A 4: Electron Scattering and Recombination

Zeit: Montag 14:00–16:00 Raum: VMP 6 HS-E

Hauptvortrag A 4.1 Mo 14:00 VMP 6 HS-E

Relativistic quantum dynamics in extremely strong electromagnetic fields — •Andrey Surzhykov[1,2], Anton Artemyev[1,2], Stephan Fritzsche[2,3], and Thomas Stöhlker[1,2] — [1]Universität Heidelberg — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Frankfurt Institute for Advanced Studies

Recent progress in theoretical studies of electronic structure and dynamical behaviour of highly–charged, heavy ions is reviewed. These investigations show that high–Z ions provide a unique tool for improving our understanding of the electron–electron and electron–photon interaction in the presence of extremely strong electromagnetic fields. We discuss that strong–filed phenomena can be probed, for instance, by exploring the radiative stabilization of excited ionic states produced by means of radiative and dielectronic recombination [1] as well as Coulomb excitation [2]. Special attention is paid, moreover, to the electron–positron pair production in relativistic collisions of highly–charged projectiles with atomic and electronic targets. For these collisions, we present recent results on the negative continuum dielectronic recombination of (initially) bare ion; the process which leads to a production of a continuum–state positron and a residual helium–like ion and which attracts nowadays much of interest both, in experiment and in theory.

[1] S. Fritzsche *et al.*, PRA **78**, 032703 (2008).
[2] A. Surzhykov *et al.*, PRA **77**, 042722 (2008).

Fachvortrag A 4.2 Mo 14:30 VMP 6 HS-E

Trielectronic Recombination with K-Shell Excitation — •Christian Beilmann, Octavian Postavaru, Rainer Ginzel, Christoph H. Keitel, Volkhard Mäckel, Paul H. Mokler, Martin C. Simon, Hiro Tawara, Joachim Ullrich, José R. Crespo López-Urrutia, and Zoltán Harman — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

We report the first observation of trielectronic recombination with excitation of a K-shell electron, involving three active electrons. It was identified in the x-ray emission spectrum of recombining highly charged Kr ions, together with indications of quadruelectronic recombination linking four active electrons. A resolution three times higher than any reported for this collision energy range around 10 keV resulted in the separation of their features from the stronger dielectronic resonances. For Kr^{30+}, contributions of nearly 6% to the total resonant photorecombination rate were found.

Fachvortrag A 4.3 Mo 15:00 VMP 6 HS-E

Trielectronic Recombination with K-Shell Excitation — •Christian Beilmann, Octavian Postavaru, Rainer Ginzel, Christoph H. Keitel, Volkhard Mäckel, Paul H. Mokler, Martin C. Simon, Hiro Tawara, Joachim Ullrich, José R. Crespo López-Urrutia, and Zoltán Harman — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany

We report the first observation of trielectronic recombination with excitation of a K-shell electron, involving three active electrons. It was identified in the x-ray emission spectrum of recombining highly charged Kr ions, together with indications of quadruelectronic recombination linking four active electrons. A resolution three times higher than any reported for this collision energy range around 10 keV resulted in the separation of their features from the stronger dielectronic resonances. For Kr^{30+}, contributions of nearly 6% to the total resonant photorecombination rate were found.

A 4.4 Mo 15:30 VMP 6 HS-E

Electron-Positron Pair Creation in Relativistic Heavy Ion Collisions Described in a Molecular View — •Sven Augustin and Werner Scheid — Institut für Theoretische Physik, Justus Liebig Universität, Gießen, Deutschland

Previous calculations of cross sections for electron-positron pair production with electron capture into the target's K shell in relativistic heavy nuclei scattering, for instance those done by Busic et al. [1], faced problems due to difficulties in defining the positron states in a two centre problem.

It is usually assumed that, after the collision, a positron is defined by a hole state in the negative continuum of the target ion. While this approach is true for a single ion, it is not if a second ion, i.e. the projectile, is present. This is indeed independent of their distance.

Thus a projection on the target's negative continuum states causes a "double counting" of the positrons. It should be replaced by a projection on time dependent solutions of the Dirac equation with electromagnetic potentials of two separating ions.

Considering such a molecular-like setting we chose the description in a centre of mass frame rotating with the axis connecting target and projectile.

[1] O. Busic, N. Grün and W. Scheid, Phys. Rev. **A70**, 062707 (2004)

A 4.5 Mo 15:45 VMP 6 HS-E

Dielectronic recombination by excitation within the $n = 3$ shell for iron ions in astrophysical plasmas — •Michael Lestinsky[1,2], Nigel R. Badnell[3], Dietrich Bernhardt[4], Manfred Grieser[2], Jens Hoffmann[2], Dragan Lukic[1,5], Alfred Müller[4], Dmitry Orlov[2], Roland Repnow[2], Eike W. Schmidt[4], Michael Schnell[2], Stefan Schippers[4], Deyang Yu[4,6], Andreas Wolf[2], and Daniel W. Savin[1] — [1]Columbia University, New York — [2]Max-Planck-Institut für Kernphysik, Heidelberg — [3]Department of Physics, University Strathclyde, Glasgow — [4]Institut für Atom- und Molekülphysik, Justus-Liebig-Universität, Gießen — [5]Institute of Physics, Belgrade — [6]Institute of Modern Physics, Lanzhou

Line emission and absorption from M-shell iron ions are observed in a wide range of cosmic plasmas. Interpreting these spectroscopic data requires an accurate understanding of the underlying charge balance distribution. Dielectronic recombination (DR) is the dominant electron-ion recombination mechanism for most atomic ions in astrophysical plasmas. We are in the process of carrying out a series of DR measurements for M-shell iron ions at the TSR ion storage ring. Here we compare some of our recent results with previously recommended DR data and recent state-of-the-art results. We find significant deviations between theory and experiment at collision energies from 0 to $\sim$ 50 eV. This range includes all cosmically relevant resonances for these ions. From our experimental data we derive plasma recombination rate coefficients for photoionized and collisionally ionized plasmas and recommend their inclusion into astrophysical codes.