Dr. Dipak Rout
Asst. Professor of Physics,
Department of Physics, Govt. College Sundargarh, Odisha, India
Email: dipak@govtcollegesundargarh.ac.in/ dipakrout224@gmail.com
Contact no.- +91-8260805071



Research Interest:

I am a physicist interested to pursue fundamental and applied research in Optics and Photonics for the realization of miniaturized optoelectronic, sensing, energy harvesting and optical devices.In general, I fabricate active and passive photonic devices that manipulate light-matter interactions exploring their potentials in integrated photonics and nano-optics applications. I do various PVD technique such as sputtering, thermal and e-beam evaporation for thin-film optical coating as well as Bragg-stack (periodic multilayers of dielectric materials) fabrication for wavelength selective application and optical cavities. I donanofabrication, structural and optical characterization of photonic nanostructures such as gratings, waveguides, photonic crystals, and plasmonic materials, and functional metal-dielectric photonic crystals and photonic simulation and computation. My current work is focused on devising silicon nitride and silicon-based structures foron-chip integrated photonic components for high brightness sources, and detectors in visible and near IR. We are exploring ways to integrate 2-D materials (such as Transition metal dichalcogenides) and quantum dots as gain medium, to high-Q photonic crystal cavities and open cavities to build light sources and detectors. Realization of such on-chip components is necessary for on-chip Quantum photonic applications.

Educational details:

Degree	Univ./college/School	Year of Passing	% of Mark/CPI	Division
Ph.D.	Indian Institute of Technology Kanpur	2017	7.6	1st
M.Sc.	Utkal University	2010	70%	1st
B.Sc.	Utkal University	2008	73%	1st, distinction
12th	C.H.S.E Odisha	2005	70%	1st
10th	B.S.E. Odisha	2003	68.4%	1st

Awards:

I. Secured 21 rank in the OES-I Asst. Prof. Stage 1 (in Physics) of OPSC Odisha.
II. Selected for postdoctoral researchat IISc. Bangalore under**National Postdoctoral Fellowship** by DST-SERB, India
III. **Postdoctoral Fellowship at Asher Research group in Univ. of Pittsburgh, U.S.A.**
IV. I was awarded a **travel grant from International Travel Support**, SERB, DST India, for presenting my research paper "*Enhancement and spectral narrowing of emission from photonic crystal hetero-structure mediated by band edge modes*," in Advanced Photonic Congress held in July 2017 at New Orlins, Louisiana, USA.
V. I have qualified several national level tests conducted in India such as **GATE-2010**, **2011**, **JEST-2010** and **NET- 2012.**

Research Experience:

February 2022- March 2023: National Postdoctoral Fellow in Photonics Research Laboratory, CeNSE, IISc. Bangalore, under the mentorship of Professor Shankar Kumar Selvaraja.

Project details: "*Large area wavelength selective photodetector integrated meta-surface for next-generation hyperspectral imaging"*

Outcome: *Successfully realized on-chip multispectral filters for both in-plane and out of plane wavelength selection that could be potential candidate for on-chip spectrometers and imaging.*

October 2020-January 2022: Postdoctoral research associate at Center for Nanoscience and Engineering (CeNSE) **IISc. Bangalore**with Prof. Shankar Kumar Selvaraja.
Project details: Silicon, Germanium and SiN photonic structure for realization of on-chip spectral filters, sensor,photodetectorsfor integrated photonic applications. Realization of guided mode resonator-based coherent, high-brightness sources using 2-D transition metal dichalcogenides and/orquantum dots as gain medium. High Q-factor cavity engineeringin silicon photonic crystals for photodetection and sensing applications.Development of Laser Interference lithography (LIL) for large area photonic fabrication, E-beam lithography and RIE-F for fabricating photonic nanostructures for on-chip device applications.

Outcome: *Planarmetasurfaceresonators for narrowband reflectors and platform for enhanced light-matter application.*

February 2020-May 2020: Postdoctoral research associate at **Rochester Institute of Technology**, United States with Professor Jie Qiao.

Project details: Ultrafast laser writing of waveguides in Nd-YAG and Lithium niobate crystals for photonic and remote sensing applications. Study of femtosecond laser-material interaction for welding of optical components for integrated photonic applications.

