Relativistic calculations of K- and L-shell yields in Ge

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The knowledge of accurate values of atomic decay rates and fluorescence yields is fundamental in quantitative analysis in x-ray spectroscopy, plasma physics, nuclear physics, dosimetry, radiation protection, among many other areas. Despite the increasing number of theoretical and experimental work concerning the determination of fluorescence yields for several elements, the available data is scarce or was obtained several decades ago. One important element is Ge, used as a semiconductor in various electronic devices and in detectors for nuclear and particle physics. The most recent experimental data of the fluorescence yields for this element is from 2001 [1] and the last theoretical calculations were published more than 40 years ago (see [2] and references therein). In this work, we present a state-of-art relativistic calculation of the K- and L-shell transition rates and yields in Ge using the multi-configuration Dirac-Fock (MCDF) code of Desclaux and Indelicato [3,4]. The MCDF code was used in a single-configuration approach, with Breit interaction and the vacuum polarization terms included in the self-consistent field calculations and other QED effects included as perturbations. Since Ge has an open shell, configuration mixing is important and the number of transitions to compute amount to several tens of thousands.

This work	Pahor (1969)	Bambynek (1972)	McGuire (1970)	Kostroun (1971)	Walter (1971)	Hartl (1976)
0.547	0.554	0.540	0.558	0.545	0.534	0.561
	Krause (1979)	Casnati (1984)	Brunner (1987)	Pious (1992)	Hubbell (1994)	Durak (2001)
	0.535	0.549	0.532	0.538	0.523	0.537

Tab. 1: K-shell fluorescense yields

Yields for the K-and L-shell in Ge will be presented. These will be compared to existing data. First results for the K-shell fluorescence yield are consistent with the available data (Tab.1) and L-shell yields calculations are being finalized.

References:

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