

Curriculum Vitae

Working research areas

Currently, I am working on beam optics and its applications in the material science

1. Nonlinear Optics
2. Structured Beam Optics
3. Laser Engineering
4. Light-matter interaction
5. Bio-photonics

Major research projects carried and on going

1. Study of optical Nonlinearity in the Absorption and Refraction and their applications
2. Structured Optical Beams generation and characterization by Diffractive optical elements
3. Direct generation of Generalized Gaussian beams from Solid State Lasers
4. Nonlinear Frequency Mixing of Generalized Gaussian Modes
5. Fabrication of Micro and Nano Structures on materials based on Generalized Gaussian beams.
6. Bio-imaging and printing based on Structured laser beams
7. Understanding Advanced research fields with Under-graduate and post-graduate level concepts
8. Educational research at Graduate level

Research articles

Journals

1. Y. Yoneda, **S. R. Allam***, W. R. Kerridge-Johns, Y. Fujimoto, and T. Omatsu*, “Multi-Color Optical Quasiparticle Laser Source Formed of a Pr³⁺ Doped Fiber Laser with a Dual-Output Coupling Geometry,” *Laser Photonics Rev.* 2401403 (2024) (<https://doi.org/10.1002/lpor.202401403>).
2. R. Tamura, **S. R. Allam**, N. M. Litchinitser, and T. Omatsu*, “Three-Dimensional Projection of Optical Hopfion Textures in a Material,” *ACS Photonics* 11(11), 4958–4965 (2024) (<https://doi.org/10.1021/acsphotonics.4c01547>).
3. O. S. N. Ghosh*, S. Gayathri, **S. R. Allam**, A. Sharan, S. S. Lal, M. J. K. Reddy, A. M. Shanmugharaj, and A. K. Viswanath, “Bound exciton engineering approach for tuning the thermal lensing phenomenon in anatase TiO₂: Gd nanosystems,” *Chem. Phys. Imp.* 100679 (2024) (<https://doi.org/10.1016/j.chphi.2024.100679>).
4. W. R. Kerridge-Johns[#], **A. S. Rao[#]**, and T. Omatsu*, “Optical skyrmion laser using a wedged output coupler,” *Optica* 11(6), 769-775 (2024) (<https://doi.org/10.1364/OPTICA.521901>).
5. C. Xuan, Y. Zhou, X. Yang, Y. Ma, **A. S. Rao**, T. Omatsu, Z. Bai, Y. Wan, J. Wen, and T. Yusufu*, “Generation of High-Order Laguerre-Gaussian Modes from an Optical Vortex Pumped Diamond Raman Laser,” *Laser Photon. Rev.* 2400081 (2024) (<https://doi.org/10.1002/lpor.202400081>).
6. **A. S. Rao**, “Optical skyrmions in the Bessel profile,” *JOSA A* 41(6), 1059-1069 (2024) (<https://doi.org/10.1364/JOSAA.522001>).
7. R. Tamura[#], P. Kumar[#], **A. S. Rao**, K. Tsuda, F. Getzlaff, K. Miyamoto, N. M. Litchinitser, and T. Omatsu*, “Direct imprint of optical skyrmions in azopolymers as photoinduced relief structures,” *APL Photonics* 9(4) (2024) (<https://doi.org/10.1063/5.0192239>).
8. Y. Yoneda, **A. S. Rao**, Y. Fujimoto, K. Miyamoto, and T. Omatsu*, “Direct generation of multicolor Bessel beams from a Pr³⁺:WPPG fiber laser,” *Opt. Express* 32(6), 9011-9018 (2024) (<https://doi.org/10.1364/OE.520672>).
9. **A. S. Rao**, “An Intriguing Interpretation of 1D and 2D Non-Diffracting Modes in Cosine Profile,” *Photonics* 10(12) 1358 (2023) (<https://doi.org/10.3390/photonics10121358>).
10. T. Morohashi, **A. S. Rao***, and T. Omatsu, “Direct generation of lower-order cylindrical vector vortex modes from an end-pumped Pr³⁺: LiYF₄ laser,” *Appl. Opt.* 62(34), 9183-9187 (2023) (<https://doi.org/10.1364/AO.509263>).
11. **A. S. Rao**, “Illustrations of Bessel Beams in s-Polarization, p-Polarization, Transverse Polarization, and Longitudinal Polarization,” *Photonics* 10(10), 1092 (2023) (<https://doi.org/10.3390/photonics10101092>).

