Giant resonaces in ^{48}Ca

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The location of the giant monopole resonance (GMR) is important because it can be directly related to the compressibility of nuclear matter K_{NM} [1]. Systematic studies of GMR in various nuclei lead to the value of nuclear compressibility at 231±5 [2]. This property of the GMR and the variation of the compressibility with neutron number can also be used to extract the symmetry energy K_{sym} in the equation of state. In the early analysis, Leptodermous expansion similar to mass formula was used to parameterize compressibility of the nucleus into volume, surface, symmetry and Coulomb terms. However, Shlomo and Youngblood [3] show that this type of analysis cannot provide a unique solution even including all available data in the world. On the other hand, microscopic calculation with specific interactions can provide information on the location of GMR and the compressibility of nuclear matter as well as the symmetry energy. In recent years, the study of the isotope dependence and the extraction of symmetry energy are mostly concentrated in heavy nuclei, especially in Sn isotopes [4-6] with the neutron excess ratio (N-Z)/A value changes from 0.107 in ^{112}Sn to 0.194 in ^{124}Sn. This gives a relative large deviation in the isotope dependence. However, in the calcium isotope, the (N-Z)/A value is 0 in ^{40}Ca and is 0.167 in ^{48}Ca. Although the neutron access value in ^{48}Ca is not as large as in ^{124}sn, the difference is larger, thus it might provide larger difference in the location of GMR and more precise determination of the symmetry energy. Therefore, we have studied the giant resonances in ^{48}Ca.

A beam of 240 MeV α particles from the Texas A&M K500 superconducting cyclotron was used to bombard a self-supporting ^{48}Ca foil in the center of the target chamber of the Multipole-dipole-multipole spectrometer. The details of the setup and the experimental technique have been

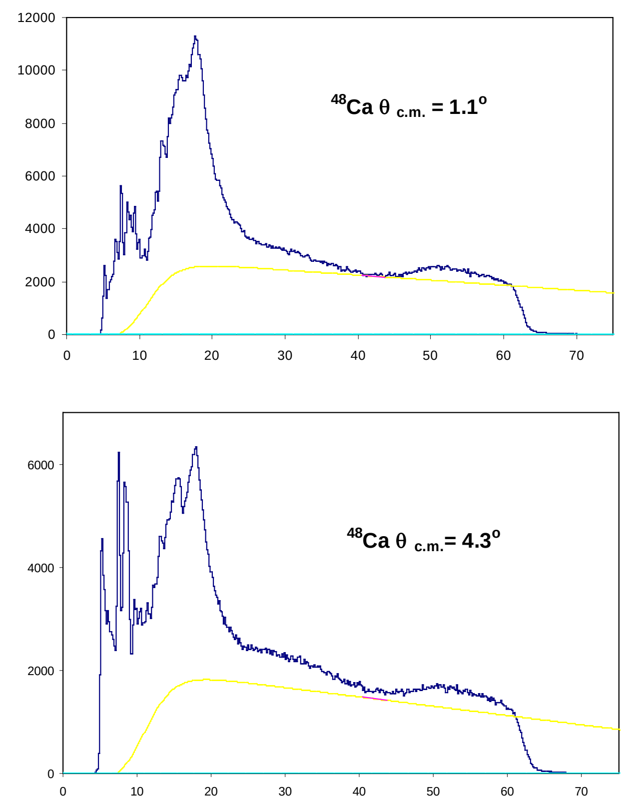

FIG. 1. Inelastic alpha spectra obtained at two angles for ^{48}Ca. The grey lines show the continuum chosen for the analysis.

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described in Ref. [7]. Sample spectra obtained for ^{48}Ca at $\theta_{avg.}$ =1.1° and 4.3° are shown in Fig. 1.

Multipole decomposition analysis was performed to extract the strength of each multipole component of the giant resonances. Single folding density-dependent DWBA calculations were carried out. The transition density, sum rules, and DWBA calculations were discussed thoroughly in Ref. [7,8]. Preliminary result of the strength distributions of GMR and giant quadrupole (GQR) resonance strength are shown in Fig. 2.

Detailed analysis is in progress.

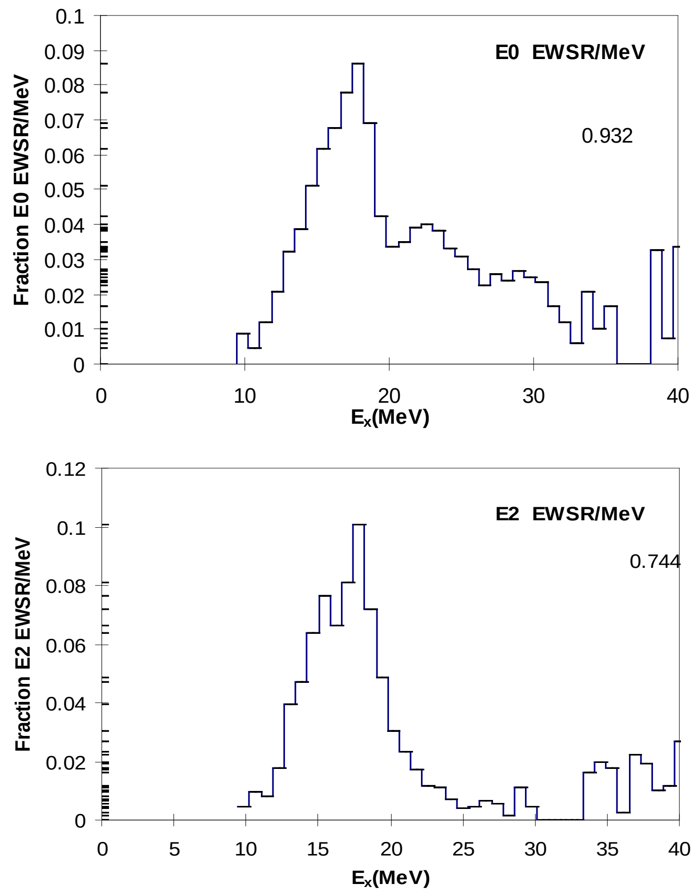

FIG. 2. Strength distributions of GMR and GQR obtained for ^{48}Ca.

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