



From the Director's Desk...

It is a pleasure to note that the second issue of RRCAT Newsletter for 2017 is ready for publication. This issue reports on a number of significant advances the Centre has made in the first half of 2017.

Both, Indus-1 and Indus-2 Synchrotron Radiation Sources continue to operate on the round-the-clock basis. Simultaneously, efforts are also going on to upgrade and improve the systems which have been continuously in operation for over two decades. Recently, two such major upgradations have been accomplished in Indus Accelerator Complex, namely, installation and commissioning of new 20 MeV microtron with improved features, and upgradation of the Transport Line – 1 (TL-1) from microtron to the booster synchrotron. Besides having new vacuum beam pipes and additional pumps, the new TL-1 has several diagnostic devices of different types, thereby providing enhanced diagnostic capabilities. Indus facility has been operational for more than 1000 hours in the round-the-clock mode with the new microtron and TL-1. The measurement of energy spread in the electron beam coming out of the microtron has been carried out using a branch-line in new TL-1, which is useful for optimization of the transport line. The betatron tune feedback system in Indus-2 has been enhanced, due to which the correction rate is increased by a factor of 10. A variety of investigations are being carried out by the researchers on Indus-1 and Indus-2 beamlines. Electronic and crystal structure of PrGe has been studied using AIPES beamline (BL-2 of Indus-1) and ADXRD beamline (BL-12 of Indus-2). Superconducting RF cavities and the driving RF sources are essential elements for the development of proton accelerators required for DAE's long term programmes such as Spallation Neutron Source. As a part of continued efforts in this direction, a 650 MHz superconducting five-cell RF cavity with $\beta=0.92$ has been recently fabricated and its RF measurements and vacuum leak testing have been completed. Similarly, a 650 MHz solid-state amplifier has been developed to power the superconducting cavities. Both the developments are also deliverables to Fermilab under the Indian Institution Fermilab Collaboration. The Centre is also committed to the linac-based Agricultural Radiation Processing Facility at Indore, for which various sub-systems are being developed and deployed.

In the areas of lasers, our Centre has done significant contributions in developing laser equipment and procedures for nuclear reactor related applications. An indigenously developed remotely operable laser cutting technique, using a home-built 300 W average power pulsed Nd:YAG laser, was deployed successfully in KAPS-1 reactor for cutting of liner tube and the end fitting from inside of the tubes, which was otherwise a difficult task using conventional methods due to various obstructions. Similarly, 603 bellow lip weld joints have been cut with refined tool design and safety interlocks during the *en masse* coolant channel replacement of KAPS-2 reactor. Non-contact inspection and metrology of the mixed carbide fuel for the FBTR fuel pin has been carried out using indigenously built optical inspection systems. Laser shock peening experiments have been performed on specimens of type 316L SS with an indigenously developed Nd:YAG laser. Synthesis of spherical and triangular silver nanoparticles has been successfully carried out using laser ablation. The Newsletter also covers spatially-offset fluorescence spectroscopy (SOFS) technique of depth-sensitive fluorescence spectroscopy for non-destructive sub-surface interrogation of layered turbid samples, and studies on gold nanorods with various polyelectrolyte coatings for cancer cell death and bacterial inactivation.

A theme article on the development and commissioning of indigenously developed 505.8 MHz normal conducting RF cavity in Indus-2 narrates the challenges in the path of this important achievement towards the self-reliance in key technologies. The second theme article gives an overview of laser interferometric gravitational-wave observatory (LIGO) and outlines RRCAT's role/contribution in the LIGO-India project. A new project has been sanctioned recently to carry out various activities for the LIGO-India project at RRCAT. Studies on incorporating artificial intelligence concepts for future accelerator control systems are presented in the third theme article.

In the end, I compliment the new Newsletter Editorial Board members for their dedicated efforts in showcasing a wide spectrum of activities of our Centre, and also for bringing out the Newsletter in time.

With best wishes,

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(P. A. Naik)
Director