EXCITATION OF GIANT SPIN-ISOSPIN MULTPOLE VIBRATIONS IN $^{54,56}$Fe AND $^{58,60}$Ni

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The selectivity and the surprising simplicity of the $(p,n)$ reaction at intermediate energies has been used to study the spin-isospin correlations in nuclei (see Ref. 1 and other references within). The zero degree spectra have been used to obtain the $\Delta L = 0$ response function of nuclei while the measured energy dependence of the effective nucleon-nucleus interaction resulting from the spin-isospin terms in the nucleon-nucleon force has been employed to identify the spin-isospin or Gamow-Teller strength. Other multipoles observed at higher excitation energies indicate a maximum differential cross section at slightly higher angles and have been interpreted as $(\Delta L = 1, \Delta S = 1)$ and $(\Delta L = 2, \Delta S = 1)$ excitations.¹

We have obtained 160 MeV $(p,n)$ data on $^{54,56}$Fe and $^{58,60}$Ni and 120 MeV data for the $^{58}$Ni$(p,n)^{58}$Cu reaction in order to study the response function of $^{58,60}$Ni targets to spin-isospin transitions characterized with $\Delta L = 0, \Delta L = 1$ and $\Delta L = 2$ transfers and to study the

response function for spin-isospin transitions with $\Delta L = 0$ transfers for $^{54,56}$Fe targets. In the case of the Ni isotopes, a comparison may be made with the Ni spectra obtained from electro-excitation.²³⁴

The experimental results and analysis for the $^{58}$Ni$(p,n)^{58}$Cu reaction have been published³; the analysis for the other isotopes is in progress.

The double differential cross section of $L = 0$ strength observed at $\theta_L = 0^\circ$ for the $^{58}$Ni$(p,n)^{58}$Cu reaction is presented in Fig. 1b and is compared in Fig. 1c with the $B(M1)$ strength reported⁴ for the $^{58}$Ni$(e,e')$ reaction. The locations of known $1^+$ excited states in $A = 58$ nuclei are shown in Fig. 1a.

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Figure 1.  
a) Locations of $1^+$ states in $A = 58$ nuclei.

b) Double differential cross section of $L=0$ strength observed at $\theta_p = 0^\circ$ for the $^{58}\text{Ni}(p,n)^{58}\text{Cu}$ reaction at $E_p = 120$ MeV and $E_p = 160$ MeV. The abscissa represents excitation energy in $^{58}\text{Cu}$.

c) $B(M1)$ strength reported in Ref. 4 for the $^{58}\text{Ni}(e,e')$ reaction.