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Using LaBr3 detectors for precision lifetimes measurements of excited states of 'interesting' nuclei

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Precision measurements of electromagnetic transition rates provide accurate inputs
into nuclear data evaluations and are also used to test and validate predictions of state of the art nuclear structure models. Measurements of transition rates can be used to ascertain or rule out multipolarity assignments for the measured EM decay, thereby providing spins and parity (difference) information for states between which the EM transition takes place. We report on a variety of precision measurements of electromagnetic transition rates between excited nuclear states using coincidence 'fast-timing' gamma-ray spectroscopy with cerium-doped lanthanum-tribromide (LaBr3(Ce)) detectors. Examples of recent precision measurements using a combined LaBr3-HpGe array based at the tandem van de Graaff accelerator, Bucharest, Romania will be presented addressing nuclear structure issues around the N=20 [1], N=82 [2] using stable-beam induced fusion-evaporation reactions; and the evolution of nuclear deformation around in neutron-rich Hf, W, Os nuclei using 7Li induced light-ion transfer reactions and following beta-decay [3]. The presentation will also discuss the ongoing development of a new multi-detector LaBr3 array for future studies of exotic nuclei produced at the upcoming Facility for Anti-Proton and Ion Research (FAIR) [4] as part of the NUSTAR–DESPEC project and the pre-NUSTAR implementations of detectors from this array to study electromagnetic transition rates in neutron-rich fission fragments at ILL-Grenoble, France and RIBF at RIKEN, Japan.

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