Low Energy Component of Isoscalar Giant Dipole Resonance

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Strength functions for the isoscalar dipole resonances in ^{90}Zr, ^{116}Sn, ^{144}Sm and ^{208}Pb have been measured with inelastic scattering of 240 MeV α particles at small angles[1]. The isoscalar E1 strength distribution in each nucleus was found to consist of two components, a broad component at E_x~$120/A^{1/3}$ MeV containing approximately 100% of the E1 EWSR and a narrower one at E_x~$75/A^{1/3}$ MeV containing 15-40% of the total isoscalar E1 strength. The lower component is near the isovector giant dipole resonance which was already accounted for in the analysis assuming the strength distribution from electromagnetic measurements. As we had done a deformed potential analysis which is known[2] to require renormalization to agree with electromagnetic measurements, we renormalized the IVGDR to eliminate this lower peak. We then did a through folding model analysis for ^{116}Sn[3] which numerous works have shown to agree with electromagnetic work[2,4,5] and found it did not change the proportion of isoscalar E1 strength in the lower peak. Figure 1 shows the isoscalar E1 distributions obtained from the deformed potential analysis[1] of ^{90}Zr, ^{116}Sn, ^{144}Sm and ^{208}Pb, and the lower component is apparent for each nucleus. The higher component is apparently the compression mode E1 strength previously reported in ^{208}Pb[6], whereas the lower component is a new mode not reported previously but suggested by recent RPA-HF[7] and relativistic mean field calculations[8]. Table 1 compares the parameters obtained from the deformed potential analysis with those predicted by Colo et al.[7].

Table 1. Comparison with Colo et al. [7] ISGDR parameters

							Splitting		
Exp.	Lower	Colo	Diff	Upper	Colo	Diff	Exp	Colo	Diff
	(MeV)	(MeV)	(MeV)	(MeV)	(MeV)	(MeV)	(MeV)	(MeV)	(MeV)
208	12.8	10.89	1.91	20.3	23.9	-3.6	7.5	13.01	5.51
144	14.7	13.53	1.17	23	26.6	-3.6	8.3	13.07	4.77
116	14.9	12.5	2.4	24.3	27.5	-3.2	9.4	15	5.6
90	16.3	14.54	1.76	26.3	30	-3.7	10	15.46	5.46

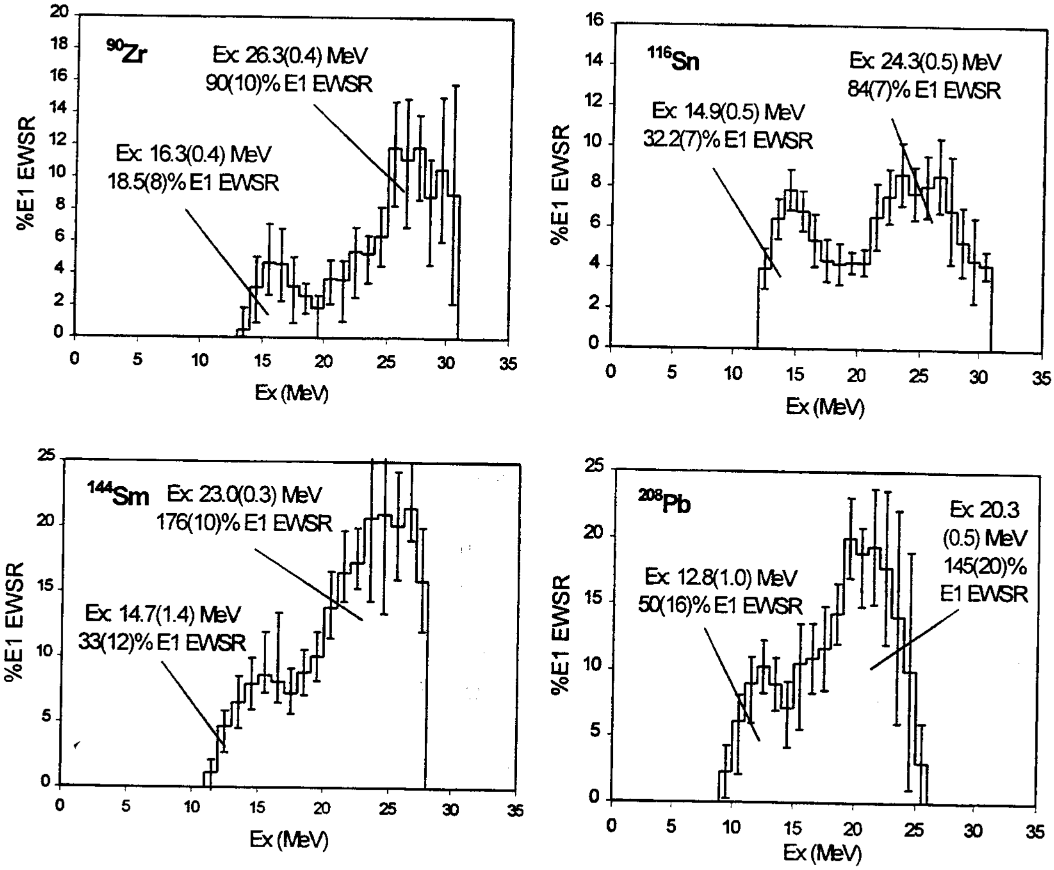

Figure Caption

Fig 1. The isocalar E1 distributions obtained from a deformed from a potential analysis for the nuclei indicated. The error bars represent the uncertainty from the fits to the angular distributions [4].

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