Relativistic effects analysis of the electron binding energies in many-electron atoms

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Electron binding energies in the average and heavy atoms () obtained in the experiment and in the relativistic calculations are studied. The method of simultaneous analysis and presentation of electron binding energies  in a large number of atoms is proposed on the basis of the atomic number scaling showed in [1], [2]. The scaling makes it possible to reduce the description of the whole data on the electron binding energies in any number of elements to two functions . Here , and the corresponding values  are calculated from the following algorithm



The pairs of numbers  for all the atoms () and all *n* form approximate common dependence in the closed energy shells (), the relativistic effects little affecting this dependence, without changing its single-valued monotonically diminishing nature. If relativistic effects are small, i.e. for the elements  the function  behaves similarly. However, in the heavy atoms the single-valued nature of function  is lost: the visible -branching for the different *l* occurs, and for each *l* , in addition, a bifurcation due to the spin-orbit interaction. Here an increase in the relativistic effects with an increase in the atomic number is visually manifested, all the dependences on  preserving smooth nature and lieing down on the corresponding dependence for the inert gases. This can be used, for example, for the new data verification and for the recovery of the missing information about the binding energies in the neighboring atoms.

References

1. Shpatakovskaya G.V. and Karpov V.Ya. J. Phys.: Conf. Ser. 774, 012002 (2016)
2. Karpov V.Ya. and Shpatakovskaya G.V. JETP, 2017, 124, 369