O(6) Dynamical Symmetry Investigation in ^{132,134}Ba $^{\diamond}$

Gh. Cata-Danil [a], D. Bucurescu [a], L. Trache [a], A. M. Oros [a], M. Jaskola [b], S. Deylitz, A. Gollwitzer, D. Hofer, B. D. Valnion, and G. Graw
[a] Institute of Atomic Physics, Bucharest, Romania
[b] Soltan Institute of Nuclear Studies, Swierk, Poland

Ba nuclei with the mass number A around 130 are typical transitional nuclei with a γ - soft collective structure. In the picture of the Interacting Boson Model these nuclei emerged from the electromagnetic data as manifestation of the dynamic O(6) - symmetry of IBA-1 [1]. To provide independent data to establish further O(6) features of the Ba isotopes we studied the two neutron transfer and compare with existing Pt data and with IBA-1 model calculations.

The resemblance of these Ba and the Pt isotopes near A=196 is expected due to their similar and almost symmetric neutron and proton boson numbers $n_n+n_p = N$, resulting from their location with respect to the closed shells. The O(6) limit also covers features of data which may be described by an interplay of triaxiality ($\gamma \neq 0$) and transition towards more deformed structures.

In the first phase of our study we have focused on the L=0 transfer strength. In our measurement of the ^{134,136}Ba(p,t) reaction at 25 MeV incident proton energy the Q3D spectrograph of the Munich tandem facility and the 1.7 m focal plane detector [2] have been used. The energy resolution obtained is 7-8 keV, determined mainly by the target characteristics. Mass separated targets of the respective Ba isotopes of typically $100\mu g/cm^2$ have been prepared at the PARIS isotope separator in Orsay. Angular distributions have been measured in order to identify unambigously the typical diffractional-shape of L=0 transfer. For ^{132}Ba in the excitation range up to 4.0 MeV we identify 57 levels , 27 of them for the first time. For ^{134}Ba we observe in the same excitation range 44 levels, 18 of them are new. The L=0 transfer of a neutron pair as s-boson has been treated in IBA-1. The monopole transfer feature, which singles out the O(6) limit, are the strongest L=0 transitions: those to the ground state and to the *second* excited 0^+ state. The results of our measurements [3] and the IBA-1 predictions are represented in fig. 1. In the upper panel the experimental results for ^{132,134}Ba are compared with those for ^{194,196}Pt from Cizewski et al. [4]. The enhancement factor values are indicated numerically and also shown by the length of the horizontal bars at the respective excitation energies. For all 4 nuclei we observe transition strengths near 10 percent, at excitation energies where in the O(6) limit the second excited 0^+ state is expected. The first excited 0^+ state and, in the case of ^{132}Ba, ^{194}Pt and ^{196}Pt, one or two additional 0^+ states, have much weaker transition strengths. The level schemes from the lower panel of the fig. 1 taken from Iachello and Arima [5], are schematic IBA-1 calculations for 0^+ states in N=6 bosons nuclei in the three limiting cases, U(5), SU(3) and O(6). The respective quantum numbers are indicated. These dynamical limits are tractable analytically and directly related to the geometrical models of the spherical vibrator, the axially symmetric deformed rotor, and the $\gamma-$ soft rotor model of Wilets and Jean respectively. For the U(5) and SU(3) cases the energy scales are in arbitrary units and different in both cases, for O(6) the energies are typical values for nuclei near A=130 as determined by formula (20) from ref. [1]. Due to intruder configurations (states with wave functions beyond the IBA space), additional 0^+ states exist in this range. Because of their non collective nature they are weakly excited in (p,t). Thus, the observation of additional weakly excited 0^+ states should not affect the comparation with IBA prediction.

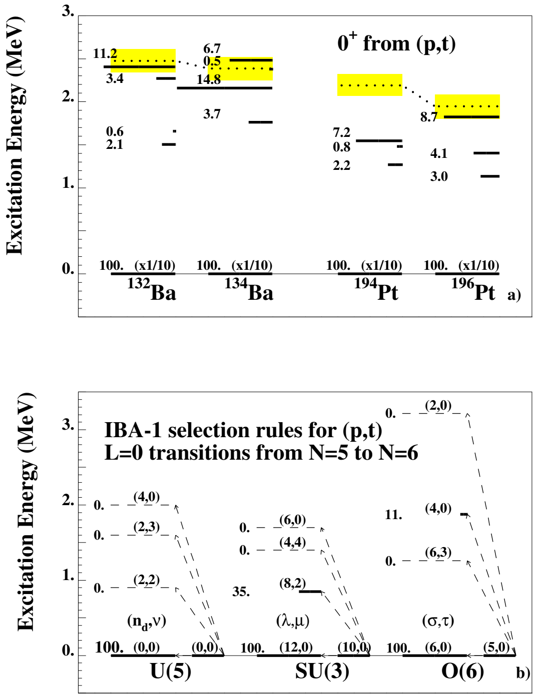

Fig. 1: The enhancement factors deduced from the L=0 cross sections for ^{132,134}Ba compared with results for ^{194,196}Pt [4] (upper panel) and IBA-1 calculations (lower panel)

References

[1] R.F. Casten and P. v. Brentano, Phys.Lett. **152B** (1985) 22
[2] E. Müller-Zanotti et al., Nucl.Instr.Meth. **A310** (1991) 706
[3] Gh. Cata-Danil et al., to be published
[4] J.A. Cizewski et al., Phys.Rev. **C23** (1981) 1453
[5] F. Iachello, A. Arima, The Interacting Boson Model, Cambridge University Press 1987

$^{\diamond}$Supported by International Office Karlsruhe, IFA contract-150B/A4, Istituto Nazionale di Fisica Nucleare, DAAD, and DFG II C4-Gr 894/2