^{196}Au, ^{195}Pt, and Complete Spectroscopy in the Framework of the IBM Supersymmetry ◇

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The supersymmetric version of the interacting boson model (IBM) [1–3] allows for a simultaneous description of an even-even, even-odd, odd-even and odd-odd nucleus. In the O(6) symmetry range the four nuclei ^{194}Pt, ^{195}Pt, ^{195}Au and ^{196}Au are one quartet of interest [3–5]. We studied the $^{197}\mathrm{Au}(\vec{d},t)^{196}\mathrm{Au}$ and the $^{196}\mathrm{Pt}(\vec{d},t)^{195}\mathrm{Pt}$ reactions with the 25MeV polarized deuteron beam of the Munich MP tandem accelerator (250nA on target, 5keV FWHM) [5]. The orbitals of the transfered neutron are $3p_{1/2}$, $3p_{3/2}$, $2f_{5/2}$, $2f_{7/2}$ and $1i_{13/2}$. In ^{195}Pt the observed fragmentation of these orbits is due to the excitation of core degrees of freedom. The observed states of ^{196}Au result from additional coupling to the $d_{3/2}$ proton orbital. If one neglects excitations of the proton orbital, each state in ^{195}Pt is splitted in up to four states in ^{196}Au. Thus, one can predict from the number of states in ^{195}Pt an expected number of states for the Au measurement. In fig. 1 these numbers are plotted versus excitation energy. The energies of Pt are shifted by about 100 keV against the levels in Au since the ^{196}Au ground state is lowered in energy by the level splitting. The predicted numbers (grey area), based on the ^{195}Pt measurements, agree very well with the analysis of the ^{196}Au experiment (solid line). This is a hint, that single particle excitations of the valence proton seem to be neglectable in this energy range. The dashed curve is an IBM calculation for ^{196}Au [4,5], which follows almost exactly the measurement in the region below 700 keV.

Fig. 2 shows an incremental plot of the spectroscopic factors for the $3p_{3/2}$ transfer, comparing ^{195}Pt, ^{196}Au and the IBM prediction. Including the 100 keV shift for the Pt levels, the different curves fit very well to each other. The results for the other transfered orbitals mentioned above are similar.

For positive parity states an incremental and a differential plot of the spectroscopic factors are shown in fig. 3. One expects for each peak in ^{195}Pt a quartet of states $(5^+, ..., 8^+)$ in the spectrum of ^{196}Au. A tentative assignment of the first quartet is shown in the figure. The weighted average of the energy and the sum over the spectroscopic factors fit to the data of the first Pt line, if one includes the 100 keV shift in energy.

The comparison of the measurements of ^{195}Pt and ^{196}Au shows the features of complete spectroscopy for energies up to 1 MeV. The IBM calculation fits in the resulting scheme, but is not sufficient for a detailed description of higher excitation energies.

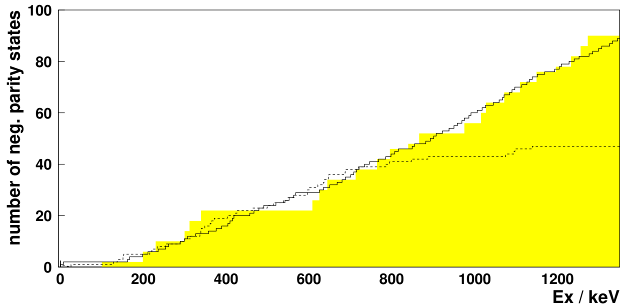

Fig. 1: The solid curve shows the number of negative parity states in ^{196}Au versus excitation energy. The dashed curve is an IBM prediction and the grey area a prediction based on the ^{195}Pt (100 keV shifted) measurement.

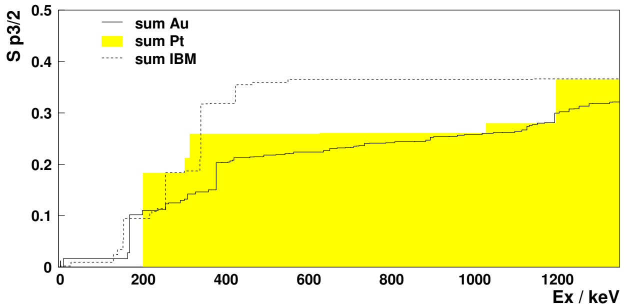

Fig. 2: Incremental plot of the spectroscopic factors $S_{p3/2}$ for ^{195}Pt (grey area, 100 keV shifted), ^{196}Au (solid curve) and the IBM prediction (dashed curve).

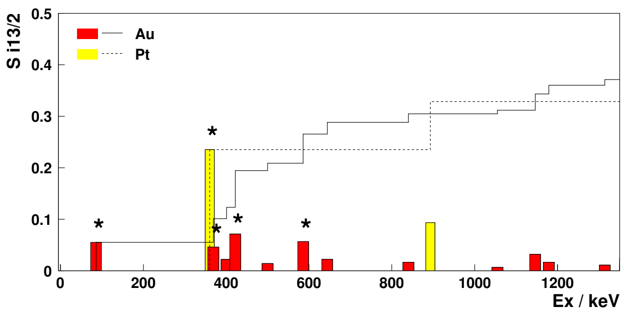

Fig. 3: Differential and incremental plots of the positive parity states of ^{196}Au and ^{195}Pt (100 keV shifted).

References

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