characterization of aligned bands in even even hf isotopes

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In the present work, the structure of the energyspectra and the backbending phenomena of the even-even Hfisotopes with mass number between 162 and 168 have beeninvestigated. Analysis ofth~se nuclei are given.the high-spin properties ofThe gradual fall in 2 .+ g (ground state band) energyfrom 285 to 123.9 KeV, and the rise of R42 = E4/E2 from2.56 to 3.11, the simple indicators of a shape transition,are reproduced in the present calculations. The cubicpolynomial was used to illustrate the necessity of each ofthe three terms, viz. , vibrational, rotational andperturbation ones, and to estimate the rotational energycontent of the investigated bands ..162Hf, R42 = 2.561 transition region I164Hf, R42 = 2.782 transition region 2, and166Hf, R42 = 2.975 transition region 2.The energy levels are·well reproduced for the variousbands (positive parity and negative parity) in the threeHf isotopes (162, i64 and 166).similar calculations are performed by using simpleModel based on the variable moment of inertia for theobserved bands in the series of the four Hf isotopes,including the rotational nucleus 168Hf. (168Hf,R42 =3.11).The calculated energy levels for the yrast and the lowestnegative parity bands are in good agreement with theexperimental values for the four Hf isotopes. Calculationspredict the correct (position and spin) of some levels inthe various bands which are tentatively assinged in thelevel schemes reported by different authers.The results mean that the various bands (Yrasts andother side bands) energies of even-even 162Hf,164Hf,166Hf,168Hf, can be interpreted on a simple model based onmoment of inertia without distinguishing between theirRotational or Vibrati~nal characteristics.Backhending of the moment of inertia of the differentbands areuiscussed. It has been possible to suggestquasiparticle assignments for the bands. from the presentreSUlts, it may be conclude that the inertia parameters,1(1) (static moment of inertia) and j(2) (dynamical) aresensitive to the r-otationlalignment band crossings. Thederived values for the parameters 10 and j1 are comparablewith the values known previously. The results obtained forthe alignment gains, routhian energies and band crossingsfor the yrast bands (positive parity) are in agreementwith the Cranked Shell Modell (CSM) predictions.The mixingand interaction between the bands (in each nucleus),leading to level-energy perturbations are discussed.The alignments of the lowest two (four) quasiparticlepositive parity configurations AB, (ABApBp) are discussedand well reproduced by the calculations.Also,the alignmentof the lowest two (four) negative parity configurationsAE, AF, (ABCE) and (ABCF) are well reproduced by

thecalculations for 162Hf, 164Hf and 166Hf.The alignments of the negative parity bands in 168Hfrequired more care in discussion. One could state that thecalculations of rotational alignments successfully explainthe available data and correctly predict the occurrenceand relative energies for the (even-odd) sequence,the suggestedband K~ = 8-, built on I~ = 8-, 2.193 MeV up to 31;9.115 MeV, belongs to the neutron configuration [642 5/2+][505 11-/2]8-'The moment of inertia and even-odd staggering behaviorare consistent with the suggestion of this two quasiparticleband, which become yrast due to the involvement of ani13/2 neut::ron.It is shown in the present work 'thatwith a view toreconstruct the band KK = 8- in 168Hf built on IK = 8-,2.193 MeV. It may be of great benefit in evaluatingreasonable values for the moments of inertia androtational alignments.