

Dr. HASANA JAHAN E.K

Email: sinuhasana@gmail.com

Ph: +918606761600



Google Scholar:

<https://scholar.google.com/citations?user=ue-DdFcAAAAI>

Education

- **Ph.D. in Physics, National Institute of Technology Calicut, India (2021–2026)**
 - UGC-JRF Fellow
 - Coursework score: 90%
 - **Thesis Title:** Enhanced Light-Matter Interaction in Graphene and VS₂-Based Low-Dimensional Materials via Photonic Cavities and Structural Design
- **M.Sc. in Physics, Central University of Kerala, India (2017–2019)**
 - Percentage: 89%
 - **University Rank: 3**
- **B.Sc. in Physics, Calicut University, India (2014–2017)**
 - Percentage: 90.5%
- **+2 Science, Directorate of Higher Secondary Education, Kerala, India (2012–2014)**
 - Percentage: 97%
- **SSLC, Board of Public Examinations, Kerala, Kerala, India (2012)**
 - Grade: Full A+

Research Experience

- Conducted experimental research on **nonlinear nanophotonics** using low-dimensional materials, including graphene quantum dots, VS₂ nanosheets, VS₂ quantum dots, MXene quantum dots, and hybrid nanostructures.
- Engineered **light-matter interactions** through the design and fabrication of **distributed Bragg reflector (DBR) microcavities** and **Tamm plasmon cavities**.
- Demonstrated **47-fold enhancement in photoluminescence** and **43-fold enhancement in nonlinear optical response** using photonic cavity engineering.
- Investigated nonlinear optical phenomena, including **reverse saturable absorption, excited-state absorption, and optical limiting**, using the **Z-scan technique**.
- Synthesized and characterized advanced nanomaterials using hydrothermal synthesis, pulsed laser ablation in liquid, pulsed laser irradiation in liquid, liquid-phase exfoliation, and thin-film fabrication techniques.
- Performed optical characterization using photoluminescence, UV-Visible spectroscopy, Raman spectroscopy, FTIR, and time-resolved optical measurements.
- Applied **COMSOL Multiphysics** and **MATLAB** for optical simulations and analysis of photonic structures.

Teaching Experience

- Working as **Assistant Professor, Dept. of Physics, University of Calicut** (Daily Wage)
- Teaching Assistant, **Department of Physics, NIT Calicut (2021–2025)**
 - Assisted in undergraduate Physics laboratory courses and tutorials.
 - Mentored undergraduate students in experimental techniques and data analysis.
 - **Supervised 3 undergraduate (B.Tech) and 2 master's student research projects.**

