Study of *M1* and *E1* Excitations by High-Resolution Proton Inelastic Scattering Measurement at Forward Angles

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Determination of *M1* strengths and their distribution is of much interest relating to subjects of Gamow-Teller quenching problem, fragmentation mechanism of one-particle one-hole strengths, search for exotic excited states, and astrophysical processes such as neutrino inelastic scattering in supernovae. Distribution of E1 strengths are discussed from the interest of giant and pygmy dipole resonance, soft dipole resonance, and nucleosynthesis.

Thanks to the recent development of experimental technique at Research Center for Nuclear Physics, a powerful probe is becoming available, which is high-resolution measurement of proton inelastic scattering at very forward angles. We have realized measurements at zero-degrees up to a heavy target of ^{208}Pb with an energy resolution of 20 keV, a scattering angle resolution of 0.5 degrees, and low instrumental background which can be reliably subtracted. Excitation strengths of discrete states can be obtained over a wide excited energy range independent of their decay channels. Spin-flip strengths (*M1*) and non-spin-flip strengths (Coulomb excitation of *E1*) can be model-independently decomposed by measuring polarization transfer coefficients. *(continue to the next page)*

Proton inelastic scattering is primarily sensitive to spin part of *M1* excitations while electromagnetic probes are sensitive to both spin and orbital parts. Thus by combining the two probes, more detailed property of excited states would be revealed.

Proton inelastic scattering data have been measured for several representative *sd*- and *fp*-shell nuclei. Measurement for the ^{208}Pb nucleus including polarization transfer coefficients is scheduled in the next October. We will present recent results and experimental plan for ^{208}Pb.