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Recent electron-spectroscopy experiments at the ESR

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The energy distribution of electrons emitted in heavy-ion atom collision is a characteristic observable for understanding the underlying charge-transfer processes. Previously, we studied the collision system U88+ + N2 at a projectile energy of 90 MeV/u at the ESR using the magnet forward-angle electron spectrometer [1-3]. For electrons released from the projectile ions in collisions with neutral target atoms, the shape of the electron-loss-to-continuum cusp is not a function of the target atomic number according to first-order perturbation theory, which was applied in ref. [2]. However, for the cusp shape of U28+ ions colliding with different atomic targets, which is relevant for understanding the lifetimes of beams in the heavy-ion accelerators of FAIR, we observed a strong asymmetry of the electron cusp shape that varies significantly with the atomic number of the target [4]. These spectra cannot be explained by current theories. In a recent experiment we therefore compared the cusp-electron spectra of U89+ projectiles colliding with neutral N2 and Xe targets at 76 MeV/u. Amongst others, the experimental results provide tests to theory describing two-center effects in the double-differential cross-sections of projectile ionization of heavy ions [5].

[1] P.-M. Hillenbrand et al., Phys. Rev. A 90, 022707 (2014)
[2] P.-M. Hillenbrand et al., Phys. Rev. A 90, 042713 (2014)
[3] P.-M. Hillenbrand et al., Phys. Rev. A 91, 022705 (2015)
[4] P.-M. Hillenbrand et al., Phys. Rev. A 93, 042709 (2016)
[5] A. B. Voitkiv et al., Phys. Rev. A 76, 022709 (2007)

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