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Study of Metastable Transitions in He- & Li-like Fe Relevant to Astrophysics

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Precision spectroscopy of highly charged ions provides a powerful tool to study many unexplored realms of physics, shedding light on many astrophysical, quantum electrodynamic, atomic collision and spectroscopic mysteries. X-ray spectra of various supernova remnants, obtained by ASCA and Suzaku observatories provided conclusive evidence of H- and He-like Si, S, Ar, Ca and Fe ions[1]. The x-rays of H-, He- and Li-like Fe have been observed in solar flares and studied with tokmak plasmas. The transition energies and lifetime measurement provide a testing ground for understanding of wave function of atomic systems.

Beam-foil spectroscopic technique is one of the most elegant tools to study highly charged ions for the measurement of both transition energies and lifetime. However this technique suffers from inherent cascading and blending problem. If the level under study is repopulated by the decay of higher levels, then this is called cascading effect. Cascading problem is inherent to BFS, and hence independent of detectors spectral resolution. On the other hand the presence of nearby transitions (below the detector resolution i.e. ~150 eV at 5.9 keV) in same ion species causes intra-ion blending, where as similar transitions from neighbouring ion species give rise to inter-ion blending also called satellite blending. In contrast to the problem imposed by cascading effect, intra-ion and inter-ion blending effect imposes problem due to experimental limit of detector resolution. To eradicate this problem, we have designed and developed high resolution multi channel Doppler tuned spectrometer (MCDTS) setup coupled with high precision foil movement system at IUAC New Delhi [2].

A beam of 165 MeV 56Fe12+ ions from the 15 UD Pelletron accelerator at IUAC, New Delhi was used in this experiment. When a well focussed beam interacts with 100 μg/cm2 thin Carbon foil, various electron stripping and capture process take place, which produce the excited H-, He- and Li-like Fe ions. We have resolved the 1s2s 3S1 – 1s2 1S0 (M1) transition in He-like Fe from its satellite 1s2s2p 4P05/2 – 1s22s 2S1/2 (M2) transition in Li-like Fe with reasonably high precision by using MCDTS setup energetically, obtained to be 6636.0 ± 4.3 eV and 6619.9 ± 5.4 eV, respectively. Further the lifetime of 1s2s2p 4P05/2 level has been measured with high precision foil-movement system, comes out to be 76 ± 1.7 ps. The details of such measurements along with setup will be presented.

Keyword: Highly Charged Ions, x-ray, Metastable Transitions, Doppler Tuned Spectrometer

References

[1] D. F. Gonzlez et. al. Astrophysics J. Lett. 781, L26 (2014).
[2] Ranjeet K. Karn et. al. Rev. of Sci. Instrum. 85, 066108 (2014).

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