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Abstract

A comprehensive analysis of the superdeformed bands observed near $A \sim 190$ indicates that there exist systematic odd-even differences in the moments of inertia similar to that observed in normally deformed nuclei, which can be considered as a compelling evidence for pairing and blocking effect in superdeformed nuclei. With increasing rotational frequency the odd-even differences become weaker and weaker due to the Coriolis anti-pairing effects. Particularly, the odd-even differences in the dynamic moments of inertia become obscure when $\hbar\omega \geq 0.2$ MeV, and in certain cases emerges nearly identical value of $J^{(2)}$ for some neighboring nuclei. However, the odd-even differences in the kinematic moments of inertia still remain to certain extent at the highest frequencies.

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Since the discovery of the superdeformed (SD) band ^{191}Hg(1) [1], over thirty SD bands have been observed in the $A \sim 190$ region [2]. First, it was noted [2, 3] that the vast majority of SD bands near $A \sim 190$ display smooth increase of the dynamic moment of inertia $J^{(2)}$with the rotational frequency ω, like what was observed in normally deformed nuclei (below bandcrossing). An explanation in terms of change in deformation with ω has been ruled out from the available lifetime measurement [2, 4]. Calculation with no pairing gives essentially no frequency dependence of $J^{(2)}$with ω [5] and the inclusion of pairing is crucial for reproducing the smooth rise of $J^{(2)}$with ω. It has been recognized that the major contribution to the rise of $J^{(2)}$is caused by the gradual alignment of neutrons and protons in high-N shells [5—7]. Therefore, one may ask if there exists systematic odd-even difference in the moments of inertia of SD bands, as observed in normally deformed nuclei at low spin. In refs. [8—10], the smaller differences in the value and the rate of increase of $J^{(2)}$with ω when comparing the even-even SD nuclei ^{192}Hg with the odd-A neighbors ^{193}Tl and ^{191}Hg have been noted. In this letter, the odd-even differences in the moments of inertia of SD bands in the $A \sim 190$ region will be addressed systematically. Second, Stephens et al. [11] pointed out that the transition energies (or $J^{(2)}$) of some SD bands in neighboring nuclei are nearly identical with each other in certain frequency range. Recently, it was recognized [12, 13] that identical bands also present in normally deformed nuclei at low spin. The contradiction between this observation and the BCS theory presents a serious challenging problem. How can we get a consistent understanding for both the observed odd-even differences in the moments of inertia and the almost identical bands in pairs of odd- and even-mass nuclei?

Because of experimental difficulties, the angular momenta of SD bands have not been measured directly and usually one has no choice but to address the dynamic moment of inertia. Several approaches to determine the angular momenta of SD bands have been suggested [14—16], and it was found that *the same spin assignment* for each SD band near $A \sim 190$ (except ^{189,190}Hg) was made [2, 14—22], which is not surprising because the spin of the lowest level observed in each SD band near $A \sim 190$ is rather low (e.g. down to $I_f = 6$ in ^{194,196}Pb), the unambiguity in spin assignment (of ± 1) can be ruled out. In the present note, we assume that these spin assignments are correct.

In ref. 23 a three-parameter expression for rotational spectra was suggested

$$E(I) = a'[1 + kI(I+1)]\left[\sqrt{1 + bI(I+1)} - 1\right], \tag{1}$$

which can be derived from the Bohr Hamiltonian (including an anharmonic potential term $k\beta^4$) for well-deformed nuclei with small axial asymmetry ($\sin^2 3\gamma \ll 1$). Eq. (1) can be recast in a more convenient form

$$E(I) = a\left[\sqrt{1 + bI(I+1)} - 1\right] + cI(I+1), \tag{2}$$

where $a = a'(1+k)$, $c = a'bk$. The dimensionless quantity b characterizing nuclear softness is very small for well-deformed nuclei. The last term in eq. (2) is a small correction ($|c| \ll a$) and c may be positive or negative according to the sign of k. The corresponding expressions for the kinematic and dynamic moments of inertia are

