Status of the SIRIUS detector array and investigation of the properties of ^{252}Fm*

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The superconducting LINAC (LINear ACcelerator) of SPIRAL2-GANIL will produce very intense heavy-ion beams by virtue of the additional NEWGAIN (NEW GAnil INjector) with mass to charge state ratios (A/q = 7)[1]. The S^3 (Super Separator Spectrometer) of SPIRAL2 was designed to have high transmission, high beam rejection and high mass resolving power capabilities to study rare isotopes like superheavy and exotic nuclei far from the stability with very low production cross sections[2]. At the focal plane of S^3, a state-of-art detector array called SIRIUS (Spectroscopy and Identification of Rare Isotopes Using S^3)[3] will be installed to perform decay spectroscopic studies in the region of very heavy and superheavy nuclei where very little spectroscopic data[4] is available. SIRIUS will be capable of detecting heavy ions and their subsequent decays products : alpha particles, internal conversion electrons, gamma rays, X-rays, beta particles and fission products. SIRIUS is composed of a secondary electron detector to track the transmitting ions and measure their time of flight, a DSSD (double-sided silicon strip detector) for implanting the ERs (evaporation residues) and establish position and time correlations between the implanted ions and their successive decays, a tunnel detector placed upstream to the DSSD and consisting of 4 stripy pad silicon detectors to detect the ionizing particles that escape the DSSD, five Germanium detectors placed in a close geometry around the silicon detectors for gamma spectroscopy. SIRIUS is in the commissioning phase now. In the first part of this talk, I will present the current status of the SIRIUS project.

In the second part of the talk, I will present some of the results obtained from the experiment that we have carried out at Argonne National Laboratory to investigate the yet unknown excited states in ^{252}Fm. Only the 2^+ state at 42.1(1.3) keV has been measured so far in the alpha decay of ^{256}No to ^{252}Fm[5]. ^{252}Fm being deformed and doubly-magic makes it a very interesting case to investigate the effects of shell closure on the nuclear structure. The ^{252}Fm nuclei were produced via the ^{238}U(^{18}O,4n) fusion-evaporation reaction. The prompt gamma rays emitted at the target position were detected by the GRETINA (Gamma-Ray Energy Tracking In-beam Nuclear Array)[6] gamma-ray detector array. The FMA (Fragment Mass Analyzer)[7] recoil mass spectrometer was used to isolate the ERs from the scattered beam and background of other reaction products and get the mass identification of ^{252}Fm from the neighboring evaporation channels. The ERs were implanted in a DSSD installed at the focal plane detector of the FMA. A clover detector was placed behind the DSSD to detect the X rays and gamma rays emitted during the isomeric decays.

References

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