinary, wildlife, bird and insect photography
- **Published writer on Medium**⁶: Featured in popular Medium journals such as 'The Faculty' and 'Being Well'

⁴ [Shaastra](#) is the annual student-run technical festival of IIT Madras

⁵ [Link to portfolio](#)

⁵ [Link to blog](#)