Attempts to synthesize new superheavy elements

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Superheavy (SH) nuclei obtained in „cold\" fusion reactions with Pb or Bi target are very neutron-deficient with a short half-life and have limiting fusion cross-section. In the recent fusion of actinides with 48Ca more neutron-rich SH nuclei were produced with much longer half-life. But they are still far from the predicted center of the „island of stability\" formed by the neutron shell around N=184. Moreover the possible combinations of actinide targets with double magic 48Ca projectile are exhausted.

At present new attempts were made at SHIP (GSI Darmstadt) to synthesize heavier superheavies combining actinide targets with projectiles of Z > 20. An experiment was performed at SHIP kinematic separator to search for the element of Z = 120 using the reaction 64Ni + 238U = 302/120*. The main goal of this experiment was to probe the strength of the predicted closed neutron shell at N = 184 and that of a subshell closure at Z = 120. The results of this experiment are given in some details in which a cross section limit of 0.1 pb was achieved. Another attempt is to synthesize element 120 using the reaction 54Cr + 248Cm = 302/120* leading to the same compound nucleus as the previous experiment. As the first step the excitation function of the reaction 48Ca + 248Cm = 296/116* is investigated to get data for the extrapolation of optimum excitation energy and evaporation channel to synthesize element 120.

In the reaction 38S + 238U at sub-barrier energy a new isotope 268Hs (Z = 108) was synthesized. The aim of the experiment was to investigate the predicted increased stability of deformed nuclei at Z = 108 and N = 162. In this region of heavy nuclei a spectroscopic experiment is prepared to investigate the supposed isomerism of 270Ds (Z = 110).