VARUN JOSHI

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EDUCATION

Integrated M.Sc. Physics	**UM-DAE Centre for Excellence in Basic Sciences, Mumbai**	12/2020 - Present
Senior Secondary School	**Lakes International School, Bhimtal**	2017 - 2019

RESEARCH EXPERIENCE

Mapping critical density surface of plasma mirrors from wavefront measurements
02/2025 - 05/2025

Prof. G Ravindra Kumar, TIFR Mumbai

Aimed at recording curvature in the critical density surface of hot-dense plasma generated by an intense femtosecond laser

- An achromatic lateral shearing interferometer is used to record curvatures in the laser-generated dense plasma.
- Modulations in critical density surface are captured in two ways- Pump Probe measurement and reflected pump measurement.
- The former provides a time-evolution picture and the latter records effects of phenomena occurring within pulse duration.

Ultrafast diagnostics of a plasma generated by an ultrashort, intense laser
06/2024 - 11/2024

Prof. G Ravindra Kumar, TIFR Mumbai

There were 2 broad themes: **Doppler spectroscopy** to measure plasma velocity and **wavefront analysis** for surface characterization.
- Pump-Probe Doppler spectroscopy provides a means to understand **shock propagation** at picosecond timescales.
- Wavefront analysis of reflected pump shows **curvature of the plasma surface** within the pulse duration.

Plasma heating by counter-propagating laser pulses (PIC Simulation)
01/2024 - 05/2024

Dr. Bhooshan Paradkar, CEBS Mumbai

Aimed at studying the effect of using counter-propagating laser pulses on heating of electrons a plasma

- Used AGASTHII-2D PIC code for **modelling of electron heating** in a relativistically under-dense plasma
- Used counter-propagating pulses **to emulate** the interaction of the incident pulse with its **reflection**
- Conducted parametric studies to explore the dependence of heating on laser intensity and configuration

Statistical Physics in Biology
08/2023 - 11/2023

Prof. SR Jain, CEBS Mumbai

Conducted literature review on statistical physics applications in biology.

- Explored **non-equilibrium statistical physics** in biological systems, focusing on **cell cycle dynamics** and **circadian rhythms**
- Applied **landscape and flux theory** to model stochastic gene regulatory networks
- Used **Markovian models** and **Fokker-Planck equations** to study cellular transport and biochemical reactions

WORKSHOPS

Winter School on intense Laser Sciences (WiSILS)
Jodhpur, India (12/2024) (🔗)

Attended a one week school with lectures and tutorials on the basics of laser-plasma interaction and current research in the field.

13th Asian Symposium on Intense Laser Sciences (ASILS-13)
Udaipur, India (12/2024)(🔗)

Had the opportunity to interact with experts at the international conference on recent advances in intense laser physics.

AWARDS

DAE DISHA Scholarship
12/2020 - 05/2025

I was awarded the DISHA scholarship of the Department of Atomic Energy upon qualifying the NEST exam.

SKILLS

Laboratory Skills Vacuum chambers (with scroll and turbo pumps), optical instrumentation (spectrometers, alignment of optics etc)

Experimental Techniques Ultrafast diagnostics (Pump-Probe Method), Z-scan

Software Python (NumPy, SciPy, Matplotlib), GNU/Linux, LaTeX

Relevant courses attended Ultrafast Optics, Plasma Physics (ongoing), EM-I & II, Atomic & Molecular Physics, Fluid Mechanics, Modern trends in Optics (ongoing; scattering and metamaterials discussed)

POSITIONS OF RESPONSIBILITY

Student Coordinator — CBS Science Club
02/2023 - Present

CBS Science Club is a student organization that aims to foster a healthy environment for scientific discussions. I have the following roles:

- To coordinate the planning and curation of interaction sessions and talks with researchers and students
- Management of expenses for the club's activities

REFERENCES

Prof. G Ravindra Kumar
grk@tifr.res.in

Dr. Bhooshan Paradkar
bhooshan.paradkar@cbs.ac.in