Structure of Strongly Coupled Band of ^{117}Sb at High Spin

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Introduction

The nuclei in the transitional region with Z>50 have been known to show rich interplay of various structural features [1,2]. The present work focuses on one such structural feature of ^{117}Sb nuclei where a strongly coupled band based on a high spin state has been reported [3]. An effort has been made to reproduce this band using Particle-Rotor model incorporating Variable Moment of Inertia formalism [4]. This strongly coupled band is built on a high lying 3.2 MeV negative parity state and the bandhead is reported to have lifetime of 290 ns [3]. The negative parity band has been observed with ΔJ=1 strong M1 transitions corroborated by ΔJ=2 relatively weak E2 crossover transitions. It has been proposed from g-factor measurements [5] that the band is built on $[(\pi g_{7/2} d_{5/2})^2 \otimes (\pi g_{9/2})^{-1}] \otimes \nu 7^-$ quasiparticle configuration with no signature splitting due to the high K of the associated $(\pi g_{9/2})^{-1}$ orbital.

Parameter Choice

In the present work the calculation for energy level has been optimized by changing the values of the deformation parameter δ, Fermi level λ, attenuation factor α and VMI co-efficient C. The μ and κ values of Nilsson model were 0.48 and 0.07 and the Fermi level of 55.49 MeV was chosennear N=5 oscillator shell after slight adjustment of the same obtained from Nilsson model calculation Fig.1. The calculation was performed using deformation δ=0.28.

Result and Discussion

The level energies have been fairly well reproduced in our present calculation Fig 2.The calculation of the theoretical lifetimes using the theoretical B(E2) values show that the half life of $23^-/2$ state is 71 ns (table1) whereas the reported experimental half life is 290 ns. The lifetimes of other states (table 1) belonging to this band have been predicted using the B(E2) values obtained from the calculation .

From the present work we find that the negative parity band is built on a high-k $11/2[505]$ prolate orbital with admixture from the neighbouring $9/2[514]$ orbital of the N=5 oscillator shell. The Coriolis attenuation co-efficient α gives best fit when it is 0.9. The present calculation show lack of signature splitting which is also observed experimentally. The calculation also confirms that the isomer built on $23^-/2$ state has significant deformation in agreement with the previous work .

Table 1

E_{level} keV	$E\gamma$ feeding E_{level} in keV	J^- Spin of the level	$T_{1/2}$ Half life	
From Experiment			Expt.	Theory
3215	16	$19^-/2$		
3231	208	$23^-/2$	290ns	71ns
3439	303	$25^-/2$	-	
3742	367	$27^-/2$	-	1.06ps
4109	403	$29^-/2$	-	0.28ps
4512		$31^-/2$	-	0.24ps

Conclusion

The strongly coupled band based on a high lying $23^-/2$state has been studied in the framework of particle rotor model using VMI formalism. The level energies as well as the lifetime of the band head could be reproduced with reasonable accuracy from this model. The study of the detailed structure of this band is currently underway.

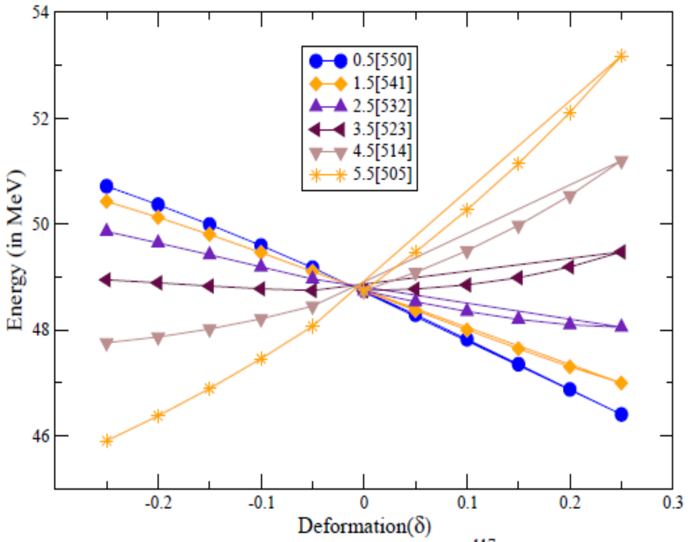

Fig.1 Relevant Nilsson Diagram for ^{117}Sb

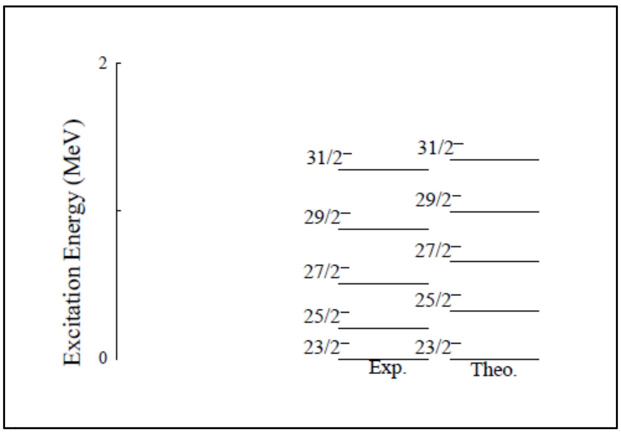

Fig.2 Comparison between experimental and theoretical levels predicted using PRM in ^{117}Sb

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