Publications

1. **Hasana Jahan Elamkulavan**, Nikhil Puthiyapurayil, Sanjay Subramaniam, Chandrasekharan Keloth, "Impact of Tamm plasmon structures on fluorescence and optical nonlinearity of graphene quantum dots", *Nature Scientific Reports*, Vol. 14, 2024. <https://doi.org/10.1038/s41598-024-62694-9>.
2. **Hasana Jahan Elamkulavan***, Anju Joseph*, Chandrasekharan Keloth, P. M Aneesh, "Hydrothermally Grown VS_2 Nanosheets: A Material for Optical Limiting Applications", *ACS Applied Optical Materials*, Vol.1, 2023, <https://doi.org/10.1021/acsaom.3c00248>. *Equal authorship
3. **Hasana Jahan Elamkulavan**, Chandrasekharan Keloth, "Tamm plasmon-induced impressive optical nonlinearity of silver@graphite core-shell nanostructures", *De Gruyter ZPC*, 2024, <https://doi.org/10.1515/zpch-2024-0807>.
4. **Hasana Jahan Elamkulavan**, Nikhil Puthiyapurayil, Sanjay Subramaniam, Jatinderbir Singh, Pacheri Madathil Aneesh, Chandrasekharan Keloth, "Plasmon Induced Enhanced Nonlinear Absorption in Vanadium Disulfide-Silver Nanocomposite", International Conference on Fundamental and Industrial Research in Materials, Springer Proceedings in Physics, *Springer Nature Singapore*, 2023, https://doi.org/10.1007/978-981-97-4557-9_17.
5. **Hasana Jahan Elamkulavan**, Vijisha Mullasseril Vinu, Anakha Purayil, and Chandrasekharan Keloth, "Synthesis and Characterization of Laser Ablated Vanadium Disulfide Quantum Dots for Optical Limiting Applications," in *Laser Congress 2024 (ASSL, LAC, LS&C)*, Technical Digest Series (Optica Publishing Group, 2024), <https://doi.org/10.1364/ASSL.2024.JTu2A.32>.
6. **Hasana Jahan Elamkulavan**, Amrutha Shivappanayaka, Dhanusmith, Chandrasekharan Keloth, "Vanadium Disulfide Quantum Sheets as a New Subwavelength Platform for Nonlinear Nanophotonics," – (Optica Publishing Group, 2025), <https://doi.org/10.1364/FIO.2025.JW4A.8>.
7. **Hasana Jahan Elamkulavan**, Athulya Kadeprath Satheesan, Chandrasekharan Keloth "Enhanced Third-order Nonlinear Optical Response of Gold@Carbon (Au@C) Core-shell due to Tamm-Plasmon Cavity", Proceedings of SPIE, *SPIE Digital Library*, Vol. 5, 2023, <https://doi.org/10.1117/12.2665348>.
8. **Hasana Jahan Elamkulavan**, Athulya Kadeprath Satheesan, Nikhil Puthiyapurayil, Jatinderbir Singh, Sanjay Subramaniam, Chandrasekharan Keloth, "Cavity-assisted fluorescence enhancement of graphene quantum dot nanostructures", *2023 IEEE Workshop on Recent Advances in Photonics (WRAP)*, IEEE Xplore, 2023, <https://doi.org/10.1109/WRAP59682.2023.10712850>.
9. **Hasana Jahan Elamkulavan**, Nikhil Puthiyapurayil, Chandrasekharan Keloth, "Enhanced Nonlinear Absorption and Effective Optical Limiting Action of Cobalt Phthalocyanine-Graphene Oxide Nanocomposite", International conference on functional materials for advanced technologies-1, *Book Rivers*, Vol.2, 2023 (ISBN: 978-93-5515-752-2).
10. Amrutha Shivappanayaka, **Hasana Jahan Elamkulavan**, Vari Sivaji Reddy, and Chandrasekharan Keloth, "Green Synthesis of V_2C MXene Quantum Dots with Tunable Nonlinear Absorption for Optical Limiting Applications", *RSC Nanoscale Advances*, 2025, <https://doi.org/10.1039/D5NA00777A>.
11. Amala Shaliya Joseph, **Hasana Jahan Elamkulavan**, P.K. Archana, Priya Malik, Chandrasekharan Keloth, Suni Vasudevan, Unnikrishnan G. Panicker, "Solvothermal synthesis of ruthenium-doped cobalt ferrite nanoparticles – A feasible approach to modify the magnetic properties and nonlinear optical absorption", *Materials Science in Semiconductor Processing*, Vol. 188, 2025, <https://doi.org/10.1016/j.mssp.2024.109246>.
12. Sreeja Lakshmi, **Hasana Jahan Elamkulavan**, Chandrasekharan Keloth, Jayaram Peediyekkal, Sabna Melethil, Sudheesh, "Third-order nonlinear optical characteristics of natural dye anthocyanin extracted from *Ixora coccinea*" *Zeitschrift für Physikalische Chemie*, 2025. <https://doi.org/10.1515/zpch-2024-0791>.
13. Adarsh Raj K P, **Hasana Jahan Elamkulavan**, Anoop C Sathyadevan Nair, Abhinand Ramachandran, Abhijith Thazhathenair, Chandrasekharan Keloth, Vari Sivaji Reddy, "Plasmon-Enhanced Nonlinear Optical

