International Initiative on X-ray Fundamental Parameters – Status and next steps

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Accurate critical data related to the interactions of X-rays with matter, called Fundamental Parameters (FP), are of paramount importance in many branches of physics and technology. However, the lack of recent reliable values of fundamental parameters with low associated uncertainties, and in addition a high degree of consistency over wider atomic number ranges, is regularly pointed out by end users of X-ray instrumentation *e.g.*, with respect to industrial needs. In order to meet current and upcoming demands, the International Initiative on X-ray Fundamental Parameters (IIFP) started as an expression of common interest in the improvement of X-ray fundamental parameters in a joint effort of companies, university laboratories, and national metrology institutes [1]. This stimulates:

(i) experimental measurements based on new facilities such as synchrotron radiation and high-resolution detectors with reduced and traceable uncertainties; comparison between different experimental approaches [2] validates the derived FPs;
(ii) theoretical calculations using the most recent theoretical approaches; the MultiConfiguration Dirac-Fock (MCDF) enables the determination of many of the significant atomic parameters due to the possibility of including, a large amount of electronic correlation and radiative corrections. The comparison of experimental and theoretical results on selected elements [3] assesses the validity of calculation that should be used when experimental approaches are difficult or impossible;
(iii) preparation of a standardized FP database established through a co-work of national metrology institutes providing user access to reliable data.

The IIFP works follow the guidelines described in the roadmap document [4] that was established during specific workshops and is regularly updated. In this review, we will present the current status of the IIFP achievements and will discuss the next steps.

[1] International Initiative on x-ray Fundamental Parameters (IIFP) https:// www.EXSA.hu/fpi.php
[3] Y Ménesguen, M Gerlach, B Pollakowski, R Unterumsberger, M Haschke, B Beckhoff, M-C Lépy, High accuracy experimental determination of copper and zinc mass attenuation coefficients in the 100 eV to 30 keV photon energy range, Metrologia 53 (2016) 7–17.
[3] J. M. Sampaio, T. I. Madeira, J. P. Marques, F. Parente, A. M. Costa, P. Indelicato, J. P. Santos, M.-C. Lépy, Y. Ménesguen, Approaches for theoretical and experimental determinations of K-shell decay rates and fluorescence yields in Ge, Phys. Rev. A 89 (1) (2014) 012512.
[4] Roadmap document on atomic Fundamental Parameters for X-ray methodologies, December 2017, http://www.exsa.hu/news/wp-content/uploads/IIFP_Roadmap_V2.pdf

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