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Radiation Properties of Ions and Exotic Nuclei at Relativistic Energies (APPA)

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Owing to the recent advances in heavy-ion accelerator facilities as well as in detection techniques, new possibilities arise to study the electronic structure of simple atomic systems in strong Coulomb fields. Relativistic, quantum electrodynamics, and even nuclear effects, which are difficult to isolate in neutral atoms, often become enhanced in high-Z, few-electron ions. In order to improve our understanding of these fundamental interactions, a number of studies have been recently carried out on the characteristic photon emission from heavy ions within the framework of the Stored Particles Atomic Physics Research Collaboration (SPARC). In this contribution, we present a theoretical study of angular and polarization properties of radiative decay of heavy atomic systems with non-zero nuclear spin. In particular, we focus on the K-alpha transitions in helium-like ions following the radiative electron capture. Special attention is given to the question of how the hyperfine interaction of the nuclear magnetic moment with those of electrons affects the angular properties of the K-alpha emission for isotopes with non-zero nuclear spin. As an example, detailed computations were carried out for selected isotopes of helium-like tin, xenon, and thallium ions. A quite sizeable contribution of the hyperfine interaction upon the K-alpha angular emission is found for isotopes with nuclear spin $I = 0$, while this effect is suppressed for (most) isotopes with larger nuclear spin $I > 1/2$ [1]. From this theoretical analysis, we suggest that accurate experimental measurements of the K-alpha angular emission at ion storage rings can be utilized as an independent tool for determining the nuclear parameters, such as nuclear spin, and magnetic dipole moment, of the exotic and radioactive isotopes with $I > 0$.

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