12. W. R. Kerridge-Johns*, A. S. Rao, Y. Fujimoto, and T. Omatsu, "Red, orange, and dual wavelength vortex emission from Pr: WPGF fiber laser using a microscope slide output coupler," *Opt. Express* **31**(10), 16607-16614 (2023) (<https://doi.org/10.1364/OE.491867>).
13. A. S. Rao*, T. Morohashi, W. R. Kerridge-Johns, and T. Omatsu, "Generation of higher-order Laguerre-Gaussian modes from a diode-pumped $\text{Pr}^{3+}:\text{LiYF}_4$ laser with an intra-cavity spherical aberration," *JOSA B*, **40**(2), 406-411 (2023) (<https://doi.org/10.1364/JOSAB.481727>) (Editors' Pick).
14. P. Kumar*, A. S. Rao, and T. Omatsu, "Generation of V-point polarization singularity using single phase encoding with a spatial light modulator," *Sci. Rep.* **13**(1), 1-7 (2023) (<https://doi.org/10.1038/s41598-022-27337-x>).
15. P. Kumar, N. K. Nishchal*, T. Omatsu, and A. S. Rao, "Self-referenced interferometry for single-shot detection of vector-vortex beams," *Sci. Rep.* **12**, 1 (2022) 1-11 (<https://doi.org/10.1038/s41598-022-21485-w>).
16. P. Kumar, N. K. Nishchal*, T. Omatsu, and A. S. Rao, "Optical vortex array for two-dimensional exclusive-OR operation," *Appl. Phys. B* **128** 5 (2022) 1-7 (<https://doi.org/10.1007/s00340-022-07818-7>).
17. S. U. Alam*, N. K. Soni, A. S. Rao, H. He, Y. Ren, and K. W. Kenneth*, "Two-photon microscopy with enhanced resolution and SBR using hollow Gaussian beam excitation." *Opt. Lett.* **15** 8 (2022) 2048-2051 (<https://doi.org/10.1364/OL.454140>).
18. A. S. Rao, T. Miike, K. Miyamoto, and T. Omatsu*, "Direct generation of 523 nm orbital Poincaré mode from a diode-pumped $\text{Pr}^{3+}:\text{LiYF}_4$ laser with an off-axis optical needle pumping geometry." *Opt. Exp.* **29** 19 (2021) 30409 (<https://doi.org/10.1364/OE.439491>).
19. A. S. Rao, T. Miike, K. Miyamoto, and T. Omatsu*, "Optical vortex lattice mode generation from a diode-pumped $\text{Pr}^{3+}:\text{LiYF}_4$ laser." *J. Opt.* **23** (2021) 075502 (<https://doi.org/10.1088/2040-8986/ac067d>).
20. A. S. Rao*, D. Yadav#, and G. K. Samanta, "Nonlinear frequency conversion of 3-D optical bottle beams generated using a single axicon." *Opt. Lett.* **46** 3 (2021) 657-660 (doi.org/10.1364/OL.413899).
21. A. S. Rao, K. Miyamoto, and T. Omatsu*, "Ultraviolet intracavity frequency-doubled $\text{Pr}^{3+}:\text{LiYF}_4$ orbital Poincaré laser." *Opt. Exp.* **28** 25 (2020) 37397 (doi.org/10.1364/OE.411624).
22. A. S. Rao*, L. Liu, and Y. Cai*, "A new method for generating approximate non-diffractive three dimensional micro-size optical potentials." *Opt. Commun.* **477** (2020) 126297 (doi.org/10.1016/j.optcom.2020.126297).
23. A. S. Rao, "Characterization of off-axis phase singular optical vortex and its nonlinear wave-mixing to generate control broad OAM spectra." *Phys. Scr.* **95** 5 (2020) 055508 (doi.org/10.1088/1402-4896/ab7b09).
24. A. S. Rao, "Theoretical study on saturable absorption using Gaussian vortex beam z-scan." *JNOPM* **28** 3 (2020) 1950038 (doi.org/10.1142/S0218863519500383).
25. A. S. Rao, "Analysis of multi-photon absorption: z-scan using ultra-short Gaussian vortex beam." *Laser Phys.* **30** 2 (2019) 025403 (doi.org/10.1088/1555-6611/ab5e23).
26. A. S. Rao, "Equations for beam waist measurement of high peak power lasers." *JNOPM* **28** (2019) 1950020 (doi.org/10.1142/S0218863519500206).
27. A. S. Rao, "Nonlinear spectroscopy of three-level cascade systems in the act of saturable and reverse saturable absorption." *Optik* **185** (2019) 14-19 (doi.org/10.1016/j.ijleo.2019.03.091).
28. A. S. Rao, "Nonlinear behavior of the population dynamics of three-level systems in the presence of single photon absorption" *Chin. Phys. B* **28** 2 (2019) 024200 (doi.org/10.1088/1674-1056/28/2/024211).
29. A. S. Rao, A. Chaitanya*, and G. K. Samanta, "High power, ultrafast, efficient source for 266 nm." *OSA cont.* **2** (2019) 99-106 (doi.org/10.1364/OSAC.2.000099).
30. A. S. Rao, "Single Photon Nonlinear Absorption Spectroscopy of Cascade Energy Level Systems." *Optik* **179** (2019) 222 (doi.org/10.1016/j.ijleo.2018.10.197).
31. N. B. Hemanth, A. S. Rao, V. S. Sravanthi, S. Alok, and R. Baskaran*, "Femtosecond laser pulse assisted photoporation for drug delivery in Chronic myelogenous leukemia cells" *J. Photochem. Photobio. B: Bio.* **187** (2018) 35 (doi.org/10.1016/j.jphotobiol.2018.07.031).
32. A. S. Rao, "Nonlinear absorption study in four and five energy level systems" *Optik* **171** (2018) 377 (doi.org/10.1016/j.ijleo.2018.06.088).
33. A. S. Rao*, and G. K. Samanta, "On-axis intensity modulation-free, segmented, zero-order Bessel beams with tunable ranges." *Opt. Lett.* **43** (2018) 3029-3032 (doi.org/10.1364/OL.43.003029).
34. S. U. Alam#, A. S. Rao#, A. Ghosh, P. Vaity, and G. K. Samanta*, "Nonlinear frequency doubling characteristics of asymmetric vortices of tunable, broad orbital angular momentum spectrum." *Appl. Phys. Lett.* **112** (2018) 171102 (doi.org/10.1063/1.5024445).
35. A. S. Rao, "Comparison of Rate Equation models for Nonlinear Absorption." *Optik* **158** (2018) 652 (doi.org/10.1016/j.ijleo.2017.12.170).
36. A. S. Rao, "Optical limiting in the presence of simultaneous one and two photon absorption." *Optik* **157** (2018) 900 (doi.org/10.1016/j.ijleo.2017.11.163).

37. **A. S. Rao***, and S. Alok. "One, two and three photon absorption of two level system in femto-second laser excitation." J. Opt. **46** 4 (2017) 486 (doi.org/10.1007/s12596-017-0412-3).
38. **A. S. Rao**, M. H. Dar, N. Venkatramaiah, R. Venkatesan, and S. Alok*, "Third order optical nonlinear studies in tetra-phenyl porphyrin derivatives and its use to estimate thickness of sandwiched films." J. Non. Opt. Phys. & Mater. **25** 03 (2016) 1650039 (doi.org/10.1142/S0218863516500399).
39. G. Chakravarthy, **A. S. Rao**, A. Sharan*, O. S. N. Ghosh, S. Gayathri, A. K. Viswanath, M. N. Prabhakar, J. I. Song, "Understanding the effect of bound excitons on two photon absorption process in anatase TiO₂nanospheres using ultrafast pulses." J. Non. Opt. Phys. & Mat. **25** 02 (2016)1650019 (doi.org/10.1142/S0218863516500193).
40. **A. S. Rao**, "Theoretical study on nonlinear properties of four level systems under nano-second illumination." Laser Phys. **25** 5 (2015) 055701 (doi.org/10.1088/1054-660X/25/5/055701).

