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Ionization Processes by Ion Impact: the Role of Multiple Electron Scattering

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Ionization of atoms by charged particle impact is a fundamental process. It is not exotic, it does not need high energies, it is a common process with many practical aspects. Still it is a challenge for theory, representing a (minimum) three-body problem with long-range forces. The measured double (or more) differential spectra of the emitted electrons (and outgoing ions) provide detailed information about the ionization process. These spectra are often rich in characteristic structures, which can be associated with different collision mechanisms. In the present talk, we provide a brief sketch of the most common structures and the underlying mechanisms, and focus our attention to a higher-order process. This is the so-called Fermi-shuttle acceleration [1,2], where the electron is scattered forward and backward by the incoming heavy projectile ion and the target core before being ejected. Due to the repeated collisions, the electron can be accelerated to high energies. In recent works [3,4], evidence has been provided for double (projectile-target, P-T), triple (P-T-P) and quadruple (P-T-P-T) scattering sequences in ion-atom collisions. Surprisingly, our latest measurements and the corresponding CTMC calculations have shown that accelerating multiple electron scattering can even dominate electron emission for slow ion impact, providing a large amount of unexpectedly high-energy electrons. This finding may get relevance in many cases, where ions are stopped in solids or in biological tissues. *Supported by the Hungarian OTKA Fund (T045905)* [1] S. Suarez *et al*, Phys. Rev. Lett. **77,** 474 (1996). [2] U. Bechthold *et al*, Phys. Rev. Lett. **79,** 2034 (1997). [3] B. Sulik *et al*, Phys. Rev. Lett. **88,** 073201 (2002). [4] B. Sulik *et al*, Nucl. Inst. and Meth. B **212**, 32 (2003).