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1. INTRODUCTION

Study of the angular distribution of gamma rays emitted from aligned states which are formed by nuclear reactions permits assignments of multipolarities of the gamma rays and spins and parities of the levels involved. This method, in conjunction with the angular correlation technique, has been applied to nuclear spectroscopy for many years, as reviewed by Ferguson.[1]

Recently, particular interest has been focused on (particle, xn) - type reactions, which were first utilized by Morinaga and Gugelot[2] to study ground-state rotational bands of deformed nuclei, and are extensively applied in the search for any low-lying levels. It has been found that a wide range of excited states populated in these reactions are well aligned[3,4,5,6] so that gamma rays exhibit angular distributions depending upon the multipolarities and the spin sequences. The simplest method of analyses of the experimental data is to regard the degree of alignment as a parameter, which may be determined experimentally, estimated empirically, or evaluated on the basis of a specific model.

The present report has been prepared to provide a simplified formulation of angular distribution functions and tables of coefficients for the angular distribution of gamma rays which the author hopes will be useful in the analyses of experimental data. The theory has been well established. One may refer to the review article by Groot et al.[7]

2. FORMULATION

The degree of alignment of a state possessing spin J is specified by population parameters $P_m(J)$. Instead of using these, we hereafter use the statistical tensor which is defined by

$$\rho_k(J) = \sqrt{2J+1} \sum_m (-)^{J-m} (JmJ-m|k0) P_m(J) \quad .$$

For an aligned state $(P_m(J) = P_{-m}(J))$, $\rho_k(J)$ vanishes unless k is even.

The angular distribution function for the case $I_i \rightarrow I_f$ (see Fig. 1)

$$W(\theta) = 1 + A_2 P_2(\cos\theta) + A_4 P_4(\cos\theta)$$

is now expressed as follows:

$$A_k(J_i L_1 L_2 J_f) = \rho_k(J_i) \frac{1}{1+\delta^2} \{F_k(J_f L_1 L_1 J_i) + 2\delta F_k(J_f L_1 L_2 J_i) + \delta^2 F_k(J_f L_2 L_2 J_i)\} \quad ,$$

where

$$F_k(J_f L_1 L_2 J_i) \equiv (-)^{J_f - J_i - 1} [(2L_1+1)(2L_2+1)(2J_i+1)]^{\frac{1}{2}} (L_1 1 L_2 -1|k0) W(J_i J_i L_1 L_2; k J_f)$$

and

$$\delta \equiv \frac{\langle J_f \| L_2 \| J_i \rangle}{\langle J_f \| L_1 \| J_i \rangle} .$$

It should be mentioned that the sign of δ obtained from the angular distribution is opposite to the sign obtained from the gamma-gamma angular correlation of the $I_i \rightarrow I_f \rightarrow I$ cascade.

The statistical tensor for the complete alignment is

$$B_k(J) \equiv \begin{cases} \sqrt{2J+1} \; (-)^J (J0J0|k0) & \text{for integral spin,} \\ \sqrt{2J+1} \; (-)^{J-\frac{1}{2}} (J\tfrac{1}{2}J-\tfrac{1}{2}|k0) & \text{for half-integral spin,} \end{cases}$$

which is presented in Table 1. Then, for this ideal case,

$$A_k^{max}(J_iL_1L_2J_f) = \frac{1}{1+\delta^2} \{f_k(J_fL_1L_1J_i) + 2\delta f_k(J_fL_1L_2J_i) + \delta^2 f_k(J_fL_2L_2J_i)\},$$

where

$$f_k(J_fL_1L_2J_i) \equiv B_k(J_i)F_k(J_fL_1L_2J_i) .$$

In Tables 2a, 2b, F_k and $B_kF_k (\equiv f_k)$ are tabulated.

In actual cases, where the alignment is partial,

$$A_k(J_iL_1L_2J_f) = \alpha_k(J_i)A_k^{max}(J_iL_1L_2J_f) ,$$

where $\alpha_k(J_i)$ is the attenuation coefficient of the alignment:

$$\alpha_k(J_i) \equiv \frac{\rho_k(J_i)}{B_k(J_i)} \quad .$$

The population parameters of a state depend on the formation process of this state which is in general complicated. However, if we assume that the population parameters be represented by a distribution function involving only one parameter, then α_4 and α_6 will be uniquely related to α_2. Therefore we regard α_2 as the only free parameter that represents the population of substates. The parameter α_2 may be determined experimentally, estimated empirically, or evaluated on the basis of a specific model.

Figure 2 illustrates $\alpha_4(J)$ and $\alpha_6(J)$ versus $\alpha_2(J)$ under the assumption of the Gaussian distribution:

$$P_m(J) = \frac{\exp\left(-\frac{m^2}{2\sigma^2}\right)}{\sum\limits_{m'=-J}^{J} \exp\left(-\frac{m'^2}{2\sigma^2}\right)}$$

(The case that σ=0 corresponds to the complete alignment: $\alpha_k(J)$=1.) In addition, Fig. 3 shows $\alpha_k(J)$ versus σ/J. These figures indicate: 1) α_4 decreases very rapidly as α_2 decreases, and 2) α_6 is negligible in most cases of interest.

Diamond et al.[5] showed that the Gaussian distribution of substates of high-spin ground-state rotational states formed by the heavy-ion induced reactions, as a consequence of the "random walkout" of emitted neutrons,[8] accounts for the experimental angular distributions fairly well.

If a state J_f is formed only through the preceeding transition $J_i \rightarrow J_f$, the statistical tensor of the state J_f is expressed in terms of that of the state J_i as follows:

$$\rho_k(J_f) = U_k(J_i L_1 L_2 J_f)\ \rho_k(J_i) \quad ,$$

where

$$U_k(J_i L_1 L_2 J_f) = \frac{1}{1+\delta^2}\ [u_k(J_i L_1 J_f) + \delta^2 u_k(J_i L_2 J_f)] \quad ,$$

$$u_k(J_i L_1 J_f) = (-)^{J_i+J_f-L_1} \sqrt{(2J_i+1)(2J_f+1)}\,W(J_i J_i J_f J_f;kL_1) \quad .$$

Therefore,

$$\alpha_k(J_f) = U_k(J_i L_1 L_2 J_f)\ \frac{B_k(J_i)}{B_k(J_f)}\ \alpha_k(J_i) \quad .$$

For convenience, u_k's are also tabulated in Tables 2a, 2b. For the "stretched" case ($L=|J_f-J_i|$), the preceeding transition reduces α_2 slightly. For other cases, α_k's are reduced considerably, and may in fact become negative in such an extreme case as $J_i = J_f = 2$, $L_1 = L_2 = 2$. However, in most cases, where higher-spin states give rise to the formation, the population of substates may still be approximated by the Gaussian distribution.