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Tutorial/ Topical/Review/Book chapters

1. **A. S. Rao**, "A conceptual review on Bessel beams," Phys. Scr. **99**, 062007 (2024) (<https://orcid.org/0000-0001-6247-2546>).
2. T. Omatsu*, and **A. S. Rao**, "Revolution of chiral materials science using optical vortex fields," Photonics Rev. **2024**, 240208 (2024) (<https://doi.org/10.11470/photo.240208>).
3. **A S. Rao**, "Saturation effects in nonlinear absorption, refraction, and frequency conversion: a review" Optik **267** (2022) 169638 (doi.org/10.1016/j.ijleo.2022.169638).

Number of articles published in each Journal

OSA

1. Optica-1
2. Optics Letters-3
3. Optics Express-4
4. JOSA A-1
5. JOSA B-1
6. OSA Continuum-1
7. Applied Optics-1

IOP

1. Physica Scripta-2
2. Laser Physics-2
3. Journal of Optics-1
4. Chinese Physics B-1

Elsevier

1. Optics Communications-1
2. Optik-6
3. Journal of Photochemistry and Photobiology B: Biology-1
4. Chemical physics impact-1

AIP

1. Applied Physics Letters-1
2. APL Photonics-1

ACS

1. ACS Photonics-1

WILEY

1. Laser & Photonics Reviews-2

Nature

1. Scientific report-2

Springer

1. Journal of Optics-1
2. Applied Physics B: Lasers and Optics-1

World Scientific

1. Journal of Nonlinear Optical Physics and Materials-4

MDPI

1. Photonics-2

J-STAGE

1. Photonics Review-1

arXiv Papers

1. **A. S. Rao**, A. Sharan, N. Venkatramaiah, and R. Venkatesan "*Detection of excited state absorption cross-section of porphyrin through cw and femto-second laser pump-probe technique.*" arXiv preprint arXiv:1903.01740 (2019).
2. **A. S. Rao**, and A. Sharan, "*A Method to Determine the Ultrafast Laser Beams Spot Size.*" arXiv preprint arXiv:1807.10739v1 (2018).
3. **A. S. Rao**, S. Gayathri, O. S. N. Ghosh, A. Sharan and A. K. Viswanath, "*Third order nonlinear study of ZnO nano particles under femto-second laser illumination.*" arXiv preprint arXiv:1806.09404 (2018).
4. **A. S. Rao**, A. Sharan, Venkatramaiah, N. and Venkatesan, R., "*Nonlinear Spectroscopic Study of Porphyrin Under cw and Femto-second Laser Pulse Excitation.*" arXiv preprint arXiv:1804.00288 (2018).
5. **A. S. Rao**, "*Overview on Second and Third Order Optical Nonlinear Processes.*" arXiv preprint arXiv:1612.09399 (2018).
6. **A. S. Rao**, Mudasir H. Dar, N. Venkatramaiah, R. Venkatesan, and A. Sharan. "*Spatial self-phase modulation in the H2TPP (OH) 4 doped in Boric Acid Glass.*" arXiv preprint arXiv:1511.00814 (2015).

Presentations

Invited talks

1. "*Fundamental concepts of optics for understanding structured beams and their applications*" OPTICA student chapter IIT Bhilai, career in Optics and Photonics (8-11-2024) **(20 minutes)**
2. "*Two-dimensional bio-printing with optical vortex induced forward transfer*" Structured Light and Materials Workshop 2024 (SLM 2024), Osaka Metropolitan University, Osaka, Japan (24-10-2024 to 25-10-2024) **(30 minutes)**.
3. "*Optical Quasiparticles Laser Source in the Visible Spectrum for Material Processing*" CIOP-15 2024, Xian, China (11-08-2024 to 15-08-2024) **(25 minutes)**.
4. "*Scalar and vector modes generation from praseodymium laser in visible spectrum*" at Institute of Laser and Optoelectronics, School of Precision Instrument and Optoelectronics Engineering, **Tianjin University**, Tianjin 300072, China (09-08-2024) **(1 hour)**.
5. "*Direct Generation of Skyrmions from Laser Cavity and Their Applications in Material Processing*" PIERS, Chengdu, China (21-04-2024 to 25-04-2024) **(20 minutes)**.
6. "*Wavelength-versatile Structured Modes Generation and Characterization for Scientific Applications*" on 19-03-2021 at Department of Physics, School of Advanced Sciences **VIT-AP**, Andhra Pradesh, India **(2 hours)**.

Conference online proceedings

1. **S. R. Allam**, Y. Yoneda, W. R. Kerridge-Johns, Y. Fujimoto, and T. Omatsu, "Green Skyrmion fiber laser," in *JSAP-Optica Joint Symposia 2024 Abstracts*, (Optica Publishing Group, 2024), paper 19p_C43_3. (https://opg.optica.org/abstract.cfm?URI=JSAPO-2024-19p_C43_3)
2. R. Tamura, P. Kumar, **A. S. Rao**, N. M. Litchinitser, and T. Omatsu, "Optical Skyrmionic Hopfion Induced Surface Structures in Azopolymers via Photo-Induced Mass Transport". In *2024 Conference on Lasers and*

