

## Performance of PARIS clusters in the study of $\gamma$ -decay of the collective states in $^{208}\text{Pb}$ excited in the $(p,p')$ reaction at the CCB facility

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In the last few years, first experiments were performed in the field of nuclear structure at the Cyclotron Centre Bronowice (CCB) facility in Krakow, Poland. A medical cyclotron IBA Proteus C-235 located at CCB produces proton beams in the energy range of 70-230 MeV, that can be used for experimental purposes as well.

One of the studied topics was  $\gamma$ -decay of collective states excited in inelastic proton scattering on the  $^{208}\text{Pb}$  target. Two experiments were performed in which one PARIS cluster combined with 8 BaF<sub>2</sub> detectors of the HECTOR array; and two PARIS clusters together with 4 big LaBr<sub>3</sub>:Ce detectors were employed, respectively. In the first one, an analogue read-out for PARIS was used and in the second – a digital one.

During the experiments, excitations in the energy region of the Giant Quadrupole and Dipole Resonances, as well as, the Pygmy Dipole States were observed. By applying different conditions on the data, spectra corresponding to  $\gamma$  decays of excited states to selected low-lying levels in  $^{208}\text{Pb}$  were obtained, allowing not only a look into  $\gamma$ -decay of the Giant Resonances but also into the Brink-Axel hypothesis.

In the presentation, the experimental set-ups and data acquisition systems will be briefly introduced. The core of the talk will focus on the performance of the PARIS detectors in comparison to other  $\gamma$  detectors used in the study. In the presentation, the data analysis method and the obtained results will be shown.