Contribution ID: **76** Type: **Invited talk**

A New Scintillator-Based Gamma-Ray Spectrometer for the RIBF

Friday, 4 August 2023 13:40 (30 minutes)

Since advent of the RIBF, the NaI(Tl) based scintillation array DALI2+ has been the workhorse for in-beam gamma-ray spectroscopy experiments, now counting 100 peer-reviewed publications (2 Nature, 28 PRL, 23 PLB). Due to its modest energy resolution, caused by large opening angles and intrinsic energy resolution of NaI(Tl) scintillators, long absorption lengths of the scintillation material, as well as modest time resolution, the long-term potential is limited. Furthermore, limited available budget makes low cost alternatives to 4pi Ge tracking arrays with superior features, except energy resolution, desirable. Consequently, a new-generation scintillator array for in-beam gamma-ray experiments is being devised for the near future. Here, the scintillation materials GAGG and CeBr3 have been identified as the most promising choices. Key advantages for the former include its high density, low radiation length, and that it's neither hygroscopic nor self-emissive, while the latter offers a better intrinsic resolution and extremely fast
decay time.

It is envisioned that a hybrid array, composed of GAGG and CeBr3 crystals, will be employed at different experimental stations of the RIBF (F8, SAMURAI, SHARAQ), each having different performance requirements and constraints. Key experiments to be carried out in the future at the RIBF at intermediate energies involve inelastic scattering on high-Z targets to induce Coulomb excitation, as well as inelastic scattering and quasi-free scattering on liquid hydrogen.

In my presentation, I will provide an overview of the planned array, including how well its performance compares to other existing and planned gamma-ray spectrometer, and examples of possible future experiments.

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Session Classification: Development of new detection devices