- Electro-Optics Pacific Rim (CLEO-PR)* (pp. 1-2). IEEE. ([10.1109/CLEO-PR60912.2024.10676590](https://doi.org/10.1109/CLEO-PR60912.2024.10676590)) (CLEO-PR 2024 **Best student paper 1st prize**) 2024 (<http://www.cleopr2024.org/award.php>).
3. Y. Yoneda, W. R. Kerridge-Johns, **A. S. Rao**, Y. Fujimoto, and T. Omatsu, "Green, Orange and Red Optical Skyrmions Generation from Pr³⁺-Doped Fiber Laser". In *2024 Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR)* (pp. 1-2). IEEE. ([10.1109/CLEO-PR60912.2024.10676752](https://doi.org/10.1109/CLEO-PR60912.2024.10676752)) (CLEO-PR 2024) 2024 **Nanophotonics Best Student Paper Awards Silver prize**) (<http://www.cleopr2024.org/award.php>).
 4. R. Tamura, P. Kumar, **A. S. Rao**, K. Miyamoto, and T. Omatsu, "Direct imprint of topologically protected polarization textures of optical skyrmions onto a material," In *CLEO: Science and Innovations* (pp. SM4C-4). Optica Publishing Group (2024) (https://doi.org/10.1364/CLEO_SI.2024.SM4C.4).
 5. Y. Yoneda, **A. S. Rao**, Y. Fujimoto, K. Miyamoto, and T. Omatsu, "Direct generation of Bessel-like vortex beams using Pr³⁺ fiber laser," In *JSAP-Optica Joint Symposia* (p. 23a_A310_7). **Optica Publishing Group** (2023, September) (https://doi.org/10.1364/JSAPO.2023.23a_A310_7).
 6. R. Tamura, P. Kumar, **A. S. Rao**, K. Miyamoto, and T. Omatsu, "Optical-skyrmions induced exotic surface structures of azo-polymers," In *JSAP-Optica Joint Symposia* (p. 23a_A310_5). Optica Publishing Group (2023, September) (https://doi.org/10.1364/JSAPO.2023.23a_A310_5) (**Best student presentation award**).
 7. R. Tamura, P. Kumar, **A. S. Rao**, K. Tsuda, F. Getzlaff, K. Miyamoto, and T. Omatsu, "Creation of exotic structures in azopolymers with optical skyrmions," In **Complex Light and Optical Forces XVIII** (p. PC1290105). **SPIE** (2024 March) (<https://doi.org/10.1117/12.2690980>).
 8. W. R. Kerridge-Johns, **A. S. Rao**, A.S. and T. Omatsu, "Visible skyrmion praseodymium laser in red and orange," In **Complex Light and Optical Forces XVIII** (Vol. 12901, pp. 30-33). **SPIE** (2024, March) (<https://doi.org/10.1117/12.3002686>).
 9. T. Morohashi, **A. S. Rao**, and T. Omatsu "Direct generation of higher-order vector vortex modes at 640 nm from a Pr³⁺:YLF laser source", **Proc. SPIE 12606, Optical Manipulation and Structured Materials Conference**, 126060Q (20 September, 2023); (<https://doi.org/10.1117/12.3008345>).
 10. R. Tamura, P. Kumar, **A. S. Rao**, K. Miyamoto, and T. Omatsu "Generation of optical skyrmion by using a spatial light modulator with a self-interferometer configuration", **Proc. SPIE 12606, Optical Manipulation and Structured Materials Conference**, 1260617 (20 September 2023); (<https://doi.org/10.1117/12.3008369>).
 11. **A. S. Rao**, T. Morohashi, W. R. Kerridge-Johns, and T. Omatsu, "Higher-order Visible Vortex Modes from a Pr³⁺: YLF Laser Source Under Intra-cavity Spherical Aberration", In **2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)** (pp. 1-1). IEEE (June-2023) ([10.1109/CLEO/Europe-EQEC57999.2023.10231968](https://doi.org/10.1109/CLEO/Europe-EQEC57999.2023.10231968)).
 12. W. R. Kerridge-Johns, **A. S. Rao**, Y. Fujimoto, and T. Omatsu, "Pr³⁺ Vortex Fibre Laser with Interferometric Output Coupler in Red and Orange", In **2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)** (pp. 1-1). IEEE (2023, June) ([10.1109/CLEO/Europe-EQEC57999.2023.10231645](https://doi.org/10.1109/CLEO/Europe-EQEC57999.2023.10231645)).
 13. **A. S. Rao**, P. Kumar, and T. Omatsu, "Cylindrical Vector Vortex Beams Generation with a Single Phase Encoded Spatial Light Modulator", In **2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)** (pp. 1-1). IEEE (2023, June) ([10.1109/CLEO/Europe-EQEC57999.2023.10231550](https://doi.org/10.1109/CLEO/Europe-EQEC57999.2023.10231550)).
 14. Y. Yoneda, W. R. Kerridge-Johns, **A. S. Rao**, Y. Fujimoto, and T. Omatsu, "Orange, Red and Deep Red Optical Vortex Mode Operation in Pr³⁺: Fiber Laser", In **2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)** (pp. 1-1). IEEE (2023, June) ([10.1109/CLEO/Europe-EQEC57999.2023.10231444](https://doi.org/10.1109/CLEO/Europe-EQEC57999.2023.10231444)).
 15. R. K. William, **A. S. Rao**, Y. Fujimoto, and T. Omatsu "Red and orange vortex Pr³⁺ fibre laser using a mode converting output coupler", **Proc. SPIE 12436, Complex Light and Optical Forces XVII**, 124360G (15 March 2023); (<https://doi.org/10.1117/12.2648839>).
 16. Y. Yoneda, **A. S. Rao**, Y. Fujimoto, K. Miyamoto, and T. Omatsu, "Visible vortex Pr³⁺: water-proof fluoro-aluminate glass fiber laser," In *JSAP-Optica Joint Symposia* (p. 21p_C302_6). Optica Publishing Group **83rd JSAP autumn meeting 2022**, Tohoku University, Sendai, Japan (https://opg.optica.org/abstract.cfm?uri=JSAPO-2022-21p_C302_6).
 17. T. Morohashi, **A. S. Rao**, K. Miyamoto, and T. Omatsu, "Direct generation of vector vortex modes from Pr³⁺: YLF laser," In *JSAP-Optica Joint Symposia* (p. 21p_C302_4). Optica Publishing Group **83rd JSAP autumn meeting 2022**, Tohoku University, Sendai, Japan (https://opg.optica.org/abstract.cfm?uri=JSAPO-2022-21p_C302_4).
 18. P. Kumar, N. K. Nishchal, T. Omatsu, and **A. S. Rao**, "A compact optical set-up to create high-order vectorial structured light beams." In **Conference on Lasers and Electro-Optics/Pacific Rim** (p.

