

Dr. RAMACHANDRAN KASU, Ph.D.

Assistant Professor | Early Career Physicist (IOP, UK) |

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I. RESEARCH INTERESTS

Optical systems researcher with nine years of experience designing and building advanced imaging, sensing, and spectroscopy platforms rooted in atomic, molecular, and optical physics. Strong background in fibre-optic interferometry, Raman and fluorescence spectroscopy, and photon-efficient detection for low-light and photon-limited measurements. Experienced in end-to-end system development, from physical modelling and optical design through experimental implementation, validation, and data analysis. Proven contributor to federally and internationally funded research programs, with a record of peer-reviewed publications and patented technologies. Motivated to advance practical optical instrumentation for biological imaging, precision sensing, atmospheric measurement, and space science through collaborative, experiment-driven research.

II. EDUCATION

Ph.D. in Physics (Fiber Optics)-Indian Institute of Information Technology, Design and Manufacturing (IIITDM), Kancheepuram, Chennai, India | 2010-2015

Dissertation: "Spectral Tailoring through Concatenated All-Fibre Interferometers for Communication and Sensing Applications"

Advisor: Prof. Dr. Naveen Kumar - External Examiner: Prof. Dr. Gordon Flockhart, University of Strathclyde, Glasgow, UK - Defence Examiner: Prof. Dr. Shenoy, IIT Delhi, India

M.Tech. in Laser and Electro-Optical Engineering- Anna University, Chennai, India | 2008-2010 Dissertation: "Synthesis and Optical Characterisation of Au–Ag core-shell Nanoparticles"

Advisor: Prof. Dr. P.K. Palani Samy

M.Sc. in Physics (Electronics)- Bharathiar University, Coimbatore, India | 2004-2006

B.Sc. in Physics (Electronics) -University of Calicut, Kerala, India | 2001-2004

III. RESEARCH/TEACHING/ PROFESSIONAL EXPERIENCE

ASSISTANT PROFESSOR – Erba Global Institute of Medical Technology (EGIMT), India | 06/2026–Present

- Contributing to academic and research activities in the Department of Medical Technology, with focus areas including biomedical imaging, optics, photonics, sensing, and healthcare technologies.
- Developing curricula and course syllabi for Medical Technology programs while conducting internship training and student mentoring activities.
- Developing and refining Optical Coherence Tomography (OCT)-based concepts, proof-of-concept systems, and intellectual property (IP)/patent-related activities.
- Supervising student and intern projects involving machine learning, biomedical image analysis, and optical instrumentation for real-time biomedical imaging applications.

- Engaged in interdisciplinary research and publication activities, including biomedical imaging, 3D bioprinting, wearable optical sensing systems, and medical device innovation.

POSTDOCTORAL FELLOW-Department of Physics, University of Idaho, USA | 02/2022-06/2025

- Developed the experimental setup for Raman/fluorescence imaging based on a single-objective epi and near-TIRF configuration.
- Delivered one or two lectures on Electromagnetism to a 100-level class comprising 80 students as a guest lecturer
- Learned techniques for preparing biological samples, including roots, cells, and particles, for microscopy.
- Developed the experimental setup for Airy light sheet fluorescence imaging and worked on dark-field, fluorescence, and photon-sparse Poisson microscopy and photon-sparse imaging.
- Exploring non-diffracting beams for ultrafast light-sheet microscopy using femtosecond lasers, with supervision of undergraduate and graduate students.
- Explored two-photon microscopy configurations as part of advanced imaging system development
- Presented research at conferences; published an article in *PNAS* and had another in *ACS Photonics*; filed one US patent; and have two additional manuscripts in progress.

POSTDOCTORAL RESEARCH ASSOCIATE- National Center for Physical Acoustics, University of Mississippi, USA | 08/2018-01/2022

- Successfully employed a line scan CMOS camera in the laser multibeam interferometric setup to measure membrane vibrations.
- Employ a polarization camera to detect the interference signal in the existing homodyne system.
- Developed a heterodyne interferometer for vibration measurements.
- Published an article in *Applied Optics* and *Optics Letters*. And one manuscript is in progress.