$$\frac{\hbar^2}{J^{(1)}} = \frac{ab}{[1+bI(I+1)]^{1/2}} + 2c, \qquad \frac{\hbar^2}{J^{(2)}} = \frac{ab}{[1+bI(I+1)]^{3/2}} + 2c \tag{3}$$

and at bandhead both $J^{(1)}$ and $J^{(2)}$tend to

$$J_0 = \frac{\hbar^2}{ab+2c}. \tag{4}$$

The rotational spectra of normally deformed nuclei in the rear-earth and actinide region can be reproduced very well up to very high spin by eq. (2) [23]. Now the experimental transition energies $E_\gamma(I) \equiv E(I) - E(I-2)$ in each SD band are used in the least squares fit to eq. 2. It is amazing to find that all the E_γ's in each SD band near $A \sim 190$ can be reproduced unusually well. Some illustrative examples are given in Table 1 and similar calculations for the other SD bands are omitted for the sake of brevity. For example, *all* the fifty-one E_γ's observed in the three SD bands ^{194}Hg(1, 2, 3) can be reproduced within the average deviation $\delta = |E_{\gamma,\mathrm{calc}} - E_{\gamma,\mathrm{expt}}| < 0.2$ keV, which is smaller than the typical experimental uncertainties. In contrast, if one changes the spin assignment by +1 or −1, the deviation δ would increase by an order of magnitude and can not be accepted. Since the E_γ values in each SD band can be reproduced so accurately by eq. (2), the moments of inertia extracted by the corresponding analytic eq. (3) would be simply considered as a *faithful reproduction of the experimental ones*. Usually, the experimental dynamic and kinematic moments of inertia are extracted by the *difference-quotients*

$$J^{(2)}(I) = \frac{4\hbar^2}{\Delta E_\gamma} = \frac{4\hbar^2}{E_\gamma(I+2) - E_\gamma(I)}, \qquad J^{(1)}(I-1) = \frac{\hbar^2(2I-1)}{E_\gamma(I)}. \tag{5}$$

Calculations show that the moments of inertia extracted by eq. (5) follow closely the smooth curves plotted by using eq. (3) (but exhibit some fluctuations for $J^{(2)}$due to the larger uncertainties of ΔE_γ, see Fig. 1). In Fig. 1 are shown the ω variations of $J^{(1)}$and $J^{(2)}$for the SD bands ^{194}Hg(2, 3), ^{191}Hg(2, 3), and ^{192}Hg. It is seen that the variations of $J^{(2)}$with ω (or angular momentum) are displayed more clearly in the plots constructed from eq. (3). For Comparison, in Fig. 2 are shown the moments of inertia of normally deformed nuclei extracted by eq. 3 for the ν[633]5/2 band in ^{233}U and the two identical bands [13] in ^{236}U and ^{238}U, where the importance of pairing and blocking effect has been well established. In Fig. 2 (and hereafter) the results extracted by eq. (5) are omitted for clarity. From Fig. 1 several observations can be made: (i) At the lowest frequencies ($\hbar\omega \le 0.2$ MeV) the $J^{(2)}$values for the two pairs of signature partners ^{191}Hg(2, 3) and ^{194}Hg(2, 3) are larger than that for ^{192}Hg, particularly the J_0 values for ^{191}Hg(2, 3) and ^{194}Hg(2, 3) are larger than that for ^{192}Hg by a factor of 7–8%, but the rate of rise in $J^{(2)}$with ω for ^{192}Hg is steeper than those for ^{191}Hg(2, 3) and ^{194}Hg(2, 3), which can be interpreted in terms of the blocking effect. As a result, the value of $J^{(2)}$for the SD bands ^{191}Hg(2, 3) and ^{194}Hg(2, 3) is nearly equal to the corresponding value for ^{192}Hg in the

frequency range $\hbar\omega \sim 0.2$—0.4 MeV. (ii) The rate of increase in $J^{(1)}$with ω is much slower than that in $J^{(2)}$similar to that observed in normally deformed nuclei (Fig. 2). Therefore, it is not surprising that over the entire frequency range observed ($\hbar\omega \le 0.4$ MeV) the value of $J^{(1)}$for ^{191}Hg(2, 3) and ^{194}Hg(2, 3) remains larger than that for ^{192}Hg, resulting in an increment of angular momentum alignments of ^{191}Hg(2, 3) and ^{194}Hg(2, 3) relative to the SD band in ^{192}Hg.