- CTuP5A_05). Optica Publishing Group (2022, August) (https://opg.optica.org/abstract.cfm?uri=CLEOPR-2022-CTuP5A_05).
19. **A. S. Rao**, T. Morohashi, T. Miike, Miyamoto, and T. Omatsu, “Generation of circular geometric modes from Pr^{3+} : YLF laser with spherical aberration.” In **Conference on Lasers and Electro-Optics/Pacific Rim** (p. CThP1H_02). Optica Publishing Group (2022, August) (https://opg.optica.org/abstract.cfm?uri=CLEOPR-2022-CThP1H_02).
 20. **A. S. Rao**, T. Morohashi, T. Miike, K. Miyamoto, and T. Omatsu “Generation of higher-order vortex modes from a Pr^{3+} :YLF laser source”, **Proc. SPIE 12479, Optical Manipulation and Structured Materials Conference** (OMC 2022), 124790F (8 December 2022); (<https://doi.org/10.1117/12.2658797>).
 21. P. Kumar, N. K. Nishchal, T. Omatsu, and **A. S. Rao**, “Optimization of spatial light modulator’s phase response through computer-generated hologram.” In **Adaptive Optics and Applications** (pp. OTh5B-3) Optica Publishing Group, 2022 (doi.org/10.1364/AOA.2022.OTh5B.3).
 22. **A. S. Rao**, T. Morohashi, T. Miike, K. Miyamoto, and T. Omatsu, “Geometric Modes Generated from a Pr : YLF laser.” In **CLEO: Science and Innovations** (pp. JW3B-44). Optica Publishing Group, 2022 (doi.org/10.1364/CLEO_AT.2022.JW3B.44).
 23. T. Miike, T. Morohashi, **A. S. Rao**, K. Miyamoto, and T. Omatsu, “Direct generation of green vortex from a Pr :YLF laser by an optical needle pump geometry,” in **JSAP-OSA Joint Symposia 2021 Abstracts**, OSA Technical Digest (Optica Publishing Group, 2021), paper 11a_N307_8 (doi.org/10.1364/JSAP.2021.11a_N307_8).
 24. **A. S. Rao**, K. Miyamoto, and T. Omatsu, “Direct Generation of Vortex Lattice Modes from an Intracavity Frequency Doubled Pr :YLF laser” In **CLEO: Science and Innovations** (pp. STh1B-2), **OSA**, 2021 (doi.org/10.1364/CLEO_SI.2021.STh1B.2).
 25. **S. R. Allam**, K. Miyamoto, and T. Omatsu, “Direct generation of ultraviolet vortex from a frequency-doubled Pr : YLF laser with an off-axis pumping geometry.” In **JSAP Annual Meetings Extended Abstracts The 81st JSAP Autumn Meeting 2020** (pp. 872-872). The Japan Society of Applied Physics (doi.org/10.11470/jsapmeeting.2020.2.0_872).
 26. **A. S. Rao**, and G. K. Samanta, “High Peak Power, Non-diffractive and Micro-size Optical Bottles Generation in Bessel Beams” In **Advanced Solid State Lasers** (pp. JTh2A-9) **OSA**, 2020 (doi.org/10.1364/ASSL.2020.JTh2A.9).
 27. **A. S. Rao**, and G. K. Samanta, “High Peak Intensity and Tunable Range Bessel Beams Generation and Characterization” In **Laser Science**, pp. JT2A-16. (FIO) **OSA**, 2018 (doi.org/10.1364/FIO.2018.JT2A.16).
 28. **A. S. Rao** and A. Sharan, “Accounting for experimental artifacts in the z-scan” In **International Conference on Fibre Optics and Photonics**, pp. Th3A-31. **OSA**, 2016 (IIT Kanpur) (doi.org/10.1364/PHOTONICS.2016.Th3A.31).
 29. C. Giridhar, **A. S. Rao**, S. V. M. Satyanarayana, and S. Alok, “Study of optical Laue diffraction.” In **Light and its interaction with matter**, 1620 (1) 139-149. **AIP Publishing**, 2014 (**Optics 14** NIT Calicut) (doi.org/10.1063/1.4898232).
 30. **A. S. Rao**, M. Hassan Dar, N. Venkatramaiah, R. Venkatesan, and A. Sharan, “Study of spatial rings in TPPOH4 doped in boric acid glass.” In **IOP Conference Series: Materials Science and Engineering 73** (1) 012023, **IOP Publishing**, 2015 (ICMST-2012 Pala) (doi.org/10.1088/1757-899X/73/1/012023).

Conference Papers

International:

1. **A. S Rao**, K. Miyamoto and T. Omatsu, “Versatile structured Pr^{3+} : $LiYF_4$ laser source” **81st OPJ 2020**, Japan.
2. **A. S. Rao**, A. Chaitanya and G. K. Samanta, “High power, ultrafast fiber laser based DUV source at 266 nm” Proceedings of **Photonics-2018 ISBN978-93-88653-41-1**, IIT Delhi.
3. **A. S. Rao**, S. U. Alam, G. Anirban, V. Pravin, and G. K. Samanta, “Nonlinear generation of high power, higher order asymmetric vortices with broad orbital angular momentum modal distribution in the green” In **Europhoton 2018 international Conference**, pp. TuP34, Barcelona, Spain, 2018.
4. **A. S. Rao**, and A. Sharan, “Indirect Method of Spot Size Measurement of High Peak Power Laser Beams” **ICLLT-2016** OSI conference, Tezpur University.
5. **A. S. Rao**, M. Sukumar, M. Ashok Kumar, Alok S., and R. Ramesh Babu, “Intensity dependent four photon absorption in $LiKB_4O_7$ and $LiRbB_4O_7$ crystals under femto-second laser excitation” **ICLLT-2016** OSI conference, Tezpur University.

