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Double KK excited states in highly charged sulphur

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Synopsis Calculation of energies and radiative decays was performed for several highly charge states of sulphur in order to identify experimental lines associated to double excited KK atomic states.

Double KK excited states have several important applications in astrophysics as well as in plasma diagnostics [1, 2]. Besides its applicability, the fundamental interest of dominance of fluorescence over autoionization decay for some KK excited states has attract much attention, both from theoreticians and experimentalists [3, 4]. Recently, it was observed the $2p3d(^1P^0) \rightarrow 1s3d(^1D^e)$ in helium with sufficient accuracy to distinguish from the H-like K_α line, showing an enhanced fluorescence rate compared to the one assuming standard selection rules [5].In this work, we continue the investigation of KK excited states for sulphur by performing a systematic identification of experimental lines, which includes both single K and double KK excited states. The relativistic calculations were made within the MCDF approach using the general relativistic MCDF code (MDFGME) [6]. Experimental measurements were performed at the Pelletron accelerator facility in TIFR Mumbai.

In these preliminary calculations, all transition energies and probabilities were computed in a monoconfiguration approach. Almost all possible combinations of excitations for K_α, K_β and K_γ transitions of He through Be charge states were considered. The positions of the experimental lines are displayed in Fig. 1 along with the decay rates of the computed transitions. Transitions from KK excited states were also considered in both He- and Li-like states. It can observed in Fig. 1 that all experimental lines lines are unambiguously identified, with the exception of one line next to the He-like K_α line. Lines near the H-like K_α line can only be associated to the KK excited states of He or Li charge states. A precise identification can be done by calculating the respective autoionization rate.

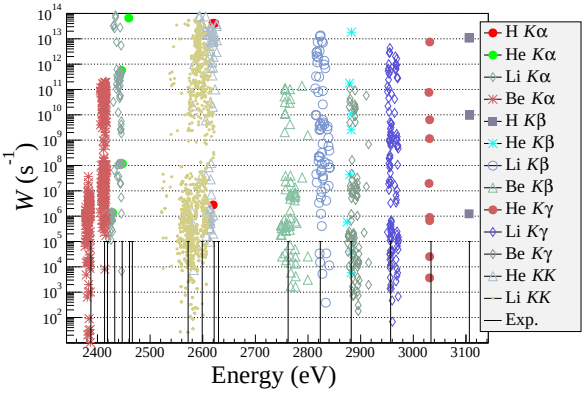

Figure 1. Comparison of obtained theoretical lines with experimental lines.

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