Now we address the systematic odd-even differences in $J^{(2)}$and $J^{(1)}$for the SD bands near $A \sim 190$ at various frequencies. The moments of inertia extracted by using eq. (3) for the yrast SD bands in even-even nuclei and the one quasi-particle SD bands in odd-A nuclei at $\hbar\omega = 0$, 0.1, 0.2, 0.3 MeV are shown in Fig. 3. From Fig. 3 we observe that: (i) At the lowest frequencies ($\hbar\omega < 0.2$ MeV), there do exist systematic odd-even differences in both $J^{(1)}$and $J^{(2)}$similar to that observed in normally deformed nuclei at low spin. This may be considered as a compelling evidence for pairing and blocking effect in SD nuclei near $A \sim 190$. (ii) However, because of the steeper rise with ω of the $J^{(2)}$for the yrast SD bands in even-even nuclei than in odd-A nuclei, the odd-even differences in $J^{(2)}$gradually become obscure with increasing ω, i.e. when $\hbar\omega > 0.2$ MeV, the odd-even differences in $J^{(2)}$for some SD bands gradually disappear, particularly in certain cases the values of $J^{(2)}$for some SD bands in neighboring nuclei (e.g. ^{192}Hg and ^{191}Hg(2, 3), ^{193}Hg(2, 3)) become almost identical. Microscopically, this is due to the Coriolis antipairing effect. (iii) Because $J^{(1)}$rises with ω much more slowly than $J^{(2)}$in each SD band (see Figs. 1 and 2), the odd-even differences in $J^{(1)}$still remain to certain extent at the highest frequencies similar to that seen in normally deformed nuclei (Fig. 2).

In Fig. 4 are displayed the ω variations of the dynamic moments of inertia for several groups of SD bands, which may help us understand the configuration structure of each SD band. In Fig. 4(a) are the $J^{(2)}$'s for the yrast SD bands in the even-even nuclei ^{192,194}Hg and ^{194,196,198}Pb, whose high-N configurations were assigned [3, 5, 7] to be $\pi 6^4 \nu 7^4$. Therefore, it is not surprising that the bandhead moments of inertia and the rise in $J^{(2)}$with ω are similar for these SD bands, like what was seen in normally deformed nuclei (e.g. ^{236,238}U in Fig. 2). The SD bands ^{191}Hg(1) and ^{191}Au are shown in Fig. 4(b) in comparison with the SD band in ^{192}Hg. The absence of signature partners to the SD bands ^{191}Hg(1) [8, 17] and ^{191}Au [27] suggests rather large signature splitting. The values of $J_0(^{191}\mathrm{Hg}(1)) = 95.3\ \hbar^2\mathrm{MeV}^{-1}$ and $J_0(^{191}\mathrm{Au}) = 94.8\ \hbar^2\mathrm{MeV}^{-1}$ are larger than $J_0(^{192}\mathrm{Hg}) = 87.15\ \hbar^2\mathrm{MeV}^{-1}$ by a factor of about 9%. However, the value of $J^{(2)}$for ^{191}Au is almost identical to the corresponding value for ^{192}Hg [27] in the frequency range $\hbar\omega > 0.20$ MeV. These features seem to be consistent with the configuration assignments [6, 8, 17, 27]: ^{191}Hg = "^{192}Hg core" $\otimes\nu$[761]3/2^{-1}, ^{191}Au = "^{192}Hg core" $\otimes\pi$[411]1/2^{-1} or π[530]1/2^{-1}. In Fig. 4(c) are shown the excited signature partner SD bands ^{191}Hg(2, 3), whose odd neutron occupies [6, 17] the low Ω orbital ν[642]3/2. Indeed, significant signature splitting is found for ^{191}Hg(2, 3) as $\hbar\omega \ge 0.15$ MeV. In Fig. (4)d are shown the signature partner SD bands ^{193}Hg(2b, 3), whose odd neutron is assigned [20] to occupy the positive parity orbital of high-Ω, ν[624]9/2. Indeed, no signature splitting is found for ^{193}Hg(2b, 3). In Fig. 4(e) are displayed the signature partner SD bands ^{194}Hg(2, 3), which was noted [9] to be identical to the SD band in ^{192}Hg.

