# Advertisement for Research Associate (RA) position

| Project CODE: FT-TOKAMAK-0003/RA/2026 | | |
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| 1 | Title of the Project | Temporal runaway electron study for high temperature tokamak plasma. |
| 2 | Domain Area | Theory / Experiment |
| 3 | Project Category as found relevant | Plasma Diagnostics; Tokamak devices; |
| 4 | Desirable Qualification/Experience required for the post: | Ph.D Experimental plasma physics /Nuclear physics).<br><br>Acquaintance with GEANT4<br><br>Experience in operating the X-ray detectors and associated electronics. |
| 5 | Brief Summary about the Project | The electrons in the tail region of the electron velocity distribution in tokamak plasma are referred to as runaway electrons (RE). The RE experience unlimited acceleration due to a minimal momentum transfer cross-section and therefore hold extremely high energies. Under favorable conditions, the RE overwhelm the magnetic confinement, escape the magnetic cage, and interact with the plasma-facing components (PFCs), the tokamak armor, and the vacuum vessel wall. This interaction generates a lot of Hard X-rays (HX). This interaction results in the loss of the RE energy to these entities, and eventually, the electron is lost. The presence of RE is observed at different stages of the tokamak discharge duration and found to have different amounts of energy and characteristics. Hence, it is clear that the RE- PFC, tokamak armor, and vacuum vessel wall interaction can take place at any point in time in the discharge duration. Considering the possible RE energy (as high as ~100 MeV), the PFC, tokamak armor, and vacuum vessel wall are subjected to a substantial amount of energy deposition. Hence, the study of RE dynamics is very important.<br><br>The RE can not be measured directly however, they are being studied by measuring the HX emissions while accelerating or retarding. |

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| | | Traditionally, these emissions are studied as the total HX power emitted in the temporal space for tokamak correlation studies. Recent developments in fast detector technologies and the processing electronics have enabled HX spectroscopy for the tokamak plasma to pick up. The key objectives of HX spectroscopy are to understand the modification of the RE energy and its impact on the plasma performance. The temporal evolution of the HX spectra gives important insight into the RE behavior of the tokamak plasma.<br><br>The ADITYA-U, an SST-1 tokamak, operates a LaBr scintillation detector-based HX spectrometer that gives the temporal evolution of the HX spectrum for any given discharge. The crystal is 1.5 x 1.5 inches coupled by a fast PMT and processing electronics. The associated software logs the HX –detector interaction into a temporally stamped event list with 250 kcps capability. In both tokamaks, the HX spectrometer is viewing the plasma tangentially which limiter in the field of view, considering the fact that most of the HX are emanating from the limiter or the plasma-facing components.<br><br>The HX spectra measured from the tokamak plasma experiment represent the HX emission observed within the given field of view. And integrated over individual HX spectra generated by the individual RE. Hence, the direct RE distribution is still unknown. The RE distribution is one of the key pieces of information that is required for better understanding the RE dynamics within the plasma at a given time. The reconstruction of the RE distribution from the measured HX spectra is the objective of this project.<br><br>The researcher is expected to analyze the obtained HX spectra from the two tokamak experimental datasets and reconstruct the RE distribution function. This task will require the generation of the detector response matrix by |

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| | | monti-carlo simulations, which is then processed computationally to reconstruct the RE distribution function. |
| 6 | Any other information/remarks | - |