Chemical Properties of Superheavy Elements: Theory and Experiment

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Superheavy elements, or transactinides, are atoms with Z>103. They do not exist in nature, and have to be produced in nuclear reactions in particle accelerators.

Chemical investigations of transactinides are a very exciting field of research. Through these experiments the dramatic influence of relativity on chemical properties of these extremely heavy elements can be studied, and the newly produced atoms are assigned their place in the periodic table. However, there are a number of challenges connected with this research. All the superheavy elements are unstable, with lifetimes of minutes to milliseconds. In addition, the production rates are very low, sometimes not more than a few atoms per month. The short lifetimes and the low production rates mean that novel, ultrafast chemistry techniques are employed, and for some of the elements "one atom at a time" chemical experiments are attempted. Thus, chemical studies carried out on superheavy elements heavily rely on theoretical investigations for planning the experiment and the experimental set-up, analyzing the data, and interpreting the results.

The main topic of this talk is theoretical studies of superheavy elements. I will make a short introduction to the benchmark methods used in these investigations, and focus on the influence of relativity on the atomic and chemical properties of transactinides. In addition, recent and ongoing chemical experiments carried out on superheavy atoms will be discussed.