Relativistic K shell decay rates and fluorescence yield for Fe

A. Kahoul[a,b*], Y. Kasri[c], Y. Sahnoune[a,b,d], B. Deghfel[e,f], F. Khalfallah[a,b], J. M. Sampaio[g] and J. P. Marques[h]

[a] Department of Materials Science, Faculty of Sciences and Technology, Mohamed El Bachir El Ibrahimi University, Bordj-Bou-Arreridj 34030, Algeria.
[b]Laboratory of Materials Physics,Radiation and *Nanostructures (*LPMRN), University of Mohamed El Bachir El Ibrahimi, Bordj-Bou-Arreridj 34030, Algeria.
[c]Theoretical Physics Laboratory, Physics Department, University of Bejaia, Algeria.
[d]Physics Department, L'école Normale Superieure Vieux-Kouba,16000 Algiers, Algérie.
[e]Department of Physics, Faculty of Sciences, University of Mohamed Boudiaf, 28000 M'sila, Algeria.
[f] Laboratory of materials physics and their applications, Physics Department, Faculty of Sciences, University of Mohamed Boudiaf, 28000 M'sila, Algeria.
[g]LIP-Laboratório de Instrumentação e Física Experimental de Partículas, Av. Elias Garcia141 D, 1000-149 Lisboa, Portugal.
[h]BioISI – Biosystems & Integrative Sciences Institute, Faculdade de Ciênciasda Universidade de Lisboa, Campo Grande, C8, 1749-016 Lisboa, Portugal.
* Corresponding author. Tel. /Fax(+213)035666599. E-mail address: ka_abdelhalim@yahoo.fr

Abstract

In this work, we derive the K-shell fluorescence yield using a Dirac-Fock model. To compute, radiationless and radiative transition rates we have used the MCDF code of Desclaux and Indelicato [1-3]. The wave functions were calculated in the single-configuration approach with magnetic (Gaunt) and first-order retardation terms of the Breit interaction included in the self-consistent variational method. Higher-order Breit retardation terms were added as perturbations. Regarding the QED contributions, the one-electron self-energy is evaluated using the values of Mohr and Kim [4-5] and the self-energy screening is treated with using the Welton method reported by Indelicato [1]. Vacuum polarization is included in the calculations taking the following approach: the Uelhing contribution is evaluated to all orders by being included in the self-consistent field while higher order corrections are accounted for as perturbations. The continuum electron wave function in the final state is evaluated by solving the Dirac-Fock equations with the full exchange potential and is normalized to represent one ejected electron per unit energy. The results are compared with available data from other authors.

Keywords:K-shell fluorescence yield, ,radiationless and radiative transtion rates, Dirac-Fock calculations