6. **A. S. Rao**, A. Sharan, "Nonlinear Spectroscopy of Three Level Cascade Systems" **ICOPMA-2015** held at Sastra University, Thanjavur India.
7. **A. S. Rao**, A. Sharan, N. Venkatramaiah, R. Venkatesan, "Spatial Self Phase Modulation studies in TPPOH₄ Doped in Boric Acid Glass" **ICOL-2014** IRDE, Dehradun India.

National:

1. **A. S. Rao**, K. Sato, K. Yuyama, M. Hanaoka, and T. Omatsu, "2-dimensional Bio-printing with optical vortex based light induced forward transfer technique" Chiral Photo-Materials Science" Conference (October 3-4), Hokkaido University, Japan.
2. S. B. Sruthil Lal, D. Murali, C. Giridhar, **A. S. Rao**, O. S. N. Ghosh, S. Gayathri and A. Sharan " Probing the origin of Ultrafast Optical Nonlinearities in anatase TiO₂ nanoparticles through DFT approach" **DAE-BRNS theme meeting on the ultrafast science** held at UoH (Nov. 2-4, 2017).
3. C. Giridhar , **A. S. Rao**, O. S. N. Ghosh, S. Gayathri, S. B. Sruthil Lal, A. Sharan and A. K. Viswanath " Nonlinear phase shift of Au and Mn doped TiO₂ anatase nanoparticles" **DAE-BRNS theme meeting on the ultrafast science** held at UoH (Nov. 2-4, 2017).
4. C. Giridhar, **A. S. Rao**, O. S. N. Ghosh, S. Gayathri, Sruthil lal S., Alok S., A. K. Viswanath "Influence of Ag doping in third order nonlinear optical characteristics of the nanostructured anataseTiO₂ using femtosecond Z-scan" **International Workshop on Advanced Functional Materials and Devices** organized by Department of Physics and Department of Chemistry Manonmaniam Sundaranar University, Tirunelveli on 8-12 January (2017) **ISBN 978-93-81402-38-2**.
5. M. Ashok Kumar, M. Sukumar, **A. S. Rao**, Alok S., and R. Ramesh Babu "Two photon absorption in bismuth zinc borate (BiZnBrO₄) single crystal" **International Workshop on Advanced Functional Materials and Devices** organized by Department of Physics and Department of Chemistry Manonmaniam Sundaranar University Tirunelveli on 8-12 January (2017) **ISBN 978-93-81402-38-2**.
6. O. S. N. Ghosh, S. Gayathri, **A. S. Rao**, Gridhar C., A. K. Viswanath, and Alok S., "Femtosecond Z-Scan Analysis of Augmented Third Order Nonlinearity in Bandgap Engineered Anatase TiO₂:Gd Nanoparticles Synthesized by Sol-Gel Method" **NLS-25** (2016) KIIT University, Bhubaneswar, India **ISBN 978-81-903321-7-0**.
7. S. Gayathri, **A. S. Rao**, O. S. N. Ghosh, Gridhar C., A. K. Viswanath, and Alok S., "Third order nonlinear study of ZnO nano particles under femto-second laser illumination" **NLS-25** (2016) KIIT University, Bhubaneswar, India **ISBN 978-81-903321-7-0**.
8. **A. S. Rao**, Alok S. "Estimation of excited state absorption cross-section of Porphyrin and its derivative by pump-probe technique" **NLS-25** (2016) KIIT University, Bhubaneswar, India **ISBN 978-81-903321-7-0**.
9. C. Gridhar, O. S. N. Ghosh, **A. S. Rao**, S. Gayathri, Alok S., A. K. Viswanath, "The Prodigious Hitch-Hiking of Photons and Bound Excitons on Two Photon Absorption Process in Anatase TiO₂ nano-spheres by Femtosecond Laser Wield" **NLS-24** (2015) RRCAT Indore, India, **ISBN 978-81-903321-6-3**.
10. O. S. Nirmal Ghosh, **A. S. Rao**, S. Gayathri, Gridhar C., Alok S., A. K. Viswanath "Direct evidence for the increase in exciton concentration and effective electron-hole pair separation in anatase TiO₂:Eu nanospheres by using femtosecond Z-scan" **NLS-24** (2015) RRCAT Indore, India, **ISBN 978-81-903321-6-3**.
11. S. Gayathri, O. S. N. Ghosh, **A. S. Rao**, Alok S., Gridhar C., M. J. Kumar Reddy, A. M. Shanmugaraj, A. K. Viswanath; "Investigation on Up-conversion Emission of NaYF₄: Yb,Er Upconverting Nanohexagons Using Femtosecond Laser" **NLS-24** (2015) RRCAT Indor, India, **ISBN 978-81-903321-6-3**.
12. **A. S. Rao**, C. Giridhar and S. Alok; "Nonlinear Spectroscopic study of phorphyrin and its derivative by Single Beam Transmittance" **NLS-24** (2015) RRCAT Indor, India, **ISBN 978-81-903321-6-3**.
13. **A. S. Rao** and S. Alok; "Control of Saturation Intensity for Saturable and Reverse saturable Absorption in Saturable Absorbers" **NLS-23** (2014) S. V. University Thirupati, India, **ISBN 978-81-903321-5-6**.
14. **A. S. Rao**, N. Venkatramaiah, R. Venkatesan and S. Alok; "Study of third order nonlinearities in the ZnTPP doped in Boric acid" **NLS-22** (2014) MIT, Manipal University India, **ISBN 978-81-903321-4-9**.
15. Ashok Kumar. M, **A. S. Rao**, Alok S.; "Monitoring Gradient Index in Sugar Solution of Varying Concentration" **37th National Symposium of Optical Society of India from 23rd to 25th Jan 2013 - Dept. of Physics**, Pondicherry University India.
16. S. Chitra, **A. S. Rao**, S. Alok; "Determination of optical rotation using Mueller matrices", **37th National Symposium of Optical Society of India from 23rd to 25th Jan 2013 - Dept. of Physics**, Pondicherry University India.
17. M. H. Dar, **A. S. Rao**, S. Alok, R. Venkatesan, and N. Venkatramaiah; "Degenerate Four Wave Mixing in Porphyrin Doped Boric Acid Glass", **Book Proc. Of NSAMS-2012** Pno: 171, M S University, Tirunelveli India (**Best Poster**).