April 2018 –February 2020: Postdoctoral research associate at **University of Pittsburgh**,

United States with Prof. Sanford Asher, in Asher Research Group.
Project details: Fabrication ofsolid, deep ultraviolet diffracting photonic crystals aswavelength selective devices for the development of a "deep ultraviolet Raman imaging spectrometers for trace explosive detection". A detailed analysis and exploitation of photonic band structure, crystal symmetry and diffraction of these wavelength selective devices for the development of deep UV optical elements for spectroscopic application.
Outcome: *Realized the best reported deep-UV reflecting photonic crystal filter using a thin-film silica photonic crystal structure.*

January 2018-April 2018: Research associate at **IIT Delhi**, India, with Prof. Joby Joseph in the Photonics Research Lab.
Project details: Fabrication of polymer grating structures using Laser Interference Lithography and their structural and optical characterization. Microstructure characterization of gratings using scanning electron microscope imaging technique.

2011 December - 2017 November: PhD Physics, Department of Physics, **IIT Kanpur**, India.
Thesis supervisor: Professor R. Vijaya.
Dissertation title, *"Localized surface plasmon resonance effects on the optical properties of metal-dielectric photonic crystals".*
May 2009-July 2009: Summer Training in Physics on "X-Ray diffraction analysis of some inorganic compounds by Rietveld refinement method", **IGCAR Kalpakkam,**Tamilnadu, India.

List of publication in peer reviewed international journals:

1. **Dipak Rout**, Venkatachalam P, Radhakant Singh, Shreelashmi KP, Shankar Kumar Selvaraja. "Guided *resonance aided polarization insensitive in-plane spectral filter for on-chip spectrometer,*" Optics letters, Vol. 47, 4704-4707*(*2022).
2. **Dipak Rout**, Govind Kumar, and R. Vijaya, "Concurrent deep UV diffraction enabled by Bragg condition and crystal symmetry of silica inverse opals," J. Phys D Appl. Phys.Vol. 54, 125104 (2021).
3. **Dipak Rout***, Ivan G. Pallares*, Thomas Deering, Kyle Hufziger, Sergei Bykov, and Sanford A. Asher, "Colloidal self-assembly of highly-ordered silica inverse opals for deep ultraviolet diffraction," ACS Appl. Nano Mater. Vol. 3, 4135-4146 (2020).(* equal contribution)
4. **Dipak Rout*,** Govind Kumar*, and R. Vijaya, *"Interplay of dual photonic stopband in fluorescence enhancement from dye-doped photonic crystal hetero-structures,"* J. nanophoton. Vol. 13, 046005 (2019). (* equal contribution)
5. Sravya Rao, Rahul Shaw, **Dipak Rout**, Govind Kumar, R. Vijaya, and Shilpi Gupta, "*Diffraction imaging of cracks in self-assembled photonic crystals*" Optical Materials Vol. **91**, 189-194 (2019).
6. **Dipak Rout**, Govind Kumar and R. Vijaya, "*Amplified emission and modified spectral features in an opal hetero-structure mediated by passive defect mode localization*," J. Phys. D Appl. Phys., Vol. **51**, 015112 (2018).
7. **Dipak Rout** and R. Vijaya, "*Role of stopband and localized surface plasmon resonance in Raman scattering from metallo-dielectric photonic crystals*," Plasmonics, Vol. **12**, 1409-1416 (2017).

8. **Dipak Rout** and R. Vijaya, "*Localized surface plasmon-influenced fluorescence decay in dye-doped metallo-dielectric opals*," J. Appl. Phys., Vol. **119**, 023108 -1-5 (2016).
9. **Dipak Rout** and R. Vijaya, "*Plasmonic resonance-induced effects on stopband and emission characteristics of dye-doped opals*," Plasmonics, Vol. **10,** 713-719 (2015).

Publications in International Conferences (Proceedings):

