

E450

## PROPOSAL FOR EXPERIMENT AT RCNP

### Study of the Structure of the Pygmy Dipole Resonance States via the $(p, p' \gamma)$ and $(\alpha, \alpha' \gamma)$ Reactions

#### Spokespersons

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#### Running Time

Tuning/Calibration	2.0 days
Data Runs	23.0 days
Total	25.0 days

#### Beam Line

WS Beam Line

#### Beam Requirement

Proton (unpolarized), 80 MeV, less than 10 pA, achromatic mode, halo-free, high-resolution  
 $^4\text{He}$ , 140 MeV, less than 10 pA, achromatic mode, halo-free, high-resolution

#### Budget

1,000,000 yen for isotopically enriched targets of  $^{94}\text{Zr}$  and  $^{206}\text{Pb}$

#### Safety Controlled Items

None

#### Other Requirements

CAGRA-Grand Raiden set-up

**Collaboration**

the CAGRA Collaboration

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## Summary of the Experiment

We propose experiments to study the low-energy part of the E1 response, denoted Pygmy Dipole Resonances (PDR), by measuring the  $(p,p'\gamma)$  and  $(\alpha,\alpha'\gamma)$  inelastic scattering reactions with the CAGRA-Grand Raiden set-up. This proposal combines four experimental proposals that aim at studying the PDR states by measuring light-ion inelastic scattering with the high-resolution spectrometer Grand-Raiden in coincidence with high-resolution gamma-ray detection by the germanium clover array CAGRA. Two main motivations are: i) to investigate the isospin character of the PDR states by comparing with high resolution data their population with the  $(\alpha,\alpha'\gamma)$  reaction (isoscalar character, surface-sensitive),  $(p,p'\gamma)$  reaction (mainly isoscalar character, better sensitivity to the inner transition density), and  $(\gamma,\gamma')$  (mainly isovector character); ii) to measure the angular distribution of the hadronic reaction which is considered to be sensitive to the shape of the transition densities of the E1 states up to around the neutron separation energy.