18. **A. S. Rao**, M. Hassan Dar, S. Alok, R. Venkatesan and N. Venkataramaiah; “*Study of Third Order Optical Nonlinearities of Porphyrin Doped in Boric Acid Glass by Z-scan technique*” **Book Proc. Of NAMS-2012** Pno. 74, M S University, Tirunelveli, India.

Workshop/conference organization member

1. Student conference on optics and photonics (**SCOP-2018**) by PRL OSA student chapter of Physical Research Laboratory, Ahmedabad, Gujarat, India (**Technical committee member**).
2. Student conference on optics and photonics (**SCOP-2017**) by PRL OSA student chapter of Physical Research Laboratory, Ahmedabad, Gujarat, India (**Technical committee member**).
3. **Workshop on Fundamental Optics and Photonics** (31st January 2014) as a part of OSA student chapter of PU, Department of Physics, Pondicherry University, India (**Organizing committee member**).
4. **Reflections-2016**, National Science Day, Department of Physics, Pondicherry University, India (**Volunteer**).
5. 37th National Symposium of Optical Society of India Symposium (OSI-2013) held at department of Physics, Pondicherry University (**Volunteer**).
6. 27th National Symposium on Plasma Science and Technology (Plasma 2012) held at the Department of Physics, Pondicherry University (**Volunteer**).

Workshop/conference chair

1. Chair for on session at Structured Light and Materials Workshop 2024 (**SLM 2024**), Osaka Metropolitan University, Osaka, Japan (24-10-2024 to 25-10-2024).
2. Chair for on session at student conference on optics and photonics (**SCOP-2018**) by PRL OSA student chapter of Physical Research Laboratory, Ahmedabad, Gujarat, India.
3. Chair for on session at student conference on optics and photonics (**SCOP-2017**) by PRL OSA student chapter of Physical Research Laboratory, Ahmedabad, Gujarat, India.
- 4.

Workshop/conference participation

National:

1. *Advances in applied mathematics and computational methods (An online workshop)*, An Online workshop held at VIT-AP University, Andhra Pradesh, India during 07–09 January, 2022
2. **National Science Day-2019**, Physical Research Laboratory, Ahmedabad, Gujarat, India
3. **National Science Day-2018**, Physical Research Laboratory, Ahmedabad, Gujarat, India
4. **National Science Day-2017**, Physical Research Laboratory, Ahmedabad, Gujarat, India
5. National Workshop on *Quantum Entanglement* (17-19 Feb. 2010) Department of Physics, Pondicherry University, India.

International:

1. *69th JSAP Spring 2022 meeting* (22-03-2022 to 26-03-2022)
2. *School on Plasmonics and Nano Optics* (24-30 June 2012) ICST (branch of TIFR) Hyderabad. (**Poster-Nonlinear Diffraction Rings**)
2. *ICTS Discussion Meeting on Emerging themes in Plasmonics* (1-3 July 2012) ICST (branch of TIFR) Hyderabad, India.

Awards and achievements

1. Awarded a fellowship under the "FY2019 JSPS Postdoctoral Fellowship for Research in Japan (Standard)" program
2. International travel supports from SERB: 31st Annual Conference of The IEEE Photonics Society, IPC 2018, USA (30 September 2018 To 04 October 2018) (ITS/2018/004261).
3. CSIR UGC NET rank secured is 307 in December 2012.
4. 41st rank secured in Mathematics Talent Test in Palakonda division (A.P.) in 2002

OPTICA member

Membership	Role	Period
OSA member at Chiba University	Individual	08/01/2024-07/31-2027

OSA member at Chiba University	Early Career	06/01/2020-07/31/2024
Pondicherry University Student	Treasurer	06/01/2015 - 05/31/2016
Chapter of OSA		
Pondicherry University Student	Other officer	06/01/2014-05/31/2015
Chapter of OSA		
Pondicherry University Student	Secretary	07/01/2013-05/31/2014
Chapter of OSA		

Member of Journal

1. Guest editor in Journal of Optics (IOP) for Special Issue " Structured Laser Sources and their Applications" (<https://iopscience.iop.org/collections/jopt-240708-606>)
2. Guest editor in Photonics Journal (MDPI) for Special Issue "Structured Light Beams: Science and Applications" (https://www.mdpi.com/journal/photonics/special_issues/5QPTCDP9XG).
3. Member of Topical Advisory Panel for section 'Lasers, Light Sources and Sensors' in Photonics Journal (MDPI) from 02-11-2023- present.
4. Volunteer reviewer in Photonics Journal (MDPI) from 09-04-2024- present

Journal review experience

OPTICA

Advances in Optics and Photonics
Optica
Optics Letters
JOSA B
Optics Express
Chinese Optics Letters
Applied Optics
Photonics Research

IOP

New Journal of Physics
Journal of Optics
Applied Physics Express
Journal of Physics: D Applied Physics
Physica Scripta
Journal of Physics B: Atomic, Molecular and Optical Physics
Quantum Science and Technology

AIP

Applied Physics Letters

Elsevier

Journal of Optics and Laser Technology
Optics Communications
Infrared Physics and Technology

Springer

Optical Review
SN Applied Sciences
Bulletin of Materials Science

Taylor & Francis

Journal of Modern Optics

John Wiley
Annalen der Physik

MDPI

Molecules
Photonics
Micromachines
Coatings
Sensors
Applied Sciences
Materials
Optics
Electronics

World Scientific

International Journal of Modern Physics B
Journal of Nonlinear Optical Physics and Materials