Indeed, it is seen in Fig. 4(e) that their dynamic moments of inertia are almost identical in the frequency range $\hbar\omega \sim 0.2$—0.4 MeV, but not elsewhere. Also no signature splitting is found for ^{194}Hg(2, 3), which is consistent with the configuration assignment [6, 17]: "^{192}Hg core" $\otimes\nu[624]9/2 \otimes \nu[512]5/2$. In Fig. 4(f) are the two pairs of signature SD bands, ^{193}Tl($\pm$) and ^{195}Tl($\pm$) and similar signature splitting is found when $\hbar\omega \geq 0.2$ MeV, which seems consistent with the assignment [8, 17] that the odd proton occupies the high-N intruder orbital $\pi[642]5/2$. In Fig. 4(g) are shown the three pairs of signature partner SD bands ^{194}Tl(1a, 1b), ^{194}Tl(2a, 2b) and ^{194}Tl(3a, 3b) [28]. No signature splitting is found for ^{194}Tl(1a, 1b) and ^{194}Tl(2a, 2b), but significant signature splitting occurs for ^{194}Tl(3a, 3b) when $\hbar\omega \geq 0.15$ MeV, which indicates that both the odd-neutron and odd-proton may occupy high-N intruder orbitals. Similar plots for the three pairs of signature partners ^{192}Tl(1, 2), ^{192}Tl(3, 4) and ^{192}Tl(5, 6) [9] are given in Fig. 4(h). Significant signature splitting is found for all three pairs when $\hbar\omega \geq 0.15$ MeV. It has been noted [9] that the dynamic moments of inertia of ^{192}Tl(3, 4) are found to be almost constant with the rotational frequency, which is clearly exhibited in Fig. 4(h). Moreover, the bandhead moments of inertia of ^{192}Tl(3, 4) are especially large (J_0(^{192}Tl(3, 4) = 103 $\hbar^2$MeV^{-1} $\gg J_0$(^{192}Hg)). All these feature of $J^{(2)}$can be interpreted [9] in terms of the double blocking of alignment in the high-N and low-Ω orbitals, $\nu[761]3/2\otimes\pi[642]5/2$. In contrast, the bandhead moments of inertia of ^{192}Tl(5, 6) ($J_0 = 89\hbar^2$MeV^{-1}) and the rise in $J^{(2)}$with ω are similar to that of ^{192}Hg, which reminds us of the situation occurring in the normally deformed nuclei [12] that the moment of inertia of the two-quasiparticle ($\pi[404]7/2 \otimes \pi[402]5/2$) band in ^{172}Hf is nearly equal to that of the ground band in ^{170}Yb. In fact, it has been shown that [29] the blocking effect on the moments of inertia depend sensitively on the energetic location and the Coriolis response of the blocked levels. It is expected that the feature of the two blocked levels in the SD bands ^{192}Tl(5, 6) may be quite different from that in ^{192}Tl(3, 4) and may have little Coriolis response.

To summarize, from the phenomenological analysis given above it is seen that there exist systematic odd-even differences in the moments of inertia for the SD bands observed near $A \sim 190$, which may be considered as a compelling evidence for pairing and blocking effect. However, with increasing rotational frequency the odd-even differences become weaker and weaker due to the Coriolis anti-pairing effect. Particularly, the odd-even differences in the dynamic moments of inertia become obscure as $\hbar\omega \geq 0.2$ MeV and in certain cases emerge the identical SD bands in some neighboring nuclei. Preliminary calculations using the particle-number-conserving treatment for the eigenvalue problem of the cranked shell model Hamiltonian [29], in which the blocking effects are taken into account exactly, show that a satisfactory explanation for the general tendency of the odd-even differences in moments of inertia may be obtained, but the strength of pairing interaction seems much weaker than that in normally deformed nuclei. Details will be published subsequently.