The computation was carried out with the CDC 6600 computer at the Lawrence Radiation Laboratory.

Footnotes and References

*This work was performed under the auspices of the U. S. Atomic Energy Commission.

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[7]S. R. de Groot, H. A. Tolhoek and W. J. Huiskamp, Alpha-, Beta- and Gamma-Ray Spectroscopy, ed. by K. Siegbahn (North-Holland Publishing Co., Amsterdam, 1965) p. 1199.

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Figure Captions

Fig. 1. Spin sequence of a transition.

Fig. 2. $\alpha_4(J)$ and $\alpha_6(J)$ versus $\alpha_2(J)$ under the assumption of the Gaussian distribution of substates.

Fig. 3. Dependence of $\alpha_k(J)$ on the distribution paramter σ/J.

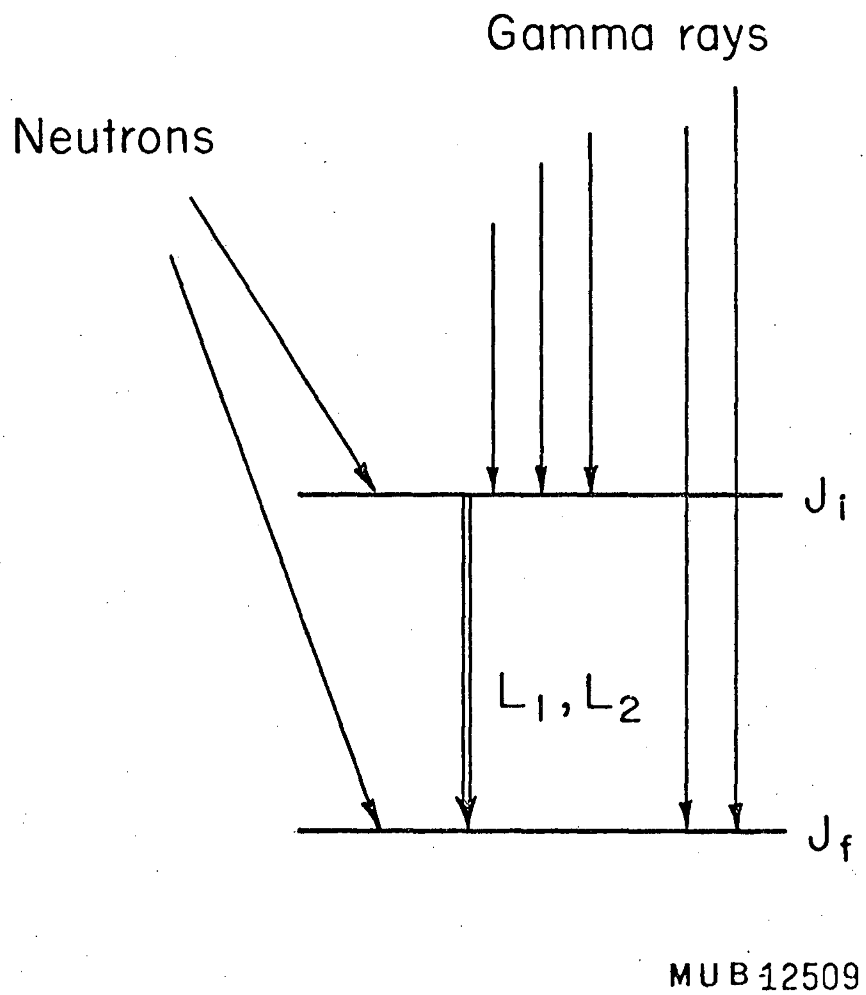
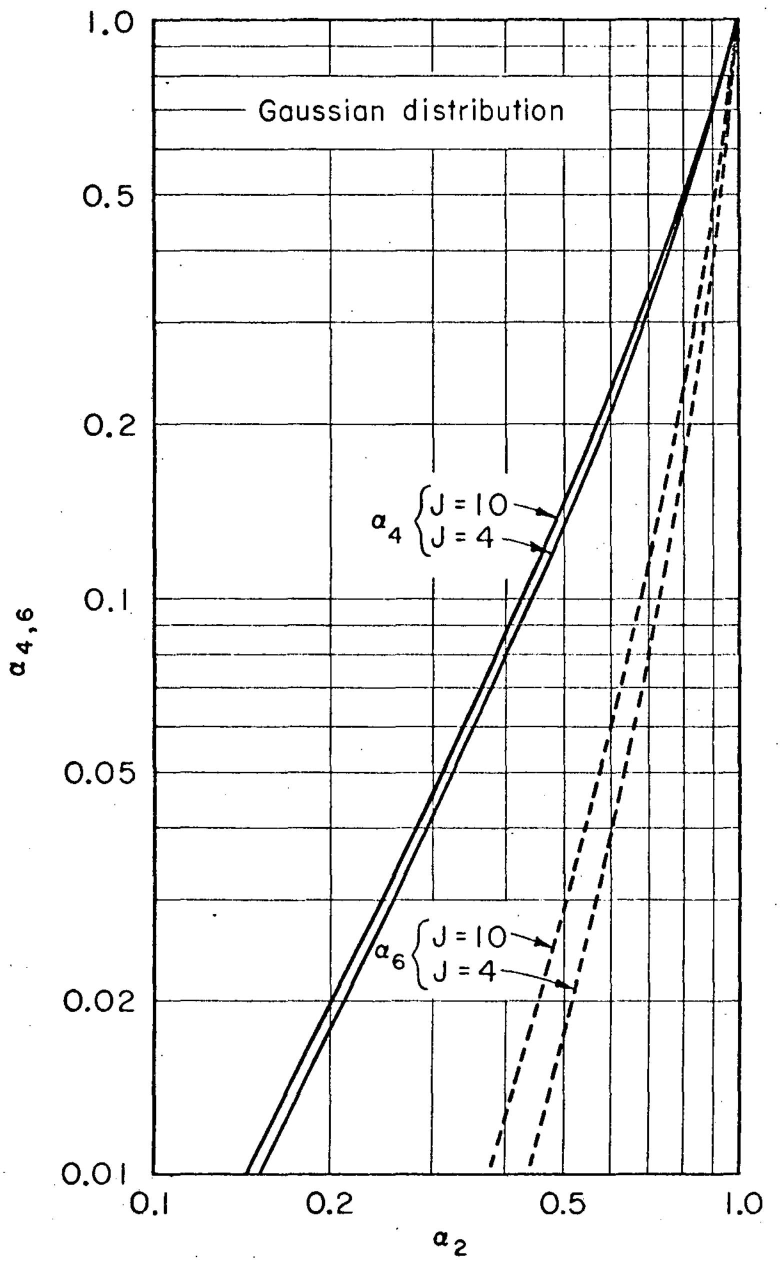


