# Possible U(5) Symmetry and Intruder Levels in $^{122}$Te

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The structure of the even-even tellurium isotopes is not clear, e. g. the energy of the $0_2^+$ is rapidly increasing from $^{118}$Te to $^{130}$Te, while the energy of the $6_1^+$ is nearly constant. Also the existence of intruder levels, like in cadmium and tin isotopes, is not confirmed. IBA–1 and IBA–2 [1] calculations with and without intruder levels were made. $^{122}$Te is the best candidate for an IBA–1 U(5) vibrational nuclei in the tellurium isotopes.

As described in [2] we used the IBA–1 U(5) energy function for the fitting of the U(5) levels. The result of this fit, the measured energies and the angular momenta of the levels are shown in table 1. The levels up to the 3–phonon levels are fitted very well, except the $6^+$ and the $0^+$ of the 3–phonon levels. The 3–phonon $6^+$ is shifted 50keV, the $0^+$ 72keV downwards.

The intensities of these levels in the $^{122}$Te(d,d')$^{122}$Te reaction (see fig. 1) are measured and found to be reasonable for U(5) levels. It was not possible to separate the $6^+$ at 1751keV from the $2^+$ at 1752keV. The $6^+$ level has also a large intensity in the ($^3$He,d) reaction, but only approximately 1/2 of the intensity of $^{124}$Te at similar energy and angle relatively to the other levels. All known levels are found in the (d,d') reaction, except for the $3^+$ 3–phonon level which has the wrong parity for the (d,d') measurement. At an energy of approximately 2348keV a new level with a small intensity is found. This and a level at 2435keV are candidates for the 4–phonon $8^+$. But no angular momentum is known of these levels. The assignment of the other 4–phonon levels is much more complicated, because the energy of the levels and the level density in this region is much higher.

| Energy | Energy$_{U(5)}$ | $\Delta E$ | J | J$_{NDS}$ | J$_{(n,n'\gamma)}$ |
|---|---|---|---|---|---|
| 0 | 0 | 0 | $0^+$ | $0^+$ | $0^+$ |
| 564 | 580 | -16 | $2^+$ | $2^+$ | $2^+$ |
| 1181 | 1180 | -1 | $4^+$ | $4^+$ | $4^+$ |
| 1257 | 1251 | 6 | $2^+$ | $2^+$ | $2^+$ |
| 1357 | 1362 | -5 | $0^+$ | $0^+$ | $0^+$ |
| 1751 | 1799 | -48 | $6^+$ | $6^+$ | $6^+$ |
| 1910 | 1911 | -1 | $4^+$ | $4^+$ | $4^+$ |
| 1941 | 2013 | -72 | $0^+$ | $0^+$ | $0^+$ |
| 1951 | 1952 | -1 | $3^+$ | | $3^+$ |
| 2099 | 2095 | 4 | $2^+$ | 0,1,2 | $2^+$ |
| | 2438 | | $8^+$ | | |
| | 2591 | | $6^+$ | | |
| | 2652 | | $5^+$ | | |
| 2690 | 2703 | | $4^+$ | ($4^+$) | |
| 2756 | 2774 | -18 | $2^+$ | 0,1,2 | |
| | 2848 | | $4^+$ | | |
| 2911 | 2919 | -8 | $2^+$ | 0,1 | |
| 3045 | 3030 | 15 | $0^+$ | 0,1,2 | |

Table 1: Comparison of the energies (from NDS) and the angular momenta (NDS and (n,n'γ) [3]) of the measured levels with the IBA-1 U(5) fit. All energies in keV.

| Energy | J$_{NDS}$ | J$_{(n,n'\gamma)}$ |
|---|---|---|
| 1747[a] | ($0^+$) | |
| 1752 | $2^+$ | $2^+$ |
| 2042 | $4^+$ | $4^+$ |
| 2196[b] | $3^-$ | $3^-$ |
| 2203[bc] | | 1 |
| 2284 | $6^+$ | $6^+$ |
| 2287 | 1,2 | $2^+$ |

[a]Energy from (d,d')
[b]Energy from (n,n'γ)
[b]Only measured in (n,n'γ)

Table 2: Known levels of $^{122}$Te up to approx. 2.3 MeV and not assigned to the U(5) levels of table 1.

Fielding et al. [4] identify a $0^+$ level in the ($^3$He,n) reaction at 1.62±0.03MeV, while Aubele and Ball [5] identify, from the (p,t) reaction, a $0^+$ level at about 1750keV. Walker et al. [6] measured an E0 transition to the ground state at 1747keV, but this transition was unresolved from a strong transition to the $2_1^+$ level. In the (d,d') measurement a weak level at 1747keV is found. This indicates that the measurement of Walker et al. is correct and this level is a $0^+$. This level is the proposed band head of an intruder band. It is probably shifted about 70keV upwards due to a strong mixing with the 3–phonon $0^+$ configuration. The other band members are $2^+$ at 1752keV, $4^+$ at 2042keV and $6^+$ at 2284keV (see table 2). Further investigations have to be made to clarify the situation in $^{122}$Te.

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## References


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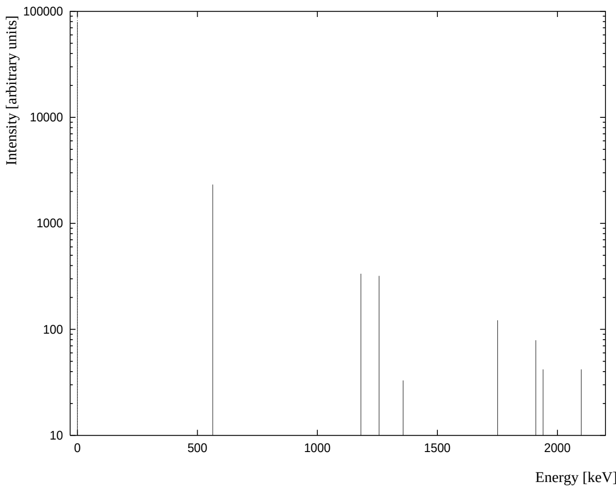


Fig. 1: Intensity of the levels of table 1 up to 2100 keV measured in the $^{122}$Te(d,d')$^{122}$Te reaction at $E_d$ = 26MeV and a laboratory angle of 30°.