RESEARCH ASSOCIATE-Advanced Centre for Research in High Energy Materials, University of Hyderabad, India | 08/2017-08/2018

- This research focused on Raman spectroscopy, Absorption spectroscopy, and Terahertz imaging.
- Learned Terahertz generation, detection, imaging, and photoacoustic spectroscopy.
- I studied the interaction and charge transfer between materials using Raman and pulsed photoacoustic spectroscopy, and constructed an off-axis THz digital holography (THz-DH) system
- Advising undergraduate and graduate students, presenting the work at a conference, and publishing an article in *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*

POSTDOCTORAL RESEARCHER: - Division of Mechanical Systems Engineering, Jeonbuk National University, South Korea | 07/2016-03/2017

- This research focused on optical metrology, interferometry-based imaging polarimetry, and dynamic ellipsometry snapshots.
- Developed a polarization-based Michelson interferometer to extract the phase of the transmissive object.
- Developed a MATLAB code to extract the phase using a 2D FFT for the object.
- Worked on the dynamic Spectro-ellipsometry based on a spectral interferometric phase extraction method.
- Designed and constructed a digital holography system, advising undergraduate and graduate students.

- Presented the work at various optics conferences.

ASSISTANT PROFESSOR- MGM College of Engineering and Technology, Kerala, India | 07/2015-07/2017 (9-Month Leave)

- I taught the undergraduate course "**PH100: Engineering Physics**" to engineering students.
- Active institute promotion/outreach.
- Responsible for the student cultural and technical fest.

DOCTORAL RESEARCHER - IITDM Kancheepuram, Chennai, India | 08/2010-05/2015

- Handled a physics laboratory course for engineering graduates and conducted research toward a Ph.D.
- Designed and employed a concatenated fibre optic Mach-Zehnder and Fiber loop mirror system for gain flattening of EDFA and prototyped a microcontroller-based electromechanical rig unit for tapered fiber geometry.
- A tapered fiber-based miniaturized Mach-Zehnder interferometer has been fabricated for Direct Current (DC) measurement.
- Presented the work at conferences and published articles in optics communications, optics, and laser technology, IEEE Sensors, Journal of Optics, Optical fiber technology, optic, etc

IV. FUNDED RESEARCH PARTICIPATION

Throughout my career, I have contributed to research projects with total funding exceeding \$700,000 from competitive sources including the US Department of Energy, Navy Office of Naval Research, India's Defence Research and Development Organisation, and international agencies.

DOE Office of Science: Advanced Microscopy Project (\$300,000+ total) - I played a central role in developing imaging technologies that resulted in patent filing and publications in PNAS and ACS Photonics.

US Navy ONR: Acousto-Optic Detection Systems (\$200,000+ total) - I developed sensing technologies for defense applications with successful technology transfer to contractors.

DRDO India: Materials Characterization Project (\$100,000+ total) - I created terahertz imaging systems for explosive detection, with methods adopted for operational use.

NRF Korea: Precision Measurement Systems (\$50,000+ total) - I contributed to industrial metrology research with commercial applications.

DST India: Fiber Optic Sensors Project (\$50,000+ total) - I contributed to fundamental research in fiber optic sensing during my doctoral studies.

V. TEACHING EXPERIENCE

COURSES TAUGHT: • Engineering Physics (PH100) - Undergraduate level, 250+ students across multiple engineering disciplines • Electromagnetism - Guest lectures to undergraduate students (~80 students) • Undergraduate physics laboratory courses - Supervision and instruction

TEACHING PHILOSOPHY: I believe in connecting theoretical concepts to practical applications and encouraging students to understand the relevance of physics to their engineering disciplines. My approach emphasizes problem-solving skills and critical thinking.

STUDENT FEEDBACK: Consistently achieved 95% satisfaction ratings in student evaluations.

VI. MENTORING AND SUPERVISION

GRADUATE AND UNDERGRADUATE RESEARCH: Supervised student research projects throughout my postdoctoral positions, providing hands-on training in optical systems development and data analysis.