Fig. 1



MUB 12510

Fig. 2

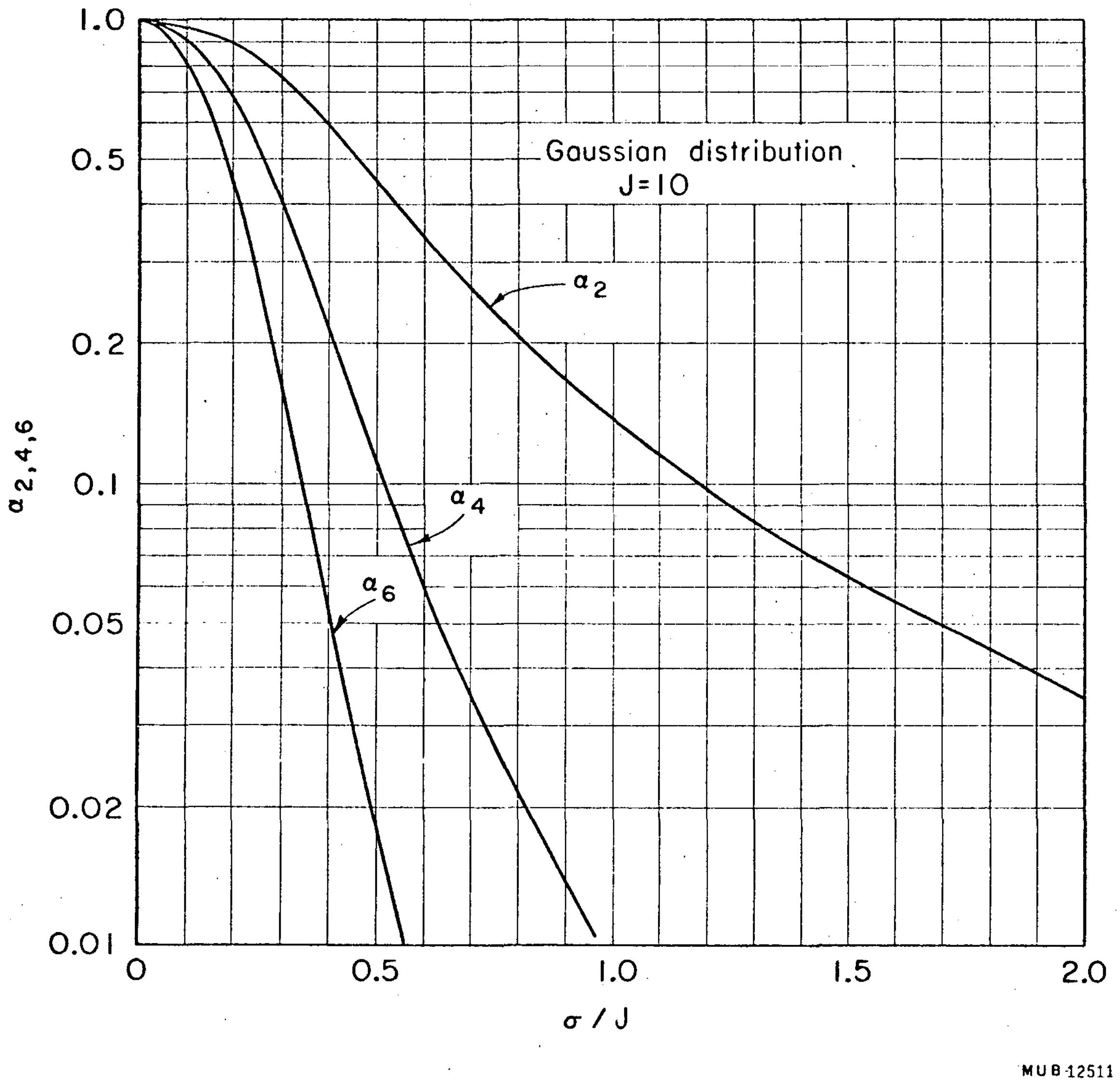

1.0
0.5
0.2
0.1
0.05
0.02
0.01
$a_{2,4,6}$
Gaussian distribution
J=10
a_2
a_4
a_6
0
0.5
1.0
1.5
2.0
σ / J
MUB-12511

Fig. 3

Table 1

Statistical tensors for complete alignment, $B_k(J)$.