- Response in Au-SnS₂ Nanohybrids for Optical Limiting”, *RSC Adv.* 2026; 16 (42): 51338–51347.**
<https://doi.org/10.1039/d6ra05188j>.
14. Siji Alappattu John, Pramod Dominic, Shija K, **Hasana Jahan Elamkulavan**, and Chandrasekharan Keloth, **“Engineering Nonlinear Optical Absorption through Slow-Photon Effects in Calix[4]resorcinarene-Based Nonlinear Distributed Bragg Reflectors”, *Phys. Chem. Chem. Phys.* 2026;**
<https://doi.org/10.1039/d6cp02052f>.
 15. Athulya Kadeprath Satheesan, **Hasana Jahan Elamkulavan**, Nikhil Puthiyapurayil, Jathinderbir Singh, Sanjay Subramaniam, Chandrasekharan Keloth, **“Enhanced Nonlinear Optical Properties of ZnS with Carbon Encapsulated Core-shell Nanostructures”, *2023 IEEE Workshop on Recent Advances in Photonics (WRAP), IEEE Xplore*, 2023,**
<https://doi.org/10.1109/WRAP59682.2023.10712979>.
 16. Athulya Kadeprath satheesan, **Hasana Jahan Elamkulavan**, Nikhil Puthiyapurayil, Jathinderbir Singh, Sanjay Subramaniam, Chandrasekharan Keloth, **“Nonlinear light-matter interactions in platinum nanoparticles embedded all-polymer microcavity”, *2023 IEEE Workshop on Recent Advances in Photonics (WRAP), IEEE Xplore*, 2023,**
<https://doi.org/10.1109/WRAP59682.2023.10713020>.
 17. Sreejalakshmi.S, Sudheesh P, **Hasana Jahan Elamkulavan**, Chandrasekharan Keloth and Jayaram Peediyekkal, **“Third-order optical nonlinearity of natural dye extracted from red Sandalwood”, OPTIX International conference, *EduPub New Delhi*, 2026 (ISBN: 978-93-92585-01-2),**
<https://doi.org/10.26643/edupub/978-93-92585-01-2>.
 18. Amrutha S, Tweja K V, **Hasana Jahan Elamkulavan**, Suchand Sangeeth C. S., Vari Sivaji Reddy, Chandrasekharan Keloth, **“Nonlinear Optical Investigation of WS₂ Quantum Dots Synthesized via Laser Ablation in Liquid”, OPTIX International conference, *EduPub New Delhi*, 2026 (ISBN: 978-93-92585-01-2),**
<https://doi.org/10.26643/edupub/978-93-92585-01-2>.

Awards and Achievements

- Awarded the **“Boris P. Stoicheff Memorial Scholarship, 2025”**, first Indian and first Asian Woman
- Selected for **“OPTICA Student Leadership Program”, 2025, Denver, USA (Fully funded)**
- **“OPTICA Emerging Economy Paper Prize”, in Optica Laser Congress and Exhibition, Japan, 2024**
- **“Best Poster Presentation Award’ in PHOTONICS-2023, IISC Bangalore, 2023**
- **‘The Best Oral Presentation Award’ in the International Conference ICFMAT, CUK, 2023**
- Selected for **“Focus Areas of Science & Technology Summer Fellowship” IAS-2019**
- **“OPTICA Family Care Grant”, for Optica Laser Congress and Exhibition, Japan, 2024**
- Qualified **National Eligibility Test (NET) with Junior Research Fellowship (JRF) 2019**
- Qualified **Graduate Aptitude Test in Engineering in Physics (GATE)- 2019**
- **University 3rd Rank Holder in M.Sc. 2019**
- Availed **Higher Education Scholarship and Central Sector Scholarship**
- **‘The Best Student Award’ of MES Mampad College, 2017**
- Qualified **Upper Secondary Scholarship (USS), 2009**

