

SHELS - Separator for Heavy Element Spectroscopy. First results.

Thursday, 5 December 2013 15:35 (20 minutes)

In the past, various types of reactions and identification techniques were applied in the investigation of formation cross sections and decay properties of transuranium elements. The fusion - evaporation reactions with heavy targets, recoil - separation techniques and identification of nuclei by the parent - daughter generic coincidences with the known daughter-nuclei after implantation into position - sensitive detectors were the most successful tools for production and identification of the heaviest elements known presently. This technique may be further improved and presently it may be very promising for the identification of new elements, search for new isotopes and measurement of new decay data for the known nuclei.

Within the past 15 years, the recoil separator VASSILISSA [1] has been used for the investigations of evaporation residues (ERs) produced in heavy ion induced complete fusion reactions. In the course of the experimental work a bulk of data on ERs formation cross sections, synthesized in asymmetric reactions was collected.

With γ and β detector arrays, installed at the focal plane of the VASSILISSA separator, detailed spectroscopy of Fm - Lr isotopes was performed during last 5 years.

In the years 2004 - 2010 using the GABRIELA (Gamma Alpha Beta Recoil Investigations with the Electromagnetic Analyser) set-up [2] the experiments aimed to the gamma and electron spectroscopy of the transfermium isotopes, formed at the complete fusion reactions with accelerated heavy ions were performed. Isotopes of No and Lr were studied. The experiments with high intensity ^{22}Ne beam showed, that for slow evaporation residues rather high ($\sim 10\%$) transmission efficiency need to be obtained. In this case for $\alpha - \gamma$ and $\alpha - \beta$ coincidences used in the study of the isotopes of 104 and 105 elements good statistics could be obtained during one month of the experiment.

Accumulated experience allowed us to perform ion optical calculations and to design the new experimental set up, which will collect the base and best parameters of the existing separators and complex detector systems used at the focal planes of these installations [3].

New experimental set up (SHELS, the velocity filter) on the basis of existing VASSILISSA separator was developed for synthesis and studies of the decay properties of heavy nuclei. In May - July 2013 first test experiments were performed. At the focal plane of the separator GABRIELA set up (α , β , γ detectors array) was installed.

[1] A. Yeremin et. al., Phys. At. Nucl., 66 (2003) 1042 - 1052

[2] K. Hauschild et. al., Nucl. Instr. and Meth., A560 (2006) 388-394

[3] A. Yeremin et. al., Nucl. Instr. and Meth., B266 (2008) 4137-4142

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Session Classification: Nuclear Physics: Parallel Session II