HIGH SCHOOL STUDENTS: Mentored US high school students for the Junior Science and Humanities Symposium (2022-2025), with notable successes including: • Student project "Pathonix" (Ovarian Cancer Detection) - 1st place at NABT Professional Development Conference (2024) • Student project "3D Bioprinting for Cartilage Repair" - student admitted to Stanford Clinical Science Program (2025)

PANEL PARTICIPATION: Served as panel member for "Postdoc experiences and guidance for graduate students" at University of Mississippi.

INVITED TALKS: • "Acousto-Optics-Based Vibration Measurements" - St. Xavier College, Kerala, India (2021) • "Optical Signal Processing" - Holy King's College of Engineering, Kerala, India (2021) • "Light Sheet Microscopy in Idaho" - University of Idaho Research Symposium (2023)

VII. PROFESSIONAL RECOGNITION AND SERVICE

AWARDS AND HONORS: • Early Career Physicist, Institute of Physics, UK (2025) • Outstanding Reviewer Award, Institute of Physics UK (2022) • Trusted Reviewer Status, Institute of Physics, UK • Ph.D. Fellowship (HTRA Scheme), Government of India

PROFESSIONAL MEMBERSHIPS: • Optica (formerly OSA) • SPIE • Institute of Physics (IOP), UK • American Association for the Advancement of Science (AAAS)

PROFESSIONAL DEVELOPMENT: • Responsible Conduct of Research (CITI Program) • Peer Review Excellence Training (Institute of Physics) • Faculty Development Program (ACUE) • Quantum Optics Certification (École Polytechnique)

EDITORIAL SERVICE: Active reviewer for major optics journals, recognized with Outstanding Reviewer Award and Trusted Reviewer Status.

VIII. TECHNICAL EXPERTISE

OPTICAL SYSTEMS: Advanced microscopy, fiber optic networks, interferometric sensors, laser-based instrumentation, light-sheet imaging, Raman spectroscopy, terahertz systems, precision metrology.

SOFTWARE AND SIMULATION: Ansys Lumerical, Tidy3D, Luceda IPKISS, KLayout, Python, MATLAB, LabVIEW, ImageJ.

FABRICATION AND HARDWARE: Precision optics assembly, tapered fiber fabrication, clean room protocols, system integration from concept through deployment.

IX. RESEARCH IMPACT AND TECHNOLOGY TRANSFER

My research has resulted in technologies that have been successfully transitioned to commercial and defense applications. The imaging system I developed is currently under evaluation by biomedical device companies for commercial licensing, addressing applications in drug discovery, cancer research, and cellular biology. The defense technologies I developed have been transferred to contractors for further development and deployment, demonstrating the practical impact of fundamental optical research on real-world security applications.

X. PUBLICATIONS

1. **PATENT:** Ramachandran. Kasu, H. Luo, D. Christodoulides, A. E. Vasdekis, Single objective Airy light-sheet imaging (SOALSI) and method for using, *US Patent Pending No. 63/704,447*, 2024.

PEER-REVIEWED PUBLICATIONS: (12 total, selected representative works below)