$BK \equiv B_k(J) \equiv \rho_k(J)$ for $\begin{cases} m = 0 & \text{(integral spin)} \\ m = 1/2 & \text{(half-integral spin)} \end{cases}$

J	B2	B4	B6
1	-1.41421	0.	0.
2	-1.19523	1.60357	0.
3	-1.15470	1.27920	-1.74078
4	-1.13961	1.20687	-1.34840
5	-1.13228	1.17670	-1.25245
6	-1.12815	1.16086	-1.20977
7	-1.12560	1.15142	-1.18628
8	-1.12390	1.14531	-1.17175
9	-1.12272	1.14112	-1.16206
10	-1.12187	1.13811	-1.15524
11	-1.12122	1.13588	-1.15025
12	-1.12073	1.13418	-1.14648
13	-1.12034	1.13285	-1.14356
14	-1.12004	1.13179	-1.14125
15	-1.11979	1.13093	-1.13939
16	-1.11958	1.13022	-1.13786
17	-1.11941	1.12964	-1.13660
18	-1.11926	1.12915	-1.13554
19	-1.11914	1.12873	-1.13465
20	-1.11903	1.12837	-1.13388
3/2	-1.00000	0.	0.
5/2	-1.06904	.92582	0.
7/2	-1.09109	1.02565	-.87039
9/2	-1.10096	1.06436	-.98473
11/2	-1.10624	1.08389	-1.03418
13/2	-1.10940	1.09522	-1.06104
15/2	-1.11144	1.10240	-1.07749
17/2	-1.11283	1.10725	-1.08837
19/2	-1.11382	1.11068	-1.09596
21/2	-1.11456	1.11321	-1.10148
23/2	-1.11511	1.11511	-1.10563
25/2	-1.11555	1.11659	-1.10882
27/2	-1.11589	1.11776	-1.11134
29/2	-1.11617	1.11870	-1.11336
31/2	-1.11639	1.11947	-1.11501
33/2	-1.11658	1.12010	-1.11636
35/2	-1.11674	1.12064	-1.11750
37/2	-1.11687	1.12109	-1.11845
39/2	-1.11698	1.12147	-1.11927
41/2	-1.11708	1.12180	-1.11997

Table 2a

Angular distribution functions for integral spins.

JI $\equiv J_i$

JF $\equiv J_f$

L1 $\equiv L_1$

L2 $\equiv L_2$

F2 $\equiv F_2(J_f L_1 L_2 J_i)$

B2F2 $\equiv B_2(J_i)F_2(J_f L_1 L_2 J_i)$

F4 $\equiv F_4(J_f L_1 L_2 J_i)$

B4F4 $\equiv B_4(J_i)F_4(J_f L_1 L_2 J_i)$

U2 $\equiv u_2(J_i L_1 J_f)$

U4 $\equiv u_4(J_i L_1 J_f)$

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
1	0	1	1	.70711	-1.00000	0.	0.	0.	0.
1	1	1	1	-.35355	.50000	0.	0.	-.50000	0.
1	1	1	2	-1.06066	1.50000	0.	0.		
1	1	2	2	-.35355	.50000	0.	0.	.10000	0.
1	2	1	1	.07071	-.10000	0.	0.	.59161	0.
1	2	1	2	.47434	-.67082	0.	0.		
1	2	2	2	.35355	-.50000	0.	0.	-.59161	0.
1	3	2	2	-.10102	.14286	0.	0.	.48990	0.
1	3	2	3	.37796	-.53452	0.	0.		
1	3	3	3	.53033	-.75000	0.	0.	-.61237	0.
1	4	3	3	-.17678	.25000	0.	0.	.44320	0.
2	0	2	2	-.59761	.71429	-1.06904	-1.71429	0.	0.
2	1	1	1	.41833	-.50000	0.	0.	.59161	0.
2	1	1	2	-.93541	1.11803	0.	0.		
2	1	2	2	-.29881	.35714	.71270	1.14286	-.59161	0.
2	2	1	1	-.41833	.50000	0.	0.	.50000	-.66667
2	2	1	2	-.61237	.73193	0.	0.		
2	2	2	2	.12806	-.15306	-.30544	-.48980	-.21429	.28571
2	3	1	1	.11952	-.14286	0.	0.	.82808	.41786
2	3	1	2	.65465	-.78246	0.	0.		
2	3	2	2	.34149	-.40816	.07636	.12245	.20702	-.62678
2	4	2	2	-.17075	.20408	-.00848	-.01361	.74915	.28472
2	4	2	3	.50508	-.60368	-.06274	-.10061		
2	4	3	3	.44821	-.53571	-.02970	-.04762	.07491	-.56944
2	5	3	3	-.29881	.35714	.00405	.00649	.70373	.22713
3	0	3	3	-.86603	1.00000	.21320	.27273	0.	0.
3	1	2	2	-.49487	.57143	-.44671	-.57143	.48990	0.
3	1	2	3	-.46291	.53452	1.04464	1.33631		
3	1	3	3	-.64952	.75000	.03553	.04545	-.61237	0.
3	2	1	1	.34641	-.40000	0.	0.	.82808	.41786
3	2	1	2	-.94868	1.09545	0.	0.		
3	2	2	2	-.12372	.14286	.67006	.85714	.20702	-.62678
3	3	1	1	-.43301	.50000	0.	0.	.75000	.16667
3	3	1	2	-.43301	.50000	0.	0.		
3	3	2	2	.22682	-.26190	-.44671	-.57143	.31667	-.50000