Paper Presentations at Conferences

1. **“Enhanced nonlinearity and effective optical limiting action of copper@graphite (Cu@C) core-shell nanostructures prepared by laser ablation” in Conference on Optics, Photonics and Quantum optics 2022 (COPaQ 2022) organized by the Indian Institute of Technology (IIT), Roorkee at International level.**
2. **“Enhanced nonlinear absorption and effective optical limiting action of Cobalt Phthalocyanine-Graphene Oxide Nanocomposite” in International Conference on Functional Materials for Advanced Technology, 2023 (ICFMAT) organized by Central University of Kerala, Kasaragod.**

3. ***“Cavity-assisted fluorescence enhancement of graphene quantum dot nanostructures”*** in Sixth IEEE International workshop on recent advances in photonics 07-09, December 2023, **IIIT Allahabad**.
4. ***“Plasmon-Induced Enhanced Nonlinear Absorption in Vanadium Disulfide- Silver Nanocomposite”*** in The International Conference on Fundamental and Industrial Research on Materials held in **IIT Ropar** from December 11th to 14th.
5. ***“Synthesis and Characterization of Laser Ablated Vanadium Disulfide Quantum Dots for Optical Limiting Applications”***, **OPTICA** Laser Congress 2024, held in **Osaka, Japan**, October 20 to 24.
6. ***“Vanadium Disulfide Quantum Sheets as a New Subwavelength Platform for Nonlinear Nanophotonics”***, in **OPTICA FIO-LS 2025** held at **Denver, USA** from October 26th to 30th.
7. ***“Enhanced Nonlinear Optical Properties of Copper@Graphite Nanoparticles Synthesized via Laser Ablation in Benzene-Derived Solvents”*** in 4th International Conference on Optoelectronic and Nanomaterials for Advanced Technology (**icONMAT 2025**) from February 11-14, 2025 at **CUSAT, Kochi**.
8. ***“Tamm plasmon-induced impressive optical nonlinearity of silver@graphite core-shell nanostructures”*** in International Conference on Advances in Functional Materials & Coatings (**ICAFMC-2024**), February 14-16 2024, **MES Ponnani College**.

Leadership and Professional Activities

- Served as the **Founding President of NIT Calicut OPTICA Student Chapter**, NIT Calicut (2024-2026)
- Organised an international conference **“OPTIX 2026- International Conference on Optics, Lasers and Photonics”** at NIT Calicut as part of the NIT Calicut Optica Student Chapter.
- Organised an outreach program for school children-Hands-on Training on **“The Optics Behind Sky-watching”** as part of the NIT Calicut Optica Student Chapter.
- Conducted a workshop on **“One-Day Workshop & Hands-on Training on Optics and Photonics Simulation Using COMSOL Multiphysics”** as a part of the NIT Calicut Optica Student Chapter
- Served as the **Secretary of the National Service Scheme** and **Trauma Care Volunteer** of MES Mampad College, 2015-2017.
- Student coordinator of many programs in the College (**Civil Service Academy, Innovation Club, Science Club, Entrepreneurship Development Cell, Walk with Scholar, Women Development Cell, Students Initiative in Palliative, and Red Ribbon Club**) of MES Mampad College, 2015-2017.
- **Invited Talk** on “Exploring optics and photonics with OPTICA”, Farook College (Autonomous), 2025
- **Invited Talk** on “From curiosity to discovery: A journey through optics and photonics”, MES Mampad College (Autonomous), 2025
- **Invited Talk** on “Science in nature”, Markazul Uloom English Senior Secondary School, 2025

Membership in Professional Bodies

- **OPTICA-** Advancing Optics and Photonics Worldwide (formerly OSA)
- **SPIE-** The International Society for Optics and Photonics
- **IEEE-** Photonics Society

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