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In-beam spectroscopy of ^{231}Pa

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An extended study of ^{231}Pa located near the boundary of octupole correlations region was carried out by Coulomb-excitation. Particularly, the investigation of the side-bands is

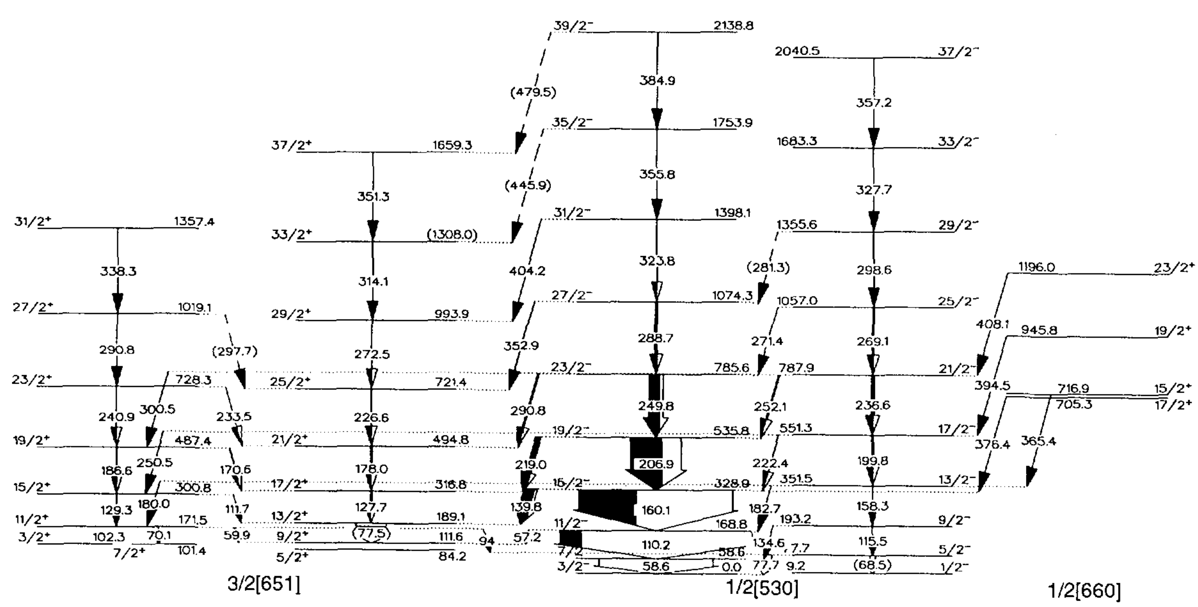

Figure 1: ^{231}Pa level scheme

possible in this case because strong K-mixing of the bands enables their excitation. Comparison of ^{231}Pa and ^{229}Pa at the boundary of octupole correlations allows to test the influence of these correlations on the nuclear structure . A 105 μg/cm^2 ^{231}Pa oxide target on a 15 μg/cm^2 carbon backing was bombarded by 148 MeV ^{32}S and 255, 260, 261 MeV ^{58}Ni projectiles. The particle-$\gamma\gamma$ coincidences of 20 Compton-suppressed germanium detectors of NORDBALL were read out in coincidence with backscattered projectiles. Position and energy of backscatered particles were measured with either a PSD-silicon detector[1] or a multi-PIN Si-diode detector[2].

A continuation of the known part of the 3/2[651] $5/2^+$band was identified up to $37/2^+$ (see Fig.1) in addition to the 1/2[530] $3/2^-$g.s. rotational band [3] by evaluating 400k-events of particle-$\gamma\gamma$ coincidences. The Radware97 computer code [4] was installed and used for this purpose. Energy and intensity of the gamma lines were fitted using the GASPAN [5] computer code. Intensity of Coulomb excited gamma lines are analyzed by the least-square search Coulomb excitation computer code GOSIA[6]. From the GOSIA analysis in a model independent way E2, E3 and M1 matrix elements will be deduced. Theoretical calculations of the ^{231}Pa structure are done in the quasiparticle-phonon-model [7]. A comparison of theoretical and experimental data gives interesting information about the 3/2[651] band structure and a possible structure change at high spins in the 1/2[530] band, as well as new insight into the nature of the weakly excited 1/2[660] band.

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References

[1] M. Sugawara et al., Activity Report, Niels Bohr Inst. Tand. Acc. Lab.,1994, p.94
Nucl. Phys.A557,1993, p.653c

[2] M. Würkner et al., Annual Report, Munich Tand. Acc. Lab.,1995, p.115

[3] M. Würkner et al., Annual Report, Munich Tand. Acc. Lab.,1996, p.35

[4] D.C. Radford, Nucl. Instr. Meth. A361,1995, p.297 and
Proceedings of the International Seminar on the Frontier of Nuclear Spectroscopy, ed. Y. Yoshizawa, H. Kusakari and T. Otsuka, World Scientific,1993, p.229

[5] F. Riess, Annual Report, Munich Tand. Acc. Lab.,1991, p.168

[6] T. Czosnyka et al., Bull. Am. Phys. Soc.,28,1983, p.745

[7] A.I. Levon et al., Nucl. Phys. A598,1996, p.11-46