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Table 1. Calculation of the transition energies $E_\gamma(I) = E(I) - E(I-1)$, kinematic and dynamic moments of inertia using eqs. (2) and (3), for the yrast SD bands ^{192}Hg, ^{194}Hg(1) and ^{196}Pb, the signature partner SD bands ^{191}Hg(2, 3) and the SD bands in ^{191}Au, the signature partner SD bands ^{194}Hg(2, 3) and the SD band in odd-odd nuclei ^{194}Tl.

	^{192}Hg($\alpha = 0$)				^{194}Hg(1)($\alpha = 0$)				^{196}Pb($\alpha = 0$)			
I	$E_\gamma(I)$ expt[a]	$E_\gamma(I)$ calc[d]	$J^{(1)}$	$J^{(2)}$	$E_\gamma(I)$ expt[b]	$E_\gamma(I)$ calc[e]	$J^{(1)}$	$J^{(2)}$	$E_\gamma(I)$ expt[c]	$E_\gamma(I)$ calc[f]	$J^{(1)}$	$J^{(2)}$
46					841.0	840.7	108.84	145.84				
44					812.9	812.7	107.65	142.95				
42	793.4	793.4	105.14	133.88	783.9	784.1	106.45	139.95				
40	762.8	763.0	104.07	131.73	754.6	754.9	105.25	136.87				
38	732.1	732.1	102.99	129.45	725.4	725.0	104.05	133.71				
36	700.6	700.6	101.89	127.04	693.8	694.3	102.85	130.48				
34	668.6	668.5	100.78	124.51	662.4	662.9	101.66	127.21	688.6	688.7	97.84	122.60
32	635.8	635.7	99.66	121.87	630.5	630.6	100.49	123.91	654.5	654.9	96.72	118.23
30	602.3	602.1	98.54	119.13	597.3	597.4	99.33	120.60	620.2	619.9	95.67	114.23
28	567.9	567.7	97.43	116.31	563.6	563.3	98.19	117.31	584.3	583.7	94.69	110.58
26	532.4	532.4	96.32	113.43	528.3	528.2	97.08	114.07	546.4	546.4	93.76	107.26
24	496.3	496.3	95.24	110.52	492.3	492.2	96.01	110.90	508.1	508.1	92.90	104.25
22	459.1	459.1	94.18	107.61	455.2	455.1	94.98	107.83	468.5	468.7	92.11	101.54
20	420.8	420.9	93.15	104.74	417.1	416.9	94.00	104.89	428.1	428.3	91.38	99.10
18	381.6	381.7	92.17	101.94	377.8	377.8	93.08	102.11	387.3	387.1	90.72	96.93
16	341.1	341.4	91.24	99.27	337.7	337.6	92.22	99.53	344.9	345.0	90.13	95.01
14	299.9	300.0	90.38	96.76	296.2	296.4	91.44	97.16	301.7	302.1	89.60	93.33
12	257.7	257.7	89.60	94.45	254.3	254.3	90.73	95.04	258.5	258.6	89.14	91.88
10	214.6	214.4	88.91	92.41		211.4	90.12	93.19	214.8	214.5	88.75	90.67
8		170.3	88.32	90.65		167.8	89.60	91.93	169.9	169.9	88.42	89.67

[a] ref. 14; [b] ref. 22; [c] ref. 25.

[d] $a = 0.6597 \times 10^4$ keV, $b = 8.1684 \times 10^{-4}$, $c = 3.0427$ keV.

[e] $a = 1.0855 \times 10^4$ keV, $b = 5.7955 \times 10^{-4}$, $c = 2.4983$ keV.

[f] $a = 9.6373 \times 10^4$ keV, $b = 1.5198 \times 10^{-4}$, $c = -1.6288$ keV.