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
3	4	1	1	.14434	-.16667	0.	0.	.90468	.68139
3	4	1	2	.72169	-.83333	0.	0.		
3	4	2	2	.30929	-.35714	.14890	.19048	.54281	-.22713
3	5	2	2	-.20620	.23810	-.02030	-.02597	.84984	.54356
3	5	2	3	.54554	-.62994	-.13430	-.17180		
3	5	3	3	.36084	-.41667	-.05492	-.07025	.42492	-.36237
3	6	3	3	-.36084	.41667	.00969	.01240	.81417	.46749
4	1	3	3	-.78348	.89286	.14527	.17532	.44320	0.
4	2	2	2	-.44770	.51020	-.30438	-.36735	.74915	.28472
4	2	2	3	-.52973	.60368	.90037	1.08663		
4	2	3	3	-.47009	.53571	-.04842	-.05844	.07491	-.56944
4	3	1	1	.31339	-.35714	0.	0.	.90468	.68139
4	3	1	2	-.94017	1.07143	0.	0.		
4	3	2	2	-.04477	.05102	.60876	.73469	.54281	-.22713
4	4	1	1	-.43875	.50000	0.	0.	.85000	.50000
4	4	1	2	-.33541	.38224	0.	0.		
4	4	2	2	.26455	-.30148	-.49807	-.60111	.57338	-.14935
4	5	1	1	.15954	-.18182	0.	0.	.93937	.79772
4	5	1	2	.75679	-.86244	0.	0.		
4	5	2	2	.28490	-.32468	.19370	.23377	.70453	.13295
4	6	2	2	-.22792	.25974	-.02980	-.03596	.89995	.68609
4	6	2	3	.56408	-.64282	-.18437	-.22252		
4	6	3	3	.29915	-.34091	-.06874	-.08296	.61068	-.04901
4	7	3	3	-.39886	.45455	.01422	.01716	.87226	.61570
5	2	3	3	-.73598	.83333	.11589	.13636	.70373	.22713
5	3	2	2	-.42056	.47619	-.24281	-.28571	.84984	.54356
5	3	2	3	-.55635	.62994	.80302	.94491		
5	3	3	3	-.36799	.41667	-.07726	-.09091	.42492	-.36237
5	4	1	1	.29439	-.33333	0.	0.	.93937	.79772
5	4	1	2	-.93095	1.05409	0.	0.		
5	4	2	2	.00000	-.00000	.56656	.66667	.70453	.13295
5	5	1	1	-.44159	.50000	0.	0.	.90000	.66667
5	5	1	2	-.27386	.31009	0.	0.		
5	5	2	2	.28307	-.32051	-.52298	-.61538	.71026	.15385
5	6	1	1	.16984	-.19231	0.	0.	.95804	.86006

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
5	6	1	2	.77831	-.88126	0.	0.		
5	6	2	2	.26689	-.30220	.22413	.26374	.79380	.36860
5	7	2	2	-.24263	.27473	-.03736	-.04396	.92856	.77182
5	7	2	3	.57417	-.65012	-.22100	-.26005		
5	7	3	3	.25476	-.28846	-.07726	-.09091	.71963	.19296
5	8	3	3	-.42460	.48077	.01783	.02098	.90671	.71128
6	3	3	3	-.70510	.79545	.09967	.11570	.81417	.46749
6	4	2	2	-.40291	.45455	-.20883	-.24242	.89995	.68609
6	4	2	3	-.56980	.64282	.73833	.85710		
6	4	3	3	-.30218	.34091	-.09018	-.10468	.61068	-.04901
6	5	1	1	.28204	-.31818	0.	0.	.95804	.86006
6	5	1	2	-.92319	1.04149	0.	0.		
6	5	2	2	.02878	-.03247	.53700	.62338	.79380	.36860
6	6	1	1	-.44320	.50000	0.	0.	.92857	.76190
6	6	1	2	-.23146	.26112	0.	0.		
6	6	2	2	.29355	-.33117	-.53700	-.62338	.79091	.36364
6	7	1	1	.17728	-.20000	0.	0.	.96923	.89741
6	7	1	2	.79282	-.89443	0.	0.		
6	7	2	2	.25326	-.28571	.24612	.28571	.84807	.52349
6	8	2	2	-.25326	.28571	-.04343	-.05042	.94642	.82701
6	8	2	3	.58029	-.65465	-.24880	-.28882		
6	8	3	3	.22160	-.25000	-.08292	-.09626	.78868	.36756
6	9	3	3	-.44320	.50000	.02073	.02406	.92884	.77580
7	4	3	3	-.68340	.76923	.08944	.10299	.87226	.61570
7	5	2	2	-.39051	.43956	-.18741	-.21578	.92856	.77182
7	5	2	3	-.57758	.65012	.69295	.79787		
7	5	3	3	-.25627	.28846	-.09690	-.11157	.71963	.19296
7	6	1	1	.27336	-.30769	0.	0.	.96923	.89741
7	6	1	2	-.91687	1.03203	0.	0.		
7	6	2	2	.04881	-.05495	.51537	.59341	.84807	.52349
7	7	1	1	-.44421	.50000	0.	0.	.94643	.82143
7	7	1	2	-.20045	.22562	0.	0.		
7	7	2	2	.30006	-.33775	-.54568	-.62831	.84219	.50792
7	8	1	1	.18291	-.20588	0.	0.	.97647	.92156
7	8	1	2	.80326	-.90414	0.	0.		

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
7	8	2	2	.24264	-.27311	.26274	.30252	.88347	.62900
7	9	2	2	-.26130	.29412	-.04840	-.05573	.95833	.86449
7	9	2	3	.58428	-.65767	-.27056	-.31153		
7	9	3	3	.19597	-.22059	-.08690	-.10006	.83512	.49399
7	10	3	3	-.45727	.51471	.02310	.02660	.94392	.82115
8	5	3	3	-.66732	.75000	.08243	.09441	.90671	.71128
8	6	2	2	-.38132	.42857	-.17271	-.19780	.94642	.82701
8	6	2	3	-.58248	.65465	.65953	.75537		
8	6	3	3	-.22244	.25000	-.10075	-.11538	.78868	.36756
8	7	1	1	.26693	-.30000	0.	0.	.97647	.92156
8	7	1	2	-.91173	1.02470	0.	0.		
8	7	2	2	.06355	-.07143	.49893	.57143	.88347	.62900
8	8	1	1	-.44488	.50000	0.	0.	.95833	.86111
8	8	1	2	-.17678	.19868	0.	0.		
8	8	2	2	.30439	-.34211	-.55145	-.63158	.87675	.60965
8	9	1	1	.18732	-.21053	0.	0.	.98142	.93807
8	9	1	2	.81111	-.91161	0.	0.		
8	9	2	2	.23415	-.26316	.27572	.31579	.90782	.70356
8	10	2	2	-.26760	.30075	-.05252	-.06015	.96667	.89105
8	10	2	3	.58704	-.65977	-.28803	-.32989		
8	10	3	3	.17561	-.19737	-.08982	-.10287	.86780	.58728
8	11	3	3	-.46829	.52632	.02507	.02871	.95466	.85415
9	6	3	3	-.65492	.73529	.07732	.08824	.92884	.77580
9	7	2	2	-.37424	.42017	-.16201	-.18487	.95833	.86449
9	7	2	3	-.58578	.65767	.63397	.72343		
9	7	3	3	-.19648	.22059	-.10310	-.11765	.83512	.49399
9	8	1	1	.26197	-.29412	0.	0.	.98142	.93807
9	8	1	2	-.90749	1.01885	0.	0.		
9	8	2	2	.07485	-.08403	.48603	.55462	.90782	.70356
9	9	1	1	-.44535	.50000	0.	0.	.96667	.88889
9	9	1	2	-.15811	.17752	0.	0.		
9	9	2	2	.30741	-.34514	-.55547	-.63385	.90112	.68347
9	10	1	1	.19086	-.21429	0.	0.	.98496	.94987
9	10	1	2	.81723	-.91752	0.	0.		
9	10	2	2	.22722	-.25510	.28615	.32653	.92527	.75798

