Spectroscopy of ^{166}Ho via the (d,p) Reaction

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The nuclide $^{166}_{67}Ho_{99}$ offers one of the best known level schemes among the odd-odd deformed nuclei, which are very interesting theoretically because interactions between the odd particles have a strong influence on the energies of the low-lying states. Over 330 energy levels and 20 rotational bands have been identified in this nucleus based on various nuclear reactions [1]. However, for some bands detailed Nilsson assignments are either missing or have been suggested using only plausibility arguments or model considerations.

Since the level densities in odd-odd nuclei are generally large (in ^{166}Ho about 100 levels up to 1000 keV), a successful study requires high energy resolution. Consequently the ^{165}Ho (d,p) ^{166}Ho reaction has been studied using a deuteron beam produced by the Munich tandem accelerator. Spectra at $\Theta_{\rm lab}$=15°, $\Theta_{\rm lab}$=30° (see fig. 2), and $\Theta_{\rm lab}$=45° were measured with a deuteron energy of 17 MeV up to an excitation energy of 1700 keV.

The sufficiently high resolution (*FWHM*≈5 keV) of the Q3D spectrograph and of the cathode strip detector [2] used in this experiment gives the possibility to improve the previous data obtained by Struble et al. in 1965 [3].

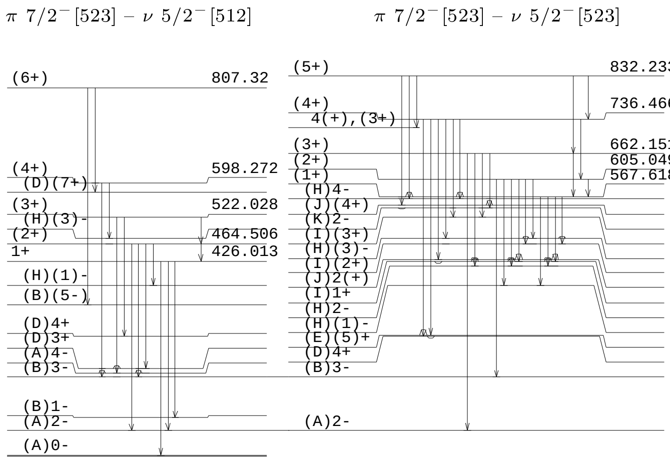

Fig. 1: The two $K^\pi = 1^+$ rotational bands at 426 keV and 568 keV [1]. The new configuration assignments are given.

One of the most interesting questions, Sood and Burke pointed out recently [4], are the currently adopted two-quasiparticle (2qp) interpretations for the two $K^\pi = 1^+$ bands at 426 keV and 568 keV. We confirm the new Nilsson assignments given by Sood and Burke, π 7/2$^-$[523] – ν 5/2$^-$[512] and π 7/2$^-$[523] – ν 5/2$^-$[523], respectively (see fig. 1). These bands interchange the assignments currently adopted [1]. The new assignments are in agreement with phenomenological and theoretical predictions.

Our new high–resolution data will also help to interpret some of the higher lying peaks of the spectrum. For example, large peaks are predicted for the $K^\pi = 4^+$ and $K^\pi = 3^+$, π 7/2$^-$[523] ± ν 1/2$^-$[510] bands. Our results support the 2qp assignment π 7/2$^-$[523] – ν 1/2$^-$[510] for the 814.3 keV ($K^\pi = 3^+$, $I^\pi = 3^+$), 889.8 keV ($I^\pi = 4^+$), and 984.6 keV ($I^\pi = 5^+$) levels given by Bollinger and Thomas [5].

In agreement with the latest (n,γ) measurements from Balodis et al. [6] some new levels can be confirmed, for example a $I^\pi = 6^+$ level at 379.5 keV (see fig. 2).

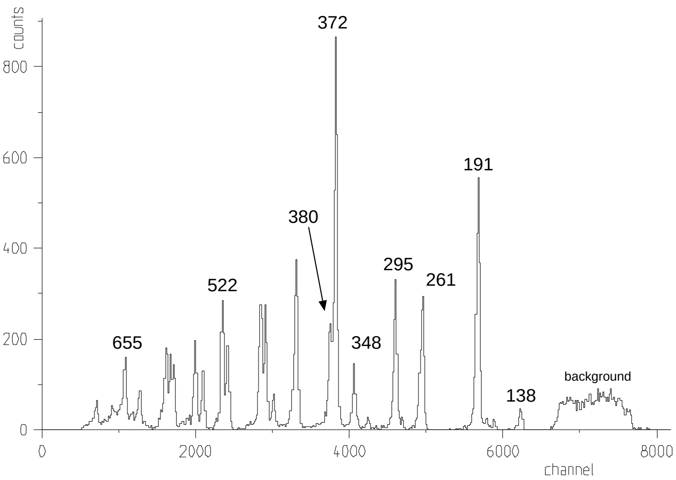

Fig. 2: Part of the spectrum of the ^{165}Ho (d,p) ^{166}Ho reaction at 30° with 17 MeV deuterons (numbers: excitation energy in keV).

References

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