I	^{191}Hg(2)($\alpha = 1/2$) $E_\gamma(I-1)$ expt[a]	calc[c]	$J^{(1)}$	$J^{(2)}$	^{191}Hg(3)($\alpha = -1/2$) $E_\gamma(I)$ expt[a]	calc[d]	$J^{(1)}$	$J^{(2)}$	^{191}Au($\alpha = -1/2$) $E_\gamma(I)$ expt[b]	calc[e]	$J^{(1)}$	$J^{(2)}$
75/2	699.2	699.1	103.21	122.96	707.5	707.4	104.86	127.53				
71/2	666.0	666.0	102.32	119.86	675.2	675.4	103.88	124.33	678.4	678.0	103.49	124.68
67/2	631.9	632.0	101.47	116.95	642.6	642.6	102.93	121.26	644.6	645.1	102.53	120.95
63/2	596.9	597.2	100.66	114.22	609.2	609.0	102.02	118.32	611.4	611.4	101.62	117.56
59/2	561.8	561.5	99.90	111.67	574.3	574.6	101.15	115.51	575.9	576.6	100.78	114.46
55/2	525.1	525.1	99.19	109.31	539.5	539.4	100.32	112.85	540.9	541.0	99.99	111.66
51/2	488.1	488.0	98.52	107.13	503.3	503.3	99.53	110.35	504.4	504.6	99.26	109.11
47/2	449.9	450.1	97.89	105.12	466.5	466.5	98.78	108.01	467.6	467.3	98.58	106.81
43/2	411.5	411.6	97.32	103.29	429.1	428.9	98.09	105.83	430.0	429.3	97.96	104.75
39/2	372.5	372.4	96.79	101.64	390.2	390.5	97.45	103.83	391.2	390.6	97.40	102.91
35/2	332.9	332.6	96.32	100.16	351.6	351.5	96.86	102.02	351.8	351.3	96.89	101.27
31/2	292.0	292.3	95.90	98.85	311.8	311.8	96.33	100.38	311.7	311.4	96.44	99.84
27/2		251.4	95.53	97.72		271.5	95.86	98.93	270.6	270.9	96.04	98.60
23/2		210.2	95.21	96.75		230.7	95.45	97.68	229.5	230.0	95.70	97.54

[a] ref. 26; [b] ref. 27.

[c] $a = 6.1411 \times 10^4$ keV, $b = 1.5936 \times 10^{-4}$, $c = 0.4004$ keV.

[d] $a = 2.9492 \times 10^4$ keV, $b = 2.5431 \times 10^{-4}$, $c = 1.5500$ keV.

[e] $a = 2.1452 \times 10^5$ keV, $b = 0.8407 \times 10^{-5}$, $c = -3.7430$ keV.

I	^{194}Hg(2)($\alpha = 0$) $E_\gamma(I)$ expt[a]	calc[c]	$J^{(1)}$	$J^{(2)}$	^{194}Hg(3)($\alpha = 1$) $E_\gamma(I+1)$ expt[a]	calc[d]	$J^{(1)}$	$J^{(2)}$	^{194}Tl(4)($\alpha = 1$) $E_\gamma(I+1)$ expt[b]	calc[e]	$J^{(1)}$	$J^{(2)}$
44	807.0	807.0	108.34	139.25								
42	777.7	777.6	107.26	135.94	793.0	793.0	107.70	135.64				
40	747.6	747.5	106.21	132.67	762.7	762.8	106.69	132.66				
38	716.7	716.6	105.17	129.45	732.2	732.0	105.69	129.69				
36	684.5	684.9	104.16	126.30	700.4	700.4	104.71	126.75	685.9	685.7	106.79	120.94
34	652.2	652.4	103.17	123.21	668.0	668.1	103.74	123.86	652.0	652.1	106.13	118.99
32	619.3	619.2	102.21	120.22	635.1	635.0	102.81	121.02	617.5	617.9	105.50	117.10
30	585.2	585.1	101.29	117.33	600.9	601.2	101.90	118.25	583.5	583.2	104.89	115.27
28	550.3	550.1	100.40	114.55	566.4	566.6	101.02	115.57	548.0	548.0	104.30	113.51
26	514.3	514.4	99.55	111.90	531.6	531.2	100.17	112.99	512.0	512.2	103.74	111.83
24	477.7	477.8	98.74	109.39	494.6	495.0	99.37	110.53	475.9	475.9	103.21	110.24
22	440.7	440.5	97.98	107.03	458.3	458.1	98.60	108.19	439.3	439.1	102.71	108.73
20	402.1	402.3	97.27	104.83	420.4	420.3	97.88	105.99	401.7	401.9	102.24	107.32
18	363.7	363.4	96.61	102.81	382.1	381.8	97.21	103.94	364.4	364.1	101.81	106.02
16	323.8	323.8	96.01	100.96	342.8	342.6	96.59	102.05	326.0	326.0	101.41	104.83
14	283.3	283.5	95.47	99.31	302.5	302.8	96.03	100.34	287.5	287.4	101.05	103.75
12	242.7	242.7	94.99	97.86	262.3	262.3	95.52	98.82	248.4	248.5	100.73	102.79
10	201.3	201.3	94.58	96.60		221.3	95.08	97.48	209.3	209.3	100.45	101.95

