From the Director's Desk...

It is my privilege to bring to you this issue of RRCAT Newsletter, highlighting the progress made by the Centre during July 2020 – December 2020. The vibrant activities of the Centre, which had been brought to standstill due to the nationwide lockdown till May 2020, to prevent the spread of COVID-19 diseases, were brought back to pace during this period, following the COVID-19 protection guidelines. The editorial team has worked meticulously to present to you fair glimpses of the progres made since then.

After restart of operations of the national facility of indigenous synchrotron radiation sources Indus-1 and Indus-2 by the end of June 2020, the facility has been operated in two-shift mode on 71 days, and in the round-the-clock mode on 98 days, till December 2020.The beam lifetime in both the machines recovered quickly to pre-lockdown values, and were further improved to 93 hours 9 min for Indus-2 (measured at 100 mA @ 2.5 GeV), and more than 9 hours in Indus-1 (measured at 100 mA @ 450 MeV), which is the best beam lifetime achieved so far in both the machines. Several upgrades in Indus-2, such as replacement of the ageing power converters of TL-2 steering coils with new ones based on switch-mode design, took place during this period. In addition, several new systems, such as a supervisory control system for beam based alignment, and a high speed data acquisition and processing platform for beam position indicators have been developed and installed.

Using Indus-1 and Indus-2 accelerators, 345 user experiments were performed, and few users from the industry continued to use the EXAFS and XRD beamlines for their R&D programmes. Based on the user experiments, nearly 75 research papers were published in peer reviewed journals during the report period of this issue of Newsletter. One of these publications is on the studies on x-ray response of the solar x-ray monitor used in the Chandrayaan-2 Orbiter, that were carried out at the Indus beamlines.

Towards the efforts to develop the advanced technology of H^- linac, a notable progress has been made by successful development and testing of a 150 kW pulse solid state amplifier at pulse repetition rate of 50 Hz, which will be used to power the 3 MeV RFQ accelerator under development. Technology transfer has taken place for high power (2 kW average and 3 kW pulsed) RF amplifier modules, and also for three types of co-axial to N-type transitions, which are important components that are required for the development of a solid state power amplifier. An Indian patent has been granted on the in-house developed technique of laser welding of niobium superconducting radio frequency cavities.

Laudable progress has been made towards development of different kinds of lasers for various useful applications. A 4.5 W average power intra-cavity frequency doubled Nd: YVO_4 green laser, pumped using 880 nm diode laser, has been developed that can be used for pumping of Ti: Sapphire laser. Generation of more than 100 W of CW output power at 1940 nm from an all-fiber oscillator configuration has been demonstrated, which has possible medical applications. On the front of development of narrow line width laser for various applications, a 1 W all-fiber amplifier system has been developed, which amplifies the 10 mW power of a narrow line width (~800 kHz) seed laser diode at 1550 nm in master oscillator power amplifier (MOPA) configuration. Remarkable progress has been made in the direction of utilizing a laser plasma source for time resolved XRD, where the XRD pattern of Si powder sample has been successfully recorded, using the pulsed x-ray from the laser plasma source generated by 50 fs, kHz rep. rate Ti: Sapphire laser. On the front of development of diode lasers and photodetectors, interesting and useful studies have been performed to understand the role of magnetic field in improving the efficiency and tunability of semiconductor quantum-well based structures, at cryogenic as well as elevated temperatures, which is nicely described in a *Theme Article*.

Important achievements have been made on extending the R&D activities carried out at the Centre for societal applications. UV-C based area sanitization device “NeelBhasmi” has been developed to inactivate various microorganisms, including corona viruses and its technology has been transferred to Indian industries. Efficacy of the device has been confirmed by ICMR approved laboratory. The Fiber Bragg Grating (FBG) sensors developed at RRCAT have been validated for various important applications, such as the wheel impact load detection system for railway safety, and the temperature monitoring system for the Glove Box of Fuel Recycling Chamber at BARC, Tarapur, which are comprehensively described in one of the *Theme Articles*.

Scientific activities carried out at the Centre have resulted into 106 publications in peer reviewed journals, and several publications in conference proceedings, during this period. Incubation Centre at RRCAT has been inaugurated by Chairman, AEC, on 30 Oct. 2020, which has started functioning, with an aim to incubate the technologies developed at RRCAT. Training of the second batch of Trade and Apprenticeship Scheme at RRCAT (TASAR) has been completed, and training of the third batch has started.

My hearty congratulations to those who have been awarded the Ph. D. degree by HBNI, and to the winner of Best Thesis Award during July – December 2020. It is heartening to note that RRCAT bagged the 1st Rank in Indore Swachhta Ranking, under Swachh Survekshan 2021, and was awarded for "Cleanest colony of city under zero waste campus category".

I sincerely express my appreciation to Chairman, convener and members of the Editorial Board in showcasing a wide spectrum of activities of our Centre, and bringing out this issue of Newsletter.

August 18, 2021

S. V. Nakhe
Director