

Academic Profile

Dr. Banoj Kumar Nayak

Assistant Professor in Physics (OES-I),
Binayak Acharya Degree College,
Berhampur, Odisha-760006,
Department of Higher Education, Govt. of Odisha.
Email: banoj29@gmail.com



Academic Qualifications/Experience

- **Post-doctoral Research Fellow:** Technion-Israel Institute of Technology, Haifa, Israel
(May 2021- March 2023)
Specialization: Optical-microwave interaction, magnonics, fiber loop laser.
- **PhD (Physics):** Tata Institute of Fundamental Research, Mumbai
(August 2014- February 2021)
Specialization: Plasmonics, nano-photonics, ultrafast optics and spectroscopy
PhD Thesis Title: “Light-matter interaction in plasmonic and photonic structures”
- **MSc (Physics) (Through Integrated MSc Programme):** National Institute of Technology, Rourkela (2012-2014)
- **BSc (Physics Honours):** National Institute of Technology, Rourkela (2009-2012)
- **Intermediate Science (+2):** College of Basic Sciences and Humanities, OUAT, Bhubaneswar (2007-2009)

Awards/ Achievements

- Got awarded Junior Research Fellowship and Eligibility of Lectureship by Council of Scientific & Industrial Research, India (CSIR) in 2014 by qualifying National level NET exam.

- Qualified National level GATE exam in 2014 with all India rank (AIR) of 04 in the discipline of Physics. Also, qualified National level JEST and TIFR GS exam in 2014 prior to my admission in PhD programme in Physics.
- Obtained merit scholarship for pursuing Masters in Physics by qualifying an exam conducted by Institute of Mathematics, Bhubaneswar, India.

Research Interest

My research areas of interest are plasmonics, nano-photonics, ultrafast optics and spectroscopy, magnonics, optical-microwave interaction, and fiber loop laser.

Work Experience

PhD work experience: I am well trained on nanofabrication tools including electron beam lithography followed by wet and dry etching techniques. I have fabricated both photonic and plasmonic structures by electron-beam lithography. I can design and optimize these devices for confining light in them over a specific wavelength range using FDTD Lumerical software. I have experience of working with ultrafast lasers and ultrahigh vacuum. I have knowledge of programming, data collection and data analysis/modelling using MATLAB.

I have setup a time-resolved 2-colour pump-probe setup to study ultrafast optical spectroscopy of plasmonic and photonic nanostructures using high power femtosecond laser. I have experience in setting up spatially resolved spectroscopic measurements like micro-photoluminescence spectroscopy on nanostructures in optical domain at room temperature as well as at cryogenic temperature using cryostat with ultrahigh vacuum. I have further performed time correlation measurements for single photon detection. Apart from that I have performed optical measurements like optical transmission, reflection and near-field scanning optical microscopy.

Postdoc work experience: I have worked on ferrimagnetic sphere resonator (FSR) strongly coupled to a microwave loop gap resonator and studied optical detection of magnetic resonance of the microwave-coupled FSR with light in telecom band. We have shown that the FSR can behave as microwave-optical interface at room temperature which is essential for quantum information processing. I have demonstrated that the FSR can be used as polarization-selective optical modulator in telecom band through magneto-optical coupling. Further, I have worked on designing and constructing a figure-8 fibre loop laser and have investigated the tunability of its degree of polarization. I have experience of experimental techniques like optical fibre splicing, coupling light with FSR through optical fibre, reflectivity and transmittivity measurement in microwave domain using vector network analyser, optical fibre-based high resolution spectroscopic measurement in telecom band, lock-in detection technique etc. Further, I can design and optimize a microwave loop gap resonator through simulation.