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
9	11	2	2	-.27266	.30612	-.05599	-.06389	.97273	.91054
9	11	2	3	.58902	-.66130	-.30236	-.34503		
9	11	3	3	.15905	-.17857	-.09204	-.10503	.89167	.65761
9	12	3	3	-.47716	.53571	.02672	.03049	.96258	.87887
10	7	3	3	-.64507	.72368	.07345	.08359	.94392	.82115
10	8	2	2	-.36861	.41353	-.15389	-.17514	.96667	.89105
10	8	2	3	-.58810	.65977	.61381	.69858		
10	8	3	3	-.17593	.19737	-.10461	-.11905	.86780	.58728
10	9	1	1	.25803	-.28947	0.	0.	.98496	.94987
10	9	1	2	-.90394	1.01410	0.	0.		
10	9	2	2	.08378	-.09398	.47566	.54135	.92527	.75798
10	10	1	1	-.44569	.50000	0.	0.	.97273	.90909
10	10	1	2	-.14302	.16045	0.	0.		
10	10	2	2	.30961	-.34734	-.55838	-.63550	.91893	.73851
10	11	1	1	.19378	-.21739	0.	0.	.98758	.95859
10	11	1	2	.82212	-.92231	0.	0.		
10	11	2	2	.22146	-.24845	.29470	.33540	.93820	.79883
10	12	2	2	-.27682	.31056	-.05894	-.06708	.97727	.92525
10	12	2	3	.59049	-.66245	-.31431	-.35772		
10	12	3	3	.14533	-.16304	-.09377	-.10672	.90961	.71173
10	13	3	3	-.48444	.54348	.02813	.03202	.96859	.89783
11	8	3	3	-.63706	.71429	.07041	.07997	.95466	.85415
11	9	2	2	-.36403	.40816	-.14752	-.16756	.97273	.91054
11	9	2	3	-.58980	.66130	.59751	.67870		
11	9	3	3	-.15926	.17857	-.10561	-.11996	.89167	.65761
11	10	1	1	.25482	-.28571	0.	0.	.98758	.95859
11	10	1	2	-.90094	1.01015	0.	0.		
11	10	2	2	.09101	-.10204	.46714	.53061	.93820	.79883
11	11	1	1	-.44594	.50000	0.	0.	.97727	.92424
11	11	1	2	-.13056	.14639	0.	0.		
11	11	2	2	.31125	-.34898	-.56056	-.63673	.93234	.78052
11	12	1	1	.19621	-.22000	0.	0.	.98957	.96522
11	12	1	2	.82614	-.92628	0.	0.		
11	12	2	2	.21660	-.24286	.30184	.34286	.94804	.83022
11	13	2	2	-.28031	.31429	-.06149	-.06984	.98077	.93662

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
11	13	2	3	.59161	-.66332	-.32443	-.36851		
11	13	3	3	.13378	-.15000	-.09515	-.10808	.92345	.75416
11	14	3	3	-.49054	.55000	.02935	.03333	.97325	.91269
12	9	3	3	-.63041	.70652	.06796	.07708	.96258	.87887
12	10	2	2	-.36024	.40373	-.14239	-.16149	.97727	.92525
12	10	2	3	-.59108	.66245	.58408	.66245		
12	10	3	3	-.14548	.16304	-.10629	-.12055	.90961	.71173
12	11	1	1	.25216	-.28261	0.	0.	.98957	.96522
12	11	1	2	-.89837	1.00683	0.	0.		
12	11	2	2	.09699	-.10870	.46002	.52174	.94804	.83022
12	12	1	1	-.44614	.50000	0.	0.	.98077	.93590
12	12	1	2	-.12010	.13460	0.	0.		
12	12	2	2	.31251	-.35024	-.56224	-.63768	.94268	.81327
12	13	1	1	.19828	-.22222	0.	0.	.99111	.97037
12	13	1	2	.82948	-.92962	0.	0.		
12	13	2	2	.21245	-.23810	.30789	.34921	.95571	.85485
12	14	2	2	-.28326	.31746	-.06370	-.07225	.98352	.94558
12	14	2	3	.59248	-.66402	-.33311	-.37780		
12	14	3	3	.12393	-.13889	-.09628	-.10920	.93434	.78799
12	15	3	3	-.49571	.55556	.03040	.03448	.97695	.92455
13	10	3	3	-.62481	.70000	.06594	.07470	.96859	.89783
13	11	2	2	-.35703	.40000	-.13817	-.15652	.98077	.93662
13	11	2	3	-.59207	.66332	.57281	.64890		
13	11	3	3	-.13389	.15000	-.10677	-.12095	.92345	.75416
13	12	1	1	.24992	-.28000	0.	0.	.99111	.97037
13	12	1	2	-.89615	1.00399	0.	0.		
13	12	2	2	.10201	-.11429	.45398	.51429	.95571	.85485
13	13	1	1	-.44629	.50000	0.	0.	.98352	.94505
13	13	1	2	-.11119	.12457	0.	0.		
13	13	2	2	.31350	-.35123	-.56356	-.63842	.95082	.83926
13	14	1	1	.20006	-.22414	0.	0.	.99234	.97446
13	14	1	2	.83231	-.93247	0.	0.		
13	14	2	2	.20886	-.23399	.31309	.35468	.96180	.87451
13	15	2	2	-.28580	.32020	-.06565	-.07437	.98571	.95278
13	15	2	3	.59318	-.66457	-.34063	-.38588		

