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Review of the Synthesis of the Heaviest Elements and Their Chemistry

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The heavy element group at Lawrence Livermore National Laboratory (LLNL) has a long tradition of nuclear and radio-chemistry dating back to the 1950's. Some of the most exciting work has taken place in the last five years (in collaboration with the Flerov Laboratory of Nuclear Reactions in Dubna, Russia) with the discovery of four new elements - 113, 114, 115, and 116. By pushing the boundaries of the periodic table, we can start to answer some of the most fundamental questions of nuclear science, such as the locations of the next "magic numbers" of protons and neutrons, and the possibility of an "Island of Stability" where nuclides would have lifetimes much longer than those currently observed in the heaviest elements. We have already seen evidence of extra-stability in the heaviest nuclides, which leads to half-lives that are long enough for us to perform chemistry on these isotopes one atom at a time. Work is already underway on developing a chemical system designed to isolate element 114. These experiments will allow chemists to identify the chemical properties of element 114 and determine whether it truly behaves as a Group 14 element such as Sn or Pb. In this presentation, a brief history of the discovery of these new elements will be given as well as an introduction to the chemical experiments in progress.