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Magnetic properties of deformed dipole bands in ^{110,112}Te

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Abstract
A lifetime analysis using the Doppler-shift attenuation method has been performed on the Tellurium isotopes ^{110,112}Te. The experiment was performed using the Gammasphere array in conjunction with the MICROBALL charged-particle detector. Three strongly coupled bands were previously established in ^{110,112}Te which were observed up to unusually high spins. In the current experiment, it has been possible to extract lifetime measurements using a Doppler broadened lineshape analysis on one of the $\Delta I = 1$ band structures in ^{110}Te. In contrast to similar $\Delta I = 1$ structures in other nuclei in this mass region, the extracted $B(M1)$ values did not rapidly decrease with increasing angular momentum. Instead, the strongly coupled band in ^{110}Te represents a deformed 1p-1h structure, rather than a weakly deformed structure showing the shears mechanism.

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Previous work on the tellurium isotopes ^{110,112}Te [1, 2] established three strongly coupled bands which were observed up to spins of $\approx 40\hbar$, with strong $\Delta I = 1$ inband transitions clearly seen up to energies $\sim$900 keV. These bands have been interpreted in terms of deformed structures built on 1-proton$-$1-hole excitations that reach termination at $I \sim 40\hbar$. In this mass region similar 1p–1h proton excitations, involving a hole in the $g_{9/2}$ high-K proton orbital, result in $\Delta I = 1$ bands of intense dipole transitions. Such structures in $_{50}$Sn [3–5] and $_{51}$Sb [6] isotopes are observed to only modest spins and drop off quickly in $M1$ strength. The $\Delta I = 1$ bands in $_{50}$Sn and $_{51}$Sb have been interpreted in terms of the tilted-axis cranking (TAC) model [7], where the angular momentum is generated through magnetic rotation. A common feature of the magnetic bands is the rapid decrease of the $B(M1)$ values with increasing spin.

In this regard, a lifetime analysis using the Doppler Shift Attenuation method was performed on the strongly coupled bands in ^{110,112}Te to extract the experimental $B(M1)$ reduced transition rates. The experiment was performed at the Lawrence Berkeley National Laboratory using the Gammasphere array coupled to the MICROBALL charged particle detector. The Tellurium isotopes were populated with a ^{58}Ni + ^{58}Ni reaction at a beam energy of 240 MeV. The 1 mg cm^{-2} ^{58}Ni target was backed with 15 mg cm^{-2} of ^{208}Pb.

Unfortunately no Doppler broadened lineshapes were observed in ^{112}Te. However, using the code of Wells and Johnson [8], it has been possible to extract lifetime

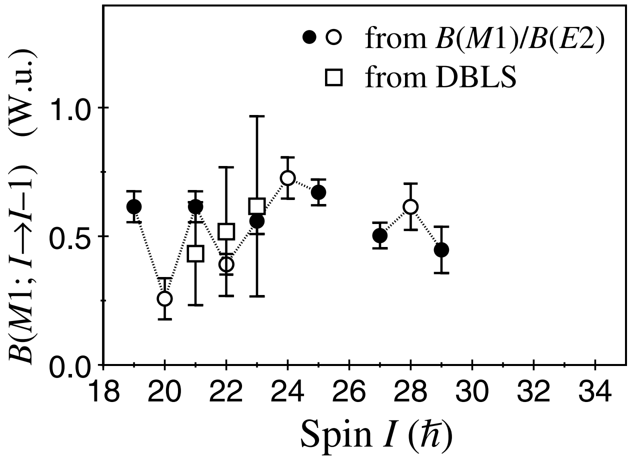

Figure 1. $B(M1; I \rightarrow I-1)$ strengths extracted for one of the dipole bands in ^{110}Te.

measurements for one of the strongly coupled bands in ^{110}Te. The extracted $B(M1)$ strengths from this lifetime analysis and from the previous thin target experiment are plotted in figure 1. The extracted $B(M1)$ values remain fairly constant between spins 21–23$\hbar$, which is in contrast to the behaviour observed in the magnetic bands of ^{108}Sn [4] where the $B(M1)$ values decrease over a spin range 15–19$\hbar$. In addition, the absolute $B(E2)$ strengths in ^{110}Te are an order of magnitude larger than in ^{108}Sn, indicating that the strongly coupled band in ^{110}Te is deformed and does not represent magnetic rotation which occurs for near spherical nuclei.

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