SHAPE COEXISTENCE IN THE ENTRY STATES OF ^{187}Au COMPOUND NUCLEUS.

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Some years ago, in the low lying levels of ^{187}Au and ^{189}Au, we showed the coexistence of two different shapes in the same nucleus[1,2]. This was observed through the existence of two decoupled bands without connexions between each other, one built on the h11/2 proton orbital (oblate shape), the other one on the h9/2 proton orbital (prolate shape). In ^{189}Au, the lower levels were observed to be oblate. The first prolate shape ($9/2^-$) was observed at 325 keV and it was the oblate band population which was favored (3.8 times more). In ^{187}Au, the situation was just the opposite, with the first oblate state ($11/2^-$) observed at 224 keV and the prolate band population favored (twice more). In this contribution, we present new results about the shape of ^{187}Au compound nucleus in its entry states just after the evaporation of the last neutron from ^{191}Au formed in the reaction ^{175}Lu+^{16}O (95 MeV). In this experiment, performed with the Alice facility in Orsay, we have measured the γ multiplicity and the variance of the γ distribution in coincidence with discrete γ lines identifying one or the other shape of the final nucleus (233.5-334.7-413.8-491.4 keV lines for the prolate shape and 449.5-709.6-731.6 for the oblate shape). The experimental set-up is similar to that of ref.3) but a second NaI detector has been added at 155° to the beam direction for γ rays angular distribution informations. The γ multiplicity has been extracted in two different ways : i) with the classical method of coincidences between the NaI's and the Ge detector and the comparison with the direct Ge spectra, ii) from the coincidences between any of the 4 sectors of a NaI sum-spectrometer and a Ge detector following a method described in ref.3). The γ multiplicities have been measured for the (4n prolate), (4n oblate) channels leading to ^{187}Au and also for the (5n) channel leading to ^{186}Au identified by the two 230 and 366 keV lines[4]. From the Ge spectra, it was also possible to extract the relative cross-sections for these three channels. The results are presented on Table I. On this table, M_γ(NaI) and M_γ(sum) are the multiplicities measured by the two methods indicated in the text, σ_γ and I_γ are the

Channel	M_γ (NaI)	M_γ (sum)	α_σ	rel	ℓ_i	I_o
4n prolate	16.3±1.0	15.6±1.0	5.6±0.7	100	31	4.5
4n oblate	11.9±1.0	13.3±1.0	3.5±0.4	49	25	5.5
5n	6.8±1.2	-	-	40 (41)	11 (12)	3

Table I

variance and relative intensities of the different channels. ℓ_i is related to M_γ through $\ell_i=2(M_\gamma-4)+I_o+x\Delta\ell_n$. I_o is the ground state of the involved band, $\Delta\ell_n$ the angular momentum carried away by each of the x neutron ($\Delta\ell_n$= 0.6h). For the γ contribution, 4 statistical transitions have been assumed. All the remaining transitions are assumed to carry 2 units of angular momentum. In fact, in the oblate band, some $\ell=1$ transitions may occur. This would decrease the initial angular momentum of the states feeding the oblate band and thus, increase even more the difference of population of the two bands as indicated on Table I. Our conclusions would not be changed.

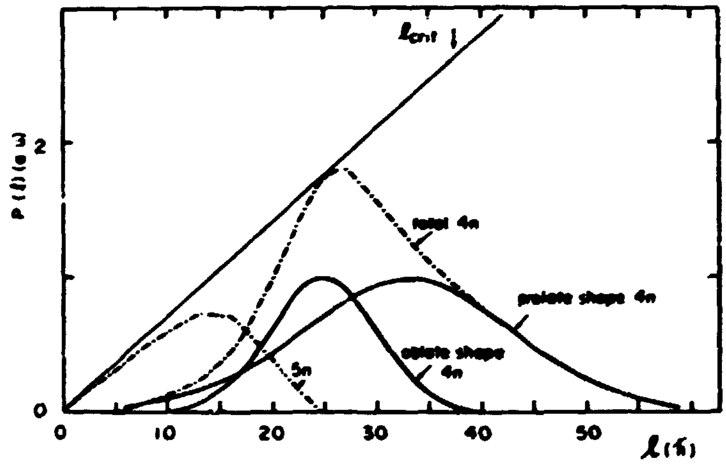

Fig. 1. Angular momentum population of the (4n prolate), (4n oblate) and (5n) channels. The straight line represents the behavior of the fusion cross-section ($P_F(\ell)\propto 2\ell+1$. The 5n population is deduced from the substraction of the 4n cross-section to the fusion cross-section.

The experimental results are summarized on fig. 1. The prolate and the oblate 4n channels have been drawn with gaussian behaviors having the characteristics and relative intensities given on Table I. The 5n channel has been obtained by substracting the probability $P_{4n}(\ell)$ of the 4n channel to the total fusion probability $P_F(\ell)\propto 2\ell+1$. Then the ℓ_i and I_γ values, for this channel have been deduced (quantities in brackets on Table I) and compared to the measured values. As we have not measured the skewness of the M_γ distributions we assumed the shapes to be gaussian. This does not change our main conclusions. On fig.1, we observe that in the higher region of angular momenta (ℓ>30h) only the prolate shape of the nucleus is fed. Between 15h and 30h both shapes are equally populated. This result is very important because it gives informations about the shape of the nucleus in the rotating frame. We learn first that the barrier between the prolate and oblate minima remains important whatever the ℓ value, so that when the nucleus is formed with a given shape at high ℓ, it keeps the same shape along the whole deexcitation path. In principle, from fig.1, we could extract the relative energies of the prolate and oblate minima for each ℓ value. For instance, we can deduce that above 30h, the prolate minimum must be lower than the oblate one, favoring the prolate shape population. In the intermediate angular momentum region (as observed at low spin), both minima must have about the same energy and are equally populated. We know that at low spin, γ deformation is involved but these conclusions remain true in the (β,γ) plane. Of course this simple picture can be smeared by the influence of geometrical conditions.

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