2. Ramachandran Kasu, Haokun Luo, Shirley Luckhart, Demetrios Christodoulides and A. E. Vasdekis, "Single-Objective Airy Light-Sheet Imaging"(2025), *ACS Photonics*, 12(5), 2432-2439, DOI:<https://doi.org/10.1021/acsp Photonics.4c02078> IF: 6.5 (Q1)
3. Lochlann Dunn, Haokun Luo, Nava R. Subedi, Ramachandran Kasu, Armando G. McDonald, Demetrios N. Christodoulides, and Andreas E. Vasdekis, "Video-Rate Raman-Based Metabolic Imaging by Airy Light-Sheet Illumination and Photon-Sparse Detection" (2023), *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, 120(9), e2210037120 DOI: [10.1073/pnas.2210037120](https://doi.org/10.1073/pnas.2210037120) , IF: 9.4 (Q1)
4. Vyacheslav Aranchuk, Ramachandran Kasu, Junrui Li, Ina Aranchuk, and Craig Hickey, "Application of line-scan CMOS camera in multi-beam heterodyne differential laser Doppler vibration sensor"(2023), *Optics Letters* 48(10), 2724-2727, DOI: [10.1364/OL.486630](https://doi.org/10.1364/OL.486630), IF:3.6 (Q2)
5. Vyacheslav Aranchuk, Ramachandran Kasu, Junrui Li, Ina Aranchuk, and Craig Hickey, "Multi-beam heterodyne laser Doppler vibrometer based on a line-scan CMOS digital camera" (2022), *Applied Optics* 61 (20), 5876-5883, DOI: [10.1364/AO.461368](https://doi.org/10.1364/AO.461368), IF: 1.7(Q3/Q2)
6. K. Ramachandran, Jitendra N Acharyya, A Kumari, and A. K. Chaudhary, "Study of photo-induced charge transfer mechanism of PEDOT with nitro groups of RDX, HMX, and TNT explosives using Anti-Stokes and Stokes Raman lines ratios "(2021) *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 251,119360, DOI: [10.1016/j.saa.2020.119360](https://doi.org/10.1016/j.saa.2020.119360), IF: 4.3(Q1)
7. K. Ramachandran, Naveen Kumar, , "Comparative spectral tuning and fluctuation analysis of all-fiber Mach-Zehnder interferometer and micro Mach-Zehnder interferometer" (2021), *Journal of Optics* 23(11), 115702, DOI: [10.1088/2040-8986/ac24be](https://doi.org/10.1088/2040-8986/ac24be), IF: 2.0 (Q2)
8. K. Ramachandran, Daesuk Kim, Naveen Kumar, "Miniaturized MMZI concatenated FLM for gain equalization of ASE response of an EDFA"(2017), *Optical Fiber Technology*, 36, 95-198, DOI: [10.1016/j.yofte.2017.03.016](https://doi.org/10.1016/j.yofte.2017.03.016), IF: 2.6(Q2)
9. G. Narendran, K. Ramachandran, Naveen Kumar, "An inline sensing of coolant temperature inside a microchannel for applications in ultra-dense packed high-power electronics"(2016), *Optik*,127(2), 871-875, DOI: [10.1016/j.ijleo.2015.10.183](https://doi.org/10.1016/j.ijleo.2015.10.183), IF: 3.1(Q2)
10. K. Ramachandran, Naveen Kumar, Venkataraman Sahoo, "A Highly Accurate All-Fiber MMZI Current Sensor", 2015, *IEEE Sensors Journal*, 15, 1270-1274, DOI: [10.1109/JSEN.2014.2361837](https://doi.org/10.1109/JSEN.2014.2361837), IF: 4.3(Q1/Q2)
11. Naveen Kumar, K. Ramachandran, "Dynamic Spectral Maneuvering by Fiber Sagnac Loop Filter", (2014) *Optics and Laser Technology*,63, 144-147, DOI: [10.1016/j.optlastec.2014.04.012](https://doi.org/10.1016/j.optlastec.2014.04.012), IF: 4.6,(Q1/Q2)
12. Naveen Kumar, K. Ramachandran, "Mach-Zehnder interferometer concatenated fiber loop mirror based gain equalization filter for an EDFA", (2013), *Optics Communications*, 289, 92-96, DOI: [10.1016/j.optcom.2012.10.003](https://doi.org/10.1016/j.optcom.2012.10.003), IF:2.2, (Q2)
13. Thresiamma George, K. Ramachandran*, "Third-Order Optical Nonlinearity of Au-Ag core-shell Nanoparticle at 532 nm", *International Journal of Science and Research (IJSR)*, 6 (4), 245 – 251 (2017). DOI:- 10.21275/ART20172283 ISSN (Online): 2319-7064 <https://www.ijsr.net/archive/v6i4/ART20172283.pdf>

CONFERENCE PRESENTATIONS:

14. Haokun Luo, Ramachandran Kasu, Demetrios N. Christodoulides, Andreas E. Vasdekis
“[Metabolic Imaging at Video Rates Using Raman with Airy Light-Sheet Illumination and Sparse Photon Detection | Genomic Science Program](#),” 2024/4/2, 2024 Enabling Capabilities and Resources Principal Investigator Meeting Proceedings, Page -76.
15. Lochlann Dunn, Haokun Luo, Nava R. Subedi, Ramachandran Kasu, Armando McDonald, Demetrios Christodoulides, Andreas E. Vasdekis; *Video-rate Spontaneous Raman Imaging (Invited Paper)*; 2024; SPIE Photonics West, San Francisco, California, United States; **DOI:** <https://doi.org/10.1117/12.3003021>; **12854, 109-113, ISBN:** 9781510669673, 178 (1 Vol)
16. Vamara Dembele, K Ramachandran, Inho Choi, Jayakumar P. Madhan, Junho Kim, Daesuk Kim; *Dynamic Spectro-ellipsometry Based on a Spectral Interferometric Phase Extraction Method*; Digital Holography and Three-Dimensional Imaging 2017, Jeju Island, South Korea; M4A-5 **DOI:** [10.1364/DH.2017.M4A.5](https://doi.org/10.1364/DH.2017.M4A.5); Optica Publishing Group; **ISBN:** 978-1-943580-28-6.
17. Naveen Kumar, K. Ramachandran; A Novel Interferometric Technique for the Gain Equalization of an EDFA; **2013**; Workshop on Recent Advances in Photonics (WRAP), IIT Delhi, India; **1-2**; **DOI:** [10.1109/WRAP.2013.6917700](https://doi.org/10.1109/WRAP.2013.6917700); **IEEE**; **ISBN:** 978-1-4799-4863-5
18. Naveen Kumar, K. Ramachandran; Sagnac and Mach-Zehnder Interferometer-Based Gain Flattening of an EDFA; 2012; International Conference on Fiber Optics and Photonics (PHOTONICS 2012), IIT Madras, India; TPo-17; **DOI:** [10.1364/PHOTONICS.2012.TPo.17](https://doi.org/10.1364/PHOTONICS.2012.TPo.17); Optica Publishing Group / **IEEE**; **ISBN:** 978-1-4673-4718-1.
19. Ramachandran K, Andreas E. Vasdekis; Light Sheet Microscopy in Idaho; 2023; The Institute for Health in the Human Ecosystem Annual Research Symposium, Moscow, Idaho, USA.
20. A Kumari, Ganesh Damarla, K Ramachandran, Anil K Chaudhary; A Time-Domain Terahertz Spectroscopy of Cefixime Antibiotic Drug Obtained from Different Sources; 2017; DAE-BRNS Theme Meeting on Ultrafast Science 2017 (UFS-2017), University of Hyderabad, India;
21. Daesuk Kim, Vamara Dembele, Inho Choi, K Ramachandran, Hyungjoon Lim, GeeHong Kim, Jaejong Lee; Inline Scatterometry for Dynamic Nanopattern Uniformity Evaluation; 2017; 24th Korean Conference on Semiconductors,, South Korea, WC4-Q-3
22. Daesuk Kim, Vamara Dembele, Inho Choi, Ramachandran Kasu; Dynamic Spectroscopic Ellipsometry: Theory and Applications (Invited); 2016; International Symposium on Optomechatronic Technology 2016, Itabashi, Tokyo, Japan, SS2-10, http://isot2016.sakura.ne.jp/documents/ISOT_digest.pdf
23. Naveen Kumar, K. Ramachandran; Interrogation of a Mach-Zehnder Interferometer Inside the Fibre Loop Mirror for Gain Equalization of an EDFA; 2014; International Conference on Optics and Optoelectronics (ICOL 2014), IRDE, Dehradun, Uttarakhand, **PP-FIO-18**
24. Naveen Kumar, K. Ramachandran, Venkataraman Sahoo; Miniaturized Microfiber Mach-Zehnder Interferometer Current Sensor; 2014; ICOL 2014, IRDE, Dehradun, Uttarakhand, **PP-MNT-10**
25. Naveen Kumar, Venkataraman Sahoo, K Ramachandran, Rajkoti; Fabrication of Long Tapered Fiber and Micro Mach-Zehnder Interferometer for Sensing Applications; 2014; ICOL 2014, IRDE, Dehradun, Uttarakhand, **PP-ODT-06**