[a] ref. 18; [b] ref. 28.

[c] $a = 2.2052 \times 10^4$ keV, $b = 3.1025 \times 10^{-4}$, $c = 1.9229$ keV.

[d] $a = 1.9241 \times 10^4$ keV, $b = 3.2972 \times 10^{-4}$, $c = 2.1532$ keV.

[e] $a = 2.5393 \times 10^4$ keV, $b = 2.1325 \times 10^{-4}$, $c = 2.3072$ keV.

Figure Captions

Fig. 1 The ω variation of the moments of inertia of the SD band in ^{192}Hg and two pairs of signature partners ^{194}Hg(2, 3) and ^{191}Hg(2, 3). The moments of inertia extracted by using eq. (5) are marked by ○ (^{192}Hg, $\mathcal{J}^{(1)}$), ∇ (^{192}Hg, $\mathcal{J}^{(2)}$), ● (^{194}Hg(2, 3), ^{191}Hg(2, 3), $\mathcal{J}^{(1)}$), and ▼ (^{194}Hg(2, 3), ^{191}Hg(2, 3), $\mathcal{J}^{(2)}$). The moments of inertia extracted by using eq. (2) are displayed by the solid (for ^{194}Hg(2, 3) and ^{191}Hg(2, 3)) and dotted curves (for ^{192}Hg). The value of ω is connected with the angular momentum I by the canonical relation $\hbar\omega = [ab/\sqrt{1+bI(I+1)} + 2c]\sqrt{I(I+1)}$.

Fig. 2 The ω variation of the moments of inertia of the ground rotational bands in the normally deformed nuclei ^{236}U (dotted line), ^{238}U (dashed line) and the [633]5/2$^+$ band in ^{233}U (solid line). The experimental data are taken from ref. 24.

Fig. 3 The odd-even differences in the moments of inertia of the SD bands in the nuclei near $A \sim 190$ at rotational frequencies $\hbar\omega = 0, 0.1, 0.2$ and 0.3 MeV. The filled inverse triangles ▼ and squares ■ are for the yrast SD bands in $^{190-194}$Hg and $^{192-198}$Pb, respectively. The open inverse triangles ∇, triangles △, and circles ○ are for the one-quasiparticle SD bands in the odd-A nuclei $^{189,\,191,\,193}$Hg, $^{193,\,195}$Tl, and ^{191}Au, respectively.

Fig. 4 Comparison of the ω variations of the dynamic moments of inertia for several groups of SD bands.

