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Absolute rate coefficients from dielectronic recombination for astrophysically important ion species

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Spectroscopic data from astronomical observations obtained at ground-based or satellite observatories are analyzed with the help of spectral synthesis codes. From complex rate equation networks, based largely on theoretical plasma rate coefficients of various up- and downcharging processes, a charge state distribution is modelled and emission and absorbtion features synthesized and matched to spectroscopic data. For a confident astrophysical analysis toolchain it is thus essential, that these calculated rate coefficents are verified with experimental evidence (Kallman and Palmeri, 2007).
Heavy ion storage rings are ideal environments to precisely determine such data, as ion beams can be prepared in purely one charge state, isotopic purity and free of metastable composition and with well-defined kinematics, reactions can be studied in isolated thin-target single-collision conditions. CRYRING in Stockholm and TSR in Heidelberg used to be reliable facilities to determine experimental data for astrophysical application with a long list of publications (Schippers, 2012, and papers cited therein). After its move from Stockholm to Darmstadt (Andelkovic et al., 2015; Danared et al., 2011; Lestinsky et al., 2012a, 2015, 2016), CRYRING is now capable of continuing its work and the measurement setup is ready to deliver scientific output.
On behalf of the SPARC collaboration, we propose a beamtime at CRYRING on merged-beams electronion collision spectroscopy on low-q Ne ion beams, which are of astrophysical importance. The process to be studied in particular is dielectronic recombination which contributes significantly to the charge state distribution in astrophysical plasma. Thanks to its ultracold electron cooler (Danared et al., 2000), CRYRING is able to deliver precise, absolute high-resolution spectra, a(E), for center-of-mass collision energies E from 0 to several hundred eV. From the measured spectra, we determine plasma recombination rate coefficients (PRRC) a(T) for astrophysical modelling for relevant plasma temperatures in the ranges of 10^3 and 10^6 K.

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