# An Infra-red Free Electron Laser based User Facility for Scientific Research

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The **I**nfra-**R**ed **F**ree **E**lectron **L**aser (IR-FEL) at RRCAT delivers continuously tunable IR radiation in the 12.5 - 50 µm wavelength range with a maximum peak power > 3 MW and CW average power > 7 mW at ~ 20 µm wavelength at the two experimental stations presently commissioned. This translates to a peak Spectral Brightness > $10^{17}$ photons/s/mm$^2$/mrad$^2$/0.1% BW and micro-pulse energy > 20 mJ in 10 ps pulses repeating at 29.75 MHz at the user stations over a wavelength range from 15 - 25 µm, with a typical measured spectral width ~1.4 % at 22.7 µm wavelength. Good stability and repeatability of operation of the machine has been achieved.

Six user ports have been built with two experimental stations presently commissioned serving users primarily from the condensed matter physics community. One more experimental station for IR irradiation studies is presently under development. Two ports for time domain studies will be developed in the near future to facilitate FEL pump - Optical probe and FEL pump - THz probe spectroscopy experiments.

The talk will cover salient aspects of the features of the IR-FEL and its user facilities at RRCAT.

FELs are a bridge between accelerators and lasers, and the talk will also give a brief overview of the Accelerator S&T related activities being pursued in different institutes of the Department of Atomic Energy, in line with the Mega Science Vision Document 2025 for Accelerator S&T and Applications, and DAE's Amritkal Vision Document.

**Brief Biosketch:**

Kamal Kumar Pant

M. Sc. Physics from the University of Roorkee (now IIT Roorkee)

Ph.D. in Theoretical Plasma Physics from IIT Delhi

Joined RRCAT in 1997 and began working on the design and development of linac structures and injector systems for FEL applications

Scientific team leader of the IR-FEL facility at RRCAT, the first operational FEL based facility in the country.