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The many facets of dielectronic recombination studies at heavy ion storage rings

The resonant process of dielectronic recombination (DR) is a powerful spectroscopic tool that is utilized for many applications, e.g. for precision QED studies, astrophysics, benchmarks of state-of-the-art relativistic atomic theories or lifetimes measurements [1].
A relatively new use of DR is the deduction of nuclear properties such as nuclear spin, magnetic moment, change in the charge distribution and, potentially, the lifetime of long-lived nuclear states (isomers) from the dielectronic resonance spectra [2,3]. In the present contribution an overview of the many facets of DR studies at heavy ion storage rings will be given.
Special emphasis will be placed on the application of DR for nuclear properties. A decisive advantage of this new methodology over established methods (e.g. laser based techniques) is the free choice of charge state. For the present case of Li-like highly charged ions one decisively benefits from the simple atomic configuration with a single valance electron outside the closed K-shell. The interpretation of the atomic spectra with respect to the nuclear parameters is enabled on a full QED level [3,4].
Only very recently, our collaboration at the ESR storage ring of GSI has proven the feasibility of DR studies with in-flight synthesized Li-like radioisotopes (234Pa88+, 237U89+) [5,6]. The DR approach at heavy ion storage rings is very efficient and can be performed with just 10^3 - 10^4 stored ions and lifetimes of the nuclide down to roughly 10 s.

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