List of Journal Publications

1. Banoj Kumar Nayak, Cijy Mathai, Dekel Meirom, Oleg Shtempluck, Eyal Buks, “**Optical interface for a magnon-photon resonator**”, *Appl. Phys. Lett.* 120, 062404 (2022).
2. Eyal Buks, Banoj Kumar Nayak, “**Quantum measurement with recycled photons**”, *Phys. Rev. B* 105, 014421 (2022).
3. Banoj Kumar Nayak, Eyal Buks, “**Polarization-selective magneto-optical modulation**”, *J. Appl. Phys.* 132, 193905 (2022).
4. Banoj Kumar Nayak, Cijy Mathai, Dmitry Panna, Eyal Buks, “**Tunable degree of polarization in a figure-8 fiber laser**”, *AIP Advances* 12, 095120 (2022).
5. Banoj Kumar Nayak, S.S. Prabhu, Venu Gopal Achanta, “**Hot carrier dynamics in a dispersionless plasmonic system**”, *J. Appl. Phys.* 126, 213105 (2019).
6. Richa Goyal, Banoj Kumar Nayak, Ashwin Tulapurkar, Venu Gopal Achanta, “**Photonic crystal based 2/3/6- way optical splitter and demultiplexer**”, *Front. Phys.* 6, 152 (2019).

List of Conference Publications

1. Banoj Kumar Nayak, Cijy Mathai, Oleg Shtempluck, Eyal Buks, “**Interaction of microwave coupled ferrimagnetic sphere with figure-8 laser**”, *IEEE International Conference on Microwaves, Antennas, Communications and Electronic Systems, Tel Aviv, Israel, Nov. 2021*.
2. Richa Goel, Banoj Kumar Nayak, Somendu Maurya, Ashwin Tulapurkar, Venu Gopal Achanta, “**Photonic crystal microcavities with Quantum dot defect: Towards quantum information processing**”, *International conference on fiber optics and photonics 2016, OSA 2016, IIT Kanpur, India, 2016*.
3. Banoj Kumar Nayak, Shriganesh Prabhu, Venu Gopal Achanta, “**2-colour pump-probe setup and carrier dynamics study**”, *OSI- International Symposium on Optics 2018, IIT Kanpur, India, Sept.19-22, 2018*.
4. Dipa Ghindani, Arkabrata Bhattacharya, Sumayya Samad, Banoj Nayak, Amit P. Shah, A. Azizur Rahman, Arnab Bhattacharya, S. S. Prabhu, “**Towards Bandwidth-enhanced GaN-based Terahertz Photoconductive Antennas**”, *2019 44th International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), Paris, France, Sept. 2019*.

Other Conference Proceedings and presentations

1. Banoj Kumar Nayak, Shriganesh Prabhu, Venu Gopal Achanta, “Hot carrier dynamics in plasmonic quasiperiodic structure”, Global Nanophotonics conference 2018, *TIFR Mumbai, India, Dec. 9-11, 2018*.
2. Banoj Kumar Nayak, Venu Gopal Achanta, “Sub-100fsec interaction with plasmonic systems”, Proc. of Time-resolved studies of dynamics in advanced materials, Coorg, India, Feb.24-28, 2019.
3. Banoj Kumar Nayak, Aman Agrawal, Shilpa Samdani, Ch. Nageswara Rao, Venkata Jayasurya Yallapragada, Ajith P Ravishankar, Sachin Kasture and Venu Gopal Achanta, “Plasmon induced hot carrier dynamics”, *Proc. of Photonics 2018, IITD, Delhi, India, Dec.2018*.
4. Banoj Kumar Nayak, Richa Goel, Venu Gopal Achanta, “Optical studies of photonic crystal cavity”, *Photonic crystal symposium, IIT Kanpur, India, sept.21-23, 2017*.
5. Banoj Kumar Nayak, Richa Goel, Somendu Maurya, Ashwin Tulapurkar, Venu Gopal Achanta, “Photonic crystal (PhC) cavity arrays”, *Global Nanophotonics conference 2016, Osaka University, Osaka, Japan, Nov.30-Dec.1, 2016*.