1. "Dye integrated planar guided mode resonators for on-chip high-brightness source," CLEO Europe 2023, Munich, Sushma Gali, Dipak Rout, Venkatachalam P,Shankar Kumar Selvaraja
2. "Near-IR detection using Photothermal Actuation of Guided-Mode Resonance MEMS Structures in Germanium," CLEO Europe 2023, Munich, Pavithra Rao, Dipak Rout, Shankar Kumar Selvaraja
3. "Guided mode resonance aided in-plane color filters for compact spectrometer," CLEO PacificRim, 31st July-6th August 2022, at Sapporo Japan, **Dipak Rout**, Venkatachalam P, Radhakant Singh, Shreelakshmi KP, Shankar Kumar Selvaraja.
4. "Diffraction imaging of self- assembled photonic crystals"Frontiers in Optics/Laser Science 2019 Washington DC, USA, Sravya Rao, Rahul Shaw, **Dipak Rout**, Govind Kumar, R Vijaya, Shilpi Gupta.
5. "Deep UV resonance Raman spectroscopy for stand-off detection,"UV and High Energy Photonics: From Materials to Application 2019, San Diego, California, USA, Sergei V Bykov, Kyle T Hufziger, Ryan D Roppel, **Dipak Rout**, Ivan G Pallares, Ryan S Jakubek, Sanford A Asher.
6. "Enhancement and spectral narrowing of emission from photonic crystal hetero-structure mediated by band edge modes," Advanced Photonic Congress-2017, Louisiana, New Orleans, USA, Govind Kumar, **Dipak Rout** and R. Vijaya. (Oral presentation)
7. "Optical study of defects in self-assembled three-dimensional photonic crystals" The International Conference on Fiber Optics and Photonics - PHOTONICS 2016, IIT Kanpur, Rahul Shaw, **Dipak Rout**, R. Vijaya and Shilpi Gupta. (Poster presentation)
8. "Dye emission in an opal hetero-structure mediated by plasmonic absorption and defect mode localization" The International Conference on Fiber Optics and Photonics - PHOTONICS 2016, IIT Kanpur, **Dipak Rout** and R. Vijaya. (Poster presentation)
9. "Localized Surface Plasmon Effect on Fluorescence Lifetime in Photonic Crystals," The 9th International Conference on Nanophotonics - ICNP 2016, Taiwan, **Dipak Rout** and R. Vijaya. (Poster presentation)
10. "Effect of localized surface plasmon on fluorescence lifetime in dye doped metallo-dielectric opals," 3rd Annual International Conference in Optoelectronics Photonics and Applied Physics - OPAP 2016, Singapore, **Dipak Rout** and R. Vijaya. (Selected for oral presentation but could not present)
11. "Raman scattering from metallo-dielectric opals influenced by surface plasmons and stopband features," Workshop on Recent Advances in Photonics - WRAP 2015, IISc Bangalore, **Dipak Rout** and R. Vijaya. (Poster presentation)
12. "Gold Assisted Plasmonic Resonance in Polymeric Opals," The International Conference on Fiber Optics and Photonics - PHOTONICS 2014, IIT Kharagpur, **Dipak Rout** and R.

Vijaya. (Poster presentation)

13. "Optical properties of silver coated polymeric opals," International Conference on Optics & Optoelectronics - ICOL 2014, IRDE Dehradun,**Dipak Rout** and R. Vijaya. (Oral presentation)

Courses Taught at Govt. College Sundargarh:

1. **Wave and Optics (UG 2nd Sem.)**
2. **Mathematical Physics (UG 1st Sem.)**
3. **Quantum Mechanics (UG 5th Sem.)**
4. **Nanomaterials and application (UG 6th Sem.)**
5. **Quantum Mechanics I (PHY 412, M. Sc. 1st Sem.)**
6. **Quantum Mechanics II (PHY 422, M. Sc. 2nd Sem.)**
7. **IDC (429, Open elective course, M.Sc. 2nd Sem.)**
8. **Condensed matter Physics (PHY 512, M. Sc. 3rd Sem.)**
9. **X-Ray and Laser Spectroscopy (PHY 513, M. Sc.3rd Sem.)**

Expertise:I have hands-on training in following techniques.

Nanofabrication methods:

Structured material fabrication by self-assembly, soft lithography, nano-imprint lithography, patterning,Laser Interference Lithography, E-beam lithography, spin coating method,RIE-F for dry etchingand Bragg stackand reflective coatings fabricationby DC and RF sputtering,thermal evaporation, PECVD and e-beam evaporation techniques.

Experimental Characterization:

Expert in experimental optics, free-space optics, spectroscopy, Raman spectroscopy, Nd:YAG laser for laser induced emission studies,He-Ne laser, Ar^+ ion laser and semiconductor diode lasers, optical microscopy, field emission scanning electron microscopy (JEOL, ZEISS), atomic force microscopy, spectrofluorometer (or PL spectrometer), UV-Vis-NIR spectrophotometer, time co-related single photon counting (TCSPC) system to measure the decay time, Grating-based fiber integratedspectrometers. I set-upinhouse optical/spectroscopy experiments using lamp monochromator, laser sources, grating/prism spectrometers etc. to characterize my samples.

Computational skills:Lumerical (FDTD) and R-Soft (Synopsis) for simulation. Origin and Excel for plotting and data analysis.
