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Electron- and proton-impact excitation of He-like uranium

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Synopsis In this contribution, we present an experimental and theoretical study of the proton- and electron-impact excitation effects in helium-like uranium ions in relativistic collisions with different gaseous targets. The experiment was carried out at the experimental storage ring at GSI Darmstadt. Our experimental results are in agreement with predictions of the state-of-the art theory which treats both processes within the relativistic framework.

Electron-impact excitation (EIE) of bound electrons is a fundamental atomic processes which is also responsible for the vast majority of x-ray radiation produced in various kinds of laboratory and astrophysical plasmas.

Up to now, electron beam ion traps (EBITs) have been the preferred tool for studying the EIE [1]. Due to the small electron-impact ionization and excitation cross sections for heavy highly-charged ions, the focus of most of these EBIT studies has been confined to low and mid-Z systems.

In this contribution, we present an extension of our previous study [2] of the effect of electron-impact excitation in heavy highly-charged ions (HCI) undergoing collisions with neutral atoms. Namely, in a measurement carried out at the Experimental Storage Ring (ESR) we looked for electron- and proton (nucleus)-impact excitation (PIE) in relativistic collisions between Helium-like uranium ions and hydrogen and argon targets. Here, electron-electron correlation and relativistic effects can be addressed which are predicted to influence these processes significantly. By performing measurements with different targets as well as at different collision energies, we were able to gain access to both; PIE and EIE processes of the ground state in He-like uranium ions in the relativistic collisions. Combined calculations which treat both processes within the relativistic framework, provide a good agreement with the experimental data. Moreover, our experimental results clearly demonstrate the importance of including the effect of the generalized Breit interaction (GBI) in the EIE calculations [3].

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