EXCITATION OF GIANT MULTIPOLE RESONANCES VIA INELASTIC SCATTERING OF INTERMEDIATE ENERGY PROTONS, DEUTERONS, AND ALPHA PARTICLES

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The existence of nondipole giant resonances have been well established over the past few years.[1] Although most observations have dealt with the properties of the T = 0 giant quadrupole resonance (GQR), some evidence[1] has been provided for the existence of a T = 0, E3 resonance. The recent observation[2] of another new resonance, located at $\approx$ 80 X $A^{-1/3}$ MeV and interpreted[2,3] as a likely candidate for a giant monopole resonance (GMR) has been of particular interest.

Nearly all of the results on the "new" resonances have been obtained through the use of inelastic scattering of hadrons and electrons. Giant multipole resonance studies using inelastic hadron scattering at incident energies available at IUCF are attractive for several reasons: 1) lower continuum magnitude and larger resonance cross section than for lower energy projectiles; 2) for proton scattering, more structured angular distributions than at lower energies; and 3) for 150-MeV alphas, the resonance spectra are expected to be freer from overlap with alphas from competing processes (e.g., α,^{5}He $\rightarrow$ α + n) than when using lower energies.

We have recently studied the giant resonance structure in ^{208}Pb, ^{120}Sn, ^{90}Zr, and ^{59}Ni using inelastic scattering of 152-MeV alpha particles. The objective of these measurements was to determine if the 80 X $A^{-1/3}$-MeV resonance observed in nuclei in the lead region, and thought to be a GMR, is also found in lighter nuclei. Figure 1 shows a spectrum from ^{120}Sn at 13 degrees. The giant resonance structure is dominated by the GQR located at $\approx$ 12.8 MeV. However, the shape of the resonance is clearly asymmetric to the high

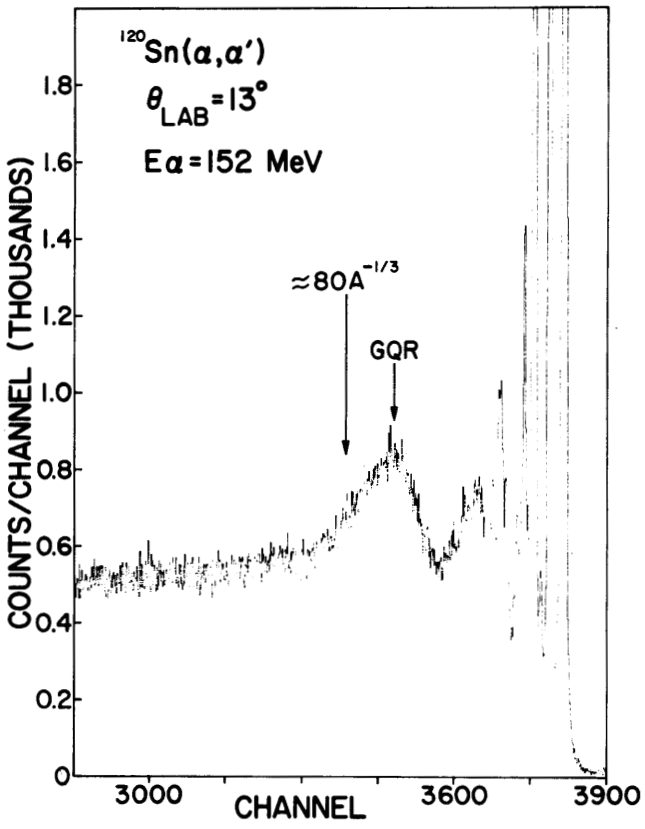

Fig. 1. Spectrum of inelastically scattered alpha particles from ^{120}Sn at 13 degrees. Incident alpha energy is 152 MeV. The arrow GQR indicates the expected location of the giant quadrupole resonance in ^{120}Sn. The arrow labeled 80 X $A^{-1/3}$ MeV indicates the anticipated location of a giant monopole resonance. The experimental gain is $\approx$ 40 keV/channel.

excitation energy side, presenting the possibility that a weaker resonance is located at 80 X $A^{-1/3}$ MeV. Detailed quantitative analysis of the data is now in progress.

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