Abstract

We propose to measure the parities of dipole excitations between 6 and 10 MeV in the doubly-magic nucleus $^{48}$Ca at HIGS. These experiments are mandatory because the existing unpolarized photon-scattering data and complementary ($\alpha,\alpha'\gamma$) experiments performed at the KVI Groningen show unexpected differences in the dipole excitation pattern below the particle separation thresholds. The proposed parity measurements will either reveal that some of the $J=1$ states have positive parity which would mean the existence of very strong M1 excitations in this nucleus which are not predicted in any model. Or it would reveal negative parity of the states which would mean that the isospin structure of E1 excitations show an unexpectedly strong state-by-state dependence. In addition the possible observation of branching ratios from these excitations to lower lying states at HIGS would add an important new observable to the experimental findings. The experiments are placed into the context of Pygmy Dipole Resonance in neutron rich nuclei which are currently intensively discussed in nuclear physics.

1 Introduction