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
13	15	3	3	.11542	-.12931	-.09721	-.11012	.94306	.81536
13	16	3	3	-.50015	.56034	.03133	.03549	.97993	.93415
14	11	3	3	-.62002	.69444	.06426	.07273	.97325	.91269
14	12	2	2	-.35430	.39683	-.13464	-.15238	.98352	.94558
14	12	2	3	-.59285	.66402	.56323	.63746		
14	12	3	3	-.12400	.13889	-.10710	-.12121	.93434	.78799
14	13	1	1	.24801	-.27778	0.	0.	.99234	.97446
14	13	1	2	-.89421	1.00154	0.	0.		
14	13	2	2	.10629	-.11905	.44879	.50794	.96180	.87451
14	14	1	1	-.44641	.50000	0.	0.	.98571	.95238
14	14	1	2	-.10351	.11593	0.	0.		
14	14	2	2	.31430	-.35202	-.56461	-.63902	.95735	.86022
14	15	1	1	.20161	-.22581	0.	0.	.99333	.97775
14	15	1	2	.83473	-.93493	0.	0.		
14	15	2	2	.20572	-.23041	.31759	.35945	.96672	.89045
14	16	2	2	-.28801	.32258	-.06737	-.07625	.98750	.95864
14	16	2	3	.59375	-.66502	-.34721	-.39296		
14	16	3	3	.10800	-.12097	-.09799	-.11090	.95016	.83780
14	17	3	3	-.50402	.56452	.03215	.03639	.98237	.94204
15	12	3	3	-.61588	.68966	.06283	.07106	.97695	.92455
15	13	2	2	-.35193	.39409	-.13164	-.14888	.98571	.95278
15	13	2	3	-.59348	.66457	.55499	.62765		
15	13	3	3	-.11548	.12931	-.10733	-.12139	.94306	.81536
15	14	1	1	.24635	-.27586	0.	0.	.99333	.97775
15	14	1	2	-.89250	.99941	0.	0.		
15	14	2	2	.10998	-.12315	.44429	.50246	.96672	.89045
15	15	1	1	-.44651	.50000	0.	0.	.98750	.95833
15	15	1	2	-.09682	.10842	0.	0.		
15	15	2	2	.31494	-.35266	-.56546	-.63950	.96266	.87735
15	16	1	1	.20296	-.22727	0.	0.	.99413	.98045
15	16	1	2	.83683	-.93707	0.	0.		
15	16	2	2	.20296	-.22727	.32154	.36364	.97074	.90355
15	17	2	2	-.28994	.32468	-.06890	-.07792	.98897	.96347
15	17	2	3	.59421	-.66539	-.35301	-.39923		
15	17	3	3	.10148	-.11364	-.09865	-.11157	.95600	.85642

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
15	18	3	3	-.50740	.56818	.03288	.03719	.98439	.94859

Table 2b

Angular distribution functions for half-integral spins.

$JI \equiv J_i$

$JF \equiv J_f$

$L1 \equiv L_1$

$L2 \equiv L_2$

$F2 \equiv F_2(J_f L_1 L_2 J_i)$

$B2F2 \equiv B_2(J_i) F_2(J_f L_1 L_2 J_i)$

$F4 \equiv F_4(J_f L_1 L_2 J_i)$

$B4F4 \equiv B_4(J_i) F_4(J_f L_1 L_2 J_i)$

$U2 \equiv u_2(J_i L_1 J_f)$

$U4 \equiv u_4(J_i L_1 J_f)$

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
3/2	1/2	1	1	.50000	-.50000	0.	0.	0.	0.
3/2	1/2	1	2	-.86603	.86603	0.	0.		
3/2	1/2	2	2	-.50000	.50000	0.	0.	0.	0.
3/2	3/2	1	1	-.40000	.40000	0.	0.	.20000	0.
3/2	3/2	1	2	-.77460	.77460	0.	0.		
3/2	3/2	2	2	.00000	-.00000	0.	0.	-.60000	0.
3/2	5/2	1	1	.10000	-.10000	0.	0.	.74833	0.
3/2	5/2	1	2	.59161	-.59161	0.	0.		
3/2	5/2	2	2	.35714	-.35714	0.	0.	-.10690	0.
3/2	7/2	2	2	-.14286	.14286	0.	0.	.65465	0.
3/2	7/2	2	3	.46291	-.46291	0.	0.		
3/2	7/2	3	3	.50000	-.50000	0.	0.	-.21822	0.
3/2	9/2	3	3	-.25000	.25000	0.	0.	.60553	0.
5/2	1/2	2	2	-.53452	.57143	-.61721	-.57143	0.	0.
5/2	1/2	2	3	-.37796	.40406	1.09109	1.01015		
5/2	1/2	3	3	-.80178	.85714	.15430	.14286	0.	0.
5/2	3/2	1	1	.37417	-.40000	0.	0.	.74833	0.
5/2	3/2	1	2	-.94868	1.01419	0.	0.		
5/2	3/2	2	2	-.19090	.20408	.70539	.65306	-.10690	0.
5/2	5/2	1	1	-.42762	.45714	0.	0.	.65714	-.14286
5/2	5/2	1	2	-.50709	.54210	0.	0.		
5/2	5/2	2	2	.19090	-.20408	-.39678	-.36735	.10000	-.50000
5/2	7/2	1	1	.13363	-.14286	0.	0.	.87482	.58029
5/2	7/2	1	2	.69437	-.74231	0.	0.		
5/2	7/2	2	2	.32453	-.34694	.11756	.10884	.40825	-.45134
5/2	9/2	2	2	-.19090	.20408	-.01470	-.01361	.80917	.43492
5/2	9/2	2	3	.52973	-.56630	-.10195	-.09438		
5/2	9/2	3	3	.40089	-.42857	-.04442	-.04113	.27953	-.51399
5/2	11/2	3	3	-.33408	.35714	.00701	.00649	.76871	.36237
7/2	1/2	3	3	-.81832	.89286	.17094	.17532	0.	0.
7/2	3/2	2	2	-.46761	.51020	-.35816	-.36735	.65465	0.
7/2	3/2	2	3	-.50508	.55108	.96715	.99195		
7/2	3/2	3	3	-.54554	.59524	-.01899	-.01948	-.21822	0.
7/2	5/2	1	1	.32733	-.35714	0.	0.	.87482	.58029
7/2	5/2	1	2	-.94491	1.03098	0.	0.		

