Seminar

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Institute for Plasma Research

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Title: Spectroscopy of highly charged ions significant to astrophysics and laboratory plasma diagnostic studies

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Date: 31st March 2023 (Friday)

Time: 03:30 PM

Venue: Join the meeting online:
https://meet.ipr.res.in/join/4586593295?be_auth=MjEwMjI5
(Conference ID: 4586593295; Password: 210229)

Abstract

Highly charged ions (HCIs) are abundantly found in astrophysical bodies from solar corona to active galactic nuclei. Historically, the proper identification of these ions is carried out by atomic spectroscopic techniques. As each ion or particular charge state of an element present in astrophysical bodies has a fingerprint spectrum, thus the observed emission spectra can be used to know the appropriate elemental abundance and existing plasma environments of such astrophysical bodies under observation. These astrophysical spectroscopic studies not only add to our knowledge of unknown and extreme phenomena present in outer space but also open the door to do better laboratory plasma diagnostic studies indispensable for plasma fusion reactors, ion sources and ion thrusters etc. The basis of all these studies is atomic spectroscopy, which is primarily done by both experimental observations and large scale calculations using the most sophisticated theories in atomic physics. The talk here consists of a brief introduction and results of the theoretical atomic structure calculations performed during my thesis work. The ion species and charge states were carefully selected in a way that the computed data will be useful for both astrophysical observations and laboratory plasma diagnostic research. For example, the K-shell and L-shell spectra of different HCIs under study in the thesis are prominently observed in solar coronae and other astrophysical sources. Further, these spectres host well studied line intensity ratios which are being used for plasma diagnostics of both astrophysical & laboratory plasma conditions. Next, in pursuit of evaluating the most reliable atomic data during the study, all the important relativistic and Quantum Electrodynamic (QED) corrections were also evaluated. Further, a brief study has been carried out on the impact of relativistic and QED effects on important emission lines which are used in plasma diagnostic studies. In the final phase of the work, the generated atomic data was used to calculate key plasma parameters such as electron temperature and electron number density by utilizing the important line intensity ratios.