

## **On the Road to FAIR: First Operation of AGATA in PreSPEC at GSI**

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on behalf of the PreSPEC-AGATA collaboration

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The international Facility for Antiproton and Ion Research (FAIR) which is currently under construction at Darmstadt, Germany, will provide intense relativistic beams of exotic nuclei at its Superconducting-Fragment Separator (Super-FRS). The planned HISPEC experiment foresees as core instrument the European Advanced GAMMA-ray Tracking Array (AGATA) [1]. AGATA is a highly segmented array of HPGe-detectors suitable for in-beam  $\gamma$ -ray spectroscopy of relativistic ions at highest possible energy resolution and sensitivity. About 20 AGATA detector modules – individually encapsulated 36-fold segmented HPGe crystals – have been used at GSI's Fragment Separator (FRS) in the framework of the PreSPEC-AGATA campaign, the predecessor of the future HISPEC experiment at FAIR. Reaction products have been characterized using the Lund-York-Cologne CALorimeter (LYCCA) [2]. Effectively some five weeks of primary beam time have been made available in the year of 2012 for commissioning the set-up and start of the experimental programme.

The commissioning of the PreSPEC-AGATA campaign was done using Coulomb excitation reactions of a primary beam of  $^{80}\text{Kr}$  ions at energies of 150 MeV per nucleon on a 400 mg/cm<sup>2</sup> thick secondary gold target. The 615-keV  $\gamma$ -ray line from the decays of the Coulomb-excited first  $2^+$  states of  $^{80}\text{Kr}$  was observed with an energy resolution of 2.5% at the current stage of the data analysis before application of  $\gamma$ -ray tracking techniques. Further experiments made use of relativistic secondary beams of unstable neutron-rich nuclei or isomers produced either by target-induced fission of a relativistic uranium beam or in primary fragmentation reactions. The experiments combine the development of dedicated FAIR-relevant tools for high-resolution in-beam spectroscopy of relativistic radioactive ion beams with timely questions of nuclear structure research, such as Coulomb-excitation of a band-terminating isomer of  $^{52}\text{Fe}$ , low-lying E1 modes of neutron-rich  $^{64}\text{Fe}$ , evolution of nuclear shapes of heavy Zr isotopes, or the collectivity of neutron-rich isotopes near  $^{208}\text{Pb}$ .

We report on the initial performance of the experimental set-up of the PreSPEC-AGATA campaign for in-beam  $\gamma$ -ray spectroscopy experiments with relativistic beams, discuss the experiments that were carried out, highlight preliminary results from them, and give an outlook to the continuation of the experimental campaign coming up later this year.

[1] S. Akkoyun *et al.*, Nucl. Instrum. Methods Phys. Res. **A 668**, 26 (2012).

[2] D. Rudolph *et al.*, LYCCA Technical Design Report, FAIR Document (2008);  
[http://www.nuclear.lu.se/english/research/basic\\_nuclear\\_physics/nustar/lycca](http://www.nuclear.lu.se/english/research/basic_nuclear_physics/nustar/lycca)