Other review process

Worked as a reviewer for the selection of 2022 [Optica Women Scholars](#) program (OPTICA)
Worked as a reviewer for the selection of 2023 [Optica Women Scholars](#) program (OPTICA)
Worked as a reviewer for the selection of 2024 [Optica Women Scholars](#) program (OPTICA)
Worked as a reviewer for the selection of 2025 [Optica Women Scholars](#) program (OPTICA)

Research links

<https://scholar.google.co.in/citations?user=S9-wFhsAAAAJ&hl=en&oi=sra>

 publons.com/a/1455615/

 orcid.org/0000-0001-6247-2546

https://www.researchgate.net/profile/A_S_Rao

Research Guidance (Co-supervising)

Undergraduate:

1. Yuto Yoneda, Graduate School of Advanced Integration Science, Chiba University in 2021-2022 (Visible vortex Pr^{3+} : water-proof fluoro-aluminate glass fiber laser).
2. Takuya Morohashi, Graduate School of Advanced Integration Science, Chiba University in 2021-2022 (Higher order LG modes generation from intra-cavity spherical aberration Pr:YLF Laser).
3. Taku Miike, Graduate School of Advanced Integration Science, Chiba University in 2020-2021 (Intra-cavity frequency doubling of orbital Poincare sphere in Pr:YLF laser).

Masters:

1. Yuto Yoneda, Graduate School of Advanced Integration Science, Chiba University in 2022-2024 (Visible Bessel vortex fiber laser).
2. Takuya Morohashi, Graduate School of Advanced Integration Science, Chiba University in 2022-2024 (Direct generation of cylindrical vector modes from Pr:YLF laser cavity).
3. Taku Miike, Graduate School of Advanced Integration Science, Chiba University in 2021-2023 (Orbital Poincare laser at 523 nm wavelength).

PhD:

1. Rihito Tamura, Graduate School of Advanced Integration Science, Chiba University in 2021-2024 (Optical Skyrmion generation and imprinting their structure on azopolymers).

Teaching Experience

1. Tutor for advanced He-Ne laser experiments, 4 years in Dpt. of Physics (Pondicherry University) (2010-2014).
2. Tutor for Nd:YAG laser demonstration to M.Sc. students, 4 years in Dpt. of Physics (Pondicherry University) (2011-2015).

3. Technical maintenance of femto-second Laser, 2 years in CIF (Pondicherry University) (2013-2015).
4. Physics expert in Chegg. Q & A from 3rd March to 5th October-2016.

Research positions occupied till now

Lecturer/Associate Professor	Institute for Advanced Academic Research (01-05-2021 to present)
Address	Institute for Advanced Academic Research, Chiba University, 1-33 Yayoichō, Inage-ku, Chiba-shi, Chiba 263-8522, Japan
JSPS PDF	Versatile structured light sources based on nonlinear optics (17-10-2019 to 30-04-2021)
Advisor	Dr. Takashige Omatsu Professor, Graduate School of Advanced Integration Science, Chiba University, Chiba, Japan- 2638522 Email: omatsu@faculty.chiba-u.jp Phone no: +81-90-9314-4401
University PDF	Generation, propagation and application of vector partially coherent beam (16-05-2019 to 16-10-2019)
Advisor	Dr. Yangjian Cai, Professor, School of physical science and technology, Soochow University, Suzhou, China E-mail: yangjiancai@suda.edu.cn
Visiting scientist	Non-diffractive optical bottle beam generation, characterization and its nonlinear wave-mixing (15-12-2018 to 15-05-2019)
Advisor	Dr. Goutam K Samanta, Professor, Photonics Science Lab, AMOPH division, Physical Research Laboratory, Thaltej, Ahmadabad, Gujarat, India- 380058 E-mail: gsamanta@prl.res.in Phone no: 7926314635
Institute PDF	Optical structure beams generation, characterization and their nonlinear wave mixing (15-12-2016 to 14-12-2018)
Advisor	Dr. Goutam K Samanta, Professor, AMOPH division, Physical Research Laboratory, Ahmadabad, India E-mail: gsamanta@prl.res.in Phone no: 7926314635

Research experience as a student

Ph.D.	Optical nonlinearities in saturable media (19-9-2011 to 23-11-2018)
Supervisor	Dr. Alok Sharan, Assistant Professor, Department of Physics,

Pondicherry University,
Chinna Kalapet,
Pondicherry, India- 605014.
E-mail: aloksharan@gmail.com
Phone no: +91-413-2654-633

M.Phil.

Supervisor

Properties of tetra phenyl porphyrin doped in boric acid glass by using z-scan technique (2010-2011)
Dr. Alok Sharan,
Assistant Professor,
Department of Physics,
Pondicherry University,
Pondicherry, India.
E-mail: aloksharan@gmail.com
Study of Entanglement in Classical and Quantum regions

M.Sc.

Supervisor

Dr. S. V. M. Satyanarayana,
Assistant Professor,
Assistant Professor,
Department of Physics,
Pondicherry University,
Puducherry, India.
E-mail: svmsatya@gmail.com

Academic Details

Degree	Board/University	Period of Study	Year of Passing	Percentage
Ph.D.	Pondicherry University	2011-2018	11-2018	
M. Phil.	Pondicherry University	2010-2011	05-2011	85.6%
M. Sc.	Pondicherry University	2008-2010	05-2010	74.5%
B. Sc.	Andhra University	2004-2007	04-2007	75%
Intermediate	Board of Intermediate	2002-2004	03-2004	73.9%
Tenth	Board of Secondary Education	2001-2002	03-2002	73%

Personal details

Name A. Srinivasa Rao
Gender Male
Date of Birth 31-05-1985
E-mail sri.jsp7@gmail.com
Languages Known English, Telugu, Hindi and Tamil
Marital Status Married
Spouse Allam Kiranmayee (wife)
Children Allam Jaisvi Akari (daughter)
Allam Bhargava Ram (son)
Permanent Address 7-65, LIG A-21,
Sagar Nagar,
Revenue Ward 6,
Visakhapatnam city,
Visakhapatnam Dist.,
Andhra Pradesh,
India-530045.

Date: 30-12-2024,
Place: Chiba, Japan.

A. Srinivasa Rao