

Introduction to the Heaviest Elements

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The field of heavy element research has made tremendous strides in the last decade, highlighted by the discoveries of six new superheavy elements since 1999. Currently, the favored reaction for production of these elements is the complete fusion, neutron evaporation reaction, where two nuclei fuse and release excess energy through the emission of neutrons. The products of these reactions are separated from unwanted reaction products and detected with atom-at-a-time techniques. These techniques have evolved such that a single nucleus can be convincingly identified in experiments lasting months.

In addition to successes in the study of nuclear reactions, the last decade has also seen the first reported chemical studies of bohrium (element 107), hassium (element 108), copernicium (element 112), and the currently unnamed element 114. These elements are produced in the nuclear reactions described above, collected by a gas, and transported to a chemical experiment for analysis. Typically, the adsorption of the element on a gold surface is studied. Through clever design, chemical properties of macroscopic amounts of material can be inferred from the identification of only a few atoms.

This talk will discuss the complete fusion reaction, the identification of single atoms, and the chemical properties of the heaviest elements. Prospects for the discovery of even heavier elements will be discussed. The talk will be accessible to students in a variety of fields.