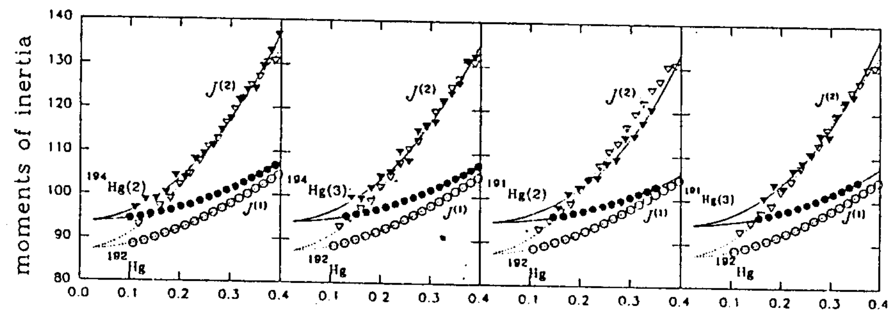

Fig. 1

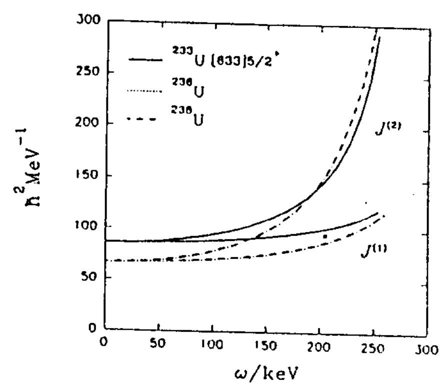

Fig. 2

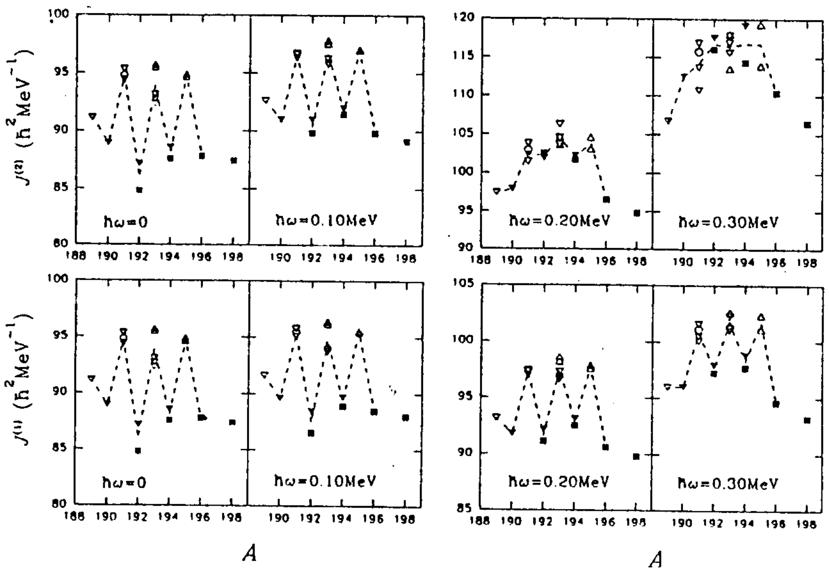

Fig. 3

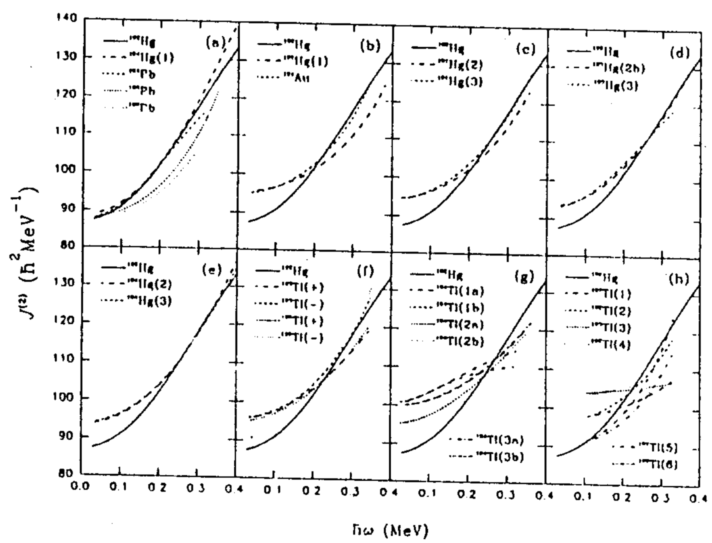

Fig. 4