PARIS – status, perspectives for installation in Poland and studies of hot rotating nuclei

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and the PARIS Collaboration

PARIS is a large array of phoswich detectors expected to measure γ rays over a wide range of energy from few hundreds keV to 40 MeV. It is envisaged to serve the dual purpose of a high-energy gamma-ray spectrometer and a spin-spectrometer, capable of determining the multiplicity of low energy (100 keV to few MeV) discrete γ rays associated with a specific reaction. Upon completion PARIS is envisaged to be an array of 216 phoswich detectors. The front section of each phoswich detectors is a cubic (2x2x2) $LaBr_3$ or $CeBr_3$ crystal optically coupled to a 6" long square bar of NaI(Tl) of matching cross section. Each of these detectors is to be read by a single photomultiplier tube (PMT) of 2" diameter that would allow close packing of such detectors. It is planned to combine 9 phoswich detectors in a square (3x3) close packed geometry forming a single cluster [1-4]. Thanks to use of $LaBr_3$-NaI and $CeBr_3$-NaI phoswiches, it is characterized by good energy and timing resolution and efficiency, especially for high energy gamma-rays. Due to this properties it can be used to measure gamma-rays coming from decay of Giant Resonances and discrete gamma transitions with moderate energy resolution. Moreover, the granularity of PARIS make possibility to use it as a multiplicity filter. A part of the presentation will be devoted to the presentation of the PARIS project status, as well as possibilities of install PARIS at the beam-line of present or new cyclotron in HIL.

In addition, few PARIS related physics cases, that will be possible at HIL, will be presented. The main ones are:

1) Nuclear deformation evolution in function of temperature and angular momentum (for example Jacobi shape transition) – use of PARIS coupled to residue/charge particles detector (FAZIA or equivalent);
2) Pre-fission GDR measurements in super heavy isotopes with PARIS and fission fragment detectors (FAZIA);
3) Studies of the properties of the GDR built on high-spin isomeric states with PARIS and HPGe (AGATA, EAGLE or equivalent) detectors.

[1] A. Maj *et al. Acta Phys. Pol B*, 40:565, 2009;
[2] M. Zieblinski et al. Acta Phys. Pol B, 44:651, 2013;
[3] B. Wasilewska and al. in: O. Roberts, L. Hanlon, S. McBreen (Eds.) Applications of Novel Scintillators for Research and Industry, Iop Publishing Ltd, Bristol, 2015;
[4] C. Gosh et al, JINST 11 P05023 (2016).