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
7/2	5/2	2	2	-.07793	.08503	.63673	.65306	.40825	-.45134
7/2	7/2	1	1	-.43644	.47619	0.	0.	.80952	.36508
7/2	7/2	1	2	-.37796	.41239	0.	0.		
7/2	7/2	2	2	.24939	-.27211	-.47755	-.48980	.46667	-.33333
7/2	9/2	1	1	.15275	-.16667	0.	0.	.92496	.74949
7/2	9/2	1	2	.74162	-.80917	0.	0.		
7/2	9/2	2	2	.29615	-.32313	.17365	.17811	.63666	-.02920
7/2	11/2	2	2	-.21822	.23810	-.02532	-.02597	.87870	.62447
7/2	11/2	2	3	.55635	-.60703	-.16141	-.16555		
7/2	11/2	3	3	.32733	-.35714	-.06274	-.06434	.53109	-.19901
7/2	13/2	3	3	-.38188	.41667	.01209	.01240	.84732	.55010
9/2	3/2	3	3	-.75691	.83333	.12812	.13636	.60553	0.
9/2	5/2	2	2	-.43252	.47619	-.26844	-.28571	.80917	.43492
9/2	5/2	2	3	-.54554	.60062	.84646	.90094		
9/2	5/2	3	3	-.41286	.45455	-.06600	-.07025	.27953	-.51399
9/2	7/2	1	1	.30277	-.33333	0.	0.	.92496	.74949
9/2	7/2	1	2	-.93541	1.02986	0.	0.		
9/2	7/2	2	2	-.01966	.02165	.58568	.62338	.63666	-.02920
9/2	9/2	1	1	-.44039	.48485	0.	0.	.87879	.59596
9/2	9/2	1	2	-.30151	.33195	0.	0.		
9/2	9/2	2	2	.27524	-.30303	-.51247	-.54545	.65152	.01515
9/2	11/2	1	1	.16514	-.18182	0.	0.	.94999	.83320
9/2	11/2	1	2	.76871	-.84632	0.	0.		
9/2	11/2	2	2	.27524	-.30303	.21024	.22378	.75512	.26349
9/2	13/2	2	2	-.23592	.25974	-.03379	-.03596	.91606	.73397
9/2	13/2	2	3	.56980	-.62733	-.20402	-.21715		
9/2	13/2	3	3	.27524	-.30303	-.07347	-.07819	.67178	.08155
9/2	15/2	3	3	-.41286	.45455	.01613	.01716	.89152	.66842
11/2	5/2	3	3	-.71906	.79545	.10675	.11570	.76871	.36237
11/2	7/2	2	2	-.41089	.45455	-.22366	-.24242	.87870	.62447
11/2	7/2	2	3	-.56408	.62401	.76761	.83201		
11/2	7/2	3	3	-.33187	.36713	-.08485	-.09197	.53109	-.19901
11/2	9/2	1	1	.28762	-.31818	0.	0.	.94999	.83320
11/2	9/2	1	2	-.92687	1.02535	0.	0.		
11/2	9/2	2	2	.01580	-.01748	.55055	.59674	.75512	.26349

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
11/2	11/2	1	1	-.44250	.48951	0.	0.	.91608	.72028
11/2	11/2	1	2	-.25087	.27753	0.	0.		
11/2	11/2	2	2	.28898	-.31968	-.53089	-.57542	.75544	.26873
11/2	13/2	1	1	.17384	-.19231	0.	0.	.96428	.88090
11/2	13/2	1	2	.78621	-.86974	0.	0.		
11/2	13/2	2	2	.25963	-.28721	.23595	.25574	.82402	.45380
11/2	15/2	2	2	-.24834	.27473	-.04055	-.04396	.93845	.80224
11/2	15/2	2	3	.57758	-.63894	-.23579	-.25558		
11/2	15/2	3	3	.23705	-.26224	-.08035	-.08709	.75779	.28743
11/2	17/2	3	3	-.43460	.48077	.01936	.02098	.91890	.74652
13/2	7/2	3	3	-.69338	.76923	.09403	.10299	.84732	.55010
13/2	9/2	2	2	-.39621	.43956	-.19702	-.21578	.91606	.73397
13/2	9/2	2	3	-.57417	.63698	.71379	.78175		
13/2	9/2	3	3	-.27735	.30769	-.09403	-.10299	.67178	.08155
13/2	11/2	1	1	.27735	-.30769	0.	0.	.96428	.88090
13/2	11/2	1	2	-.91987	1.02050	0.	0.		
13/2	11/2	2	2	.03962	-.04396	.52540	.57542	.82402	.45380
13/2	13/2	1	1	-.44376	.49231	0.	0.	.93846	.79487
13/2	13/2	1	2	-.21483	.23834	0.	0.		
13/2	13/2	2	2	.29716	-.32967	-.54182	-.59341	.81923	.44231
13/2	15/2	1	1	.18028	-.20000	0.	0.	.97321	.91069
13/2	15/2	1	2	.79844	-.88579	0.	0.		
13/2	15/2	2	2	.24763	-.27473	.25497	.27925	.86752	.58103
13/2	17/2	2	2	-.25754	.28571	-.04604	-.05042	.95294	.84744
13/2	17/2	2	3	.58248	-.64621	-.26030	-.28509		
13/2	17/2	3	3	.20801	-.23077	-.08507	-.09317	.81405	.43573
13/2	19/2	3	3	-.45069	.50000	.02197	.02406	.93705	.80036
15/2	9/2	3	3	-.67480	.75000	.08564	.09441	.89152	.66842
15/2	11/2	2	2	-.38560	.42857	-.17943	-.19780	.93845	.80224
15/2	11/2	2	3	-.58029	.64495	.67505	.74418		
15/2	11/2	3	3	-.23817	.26471	-.09907	-.10921	.75779	.28743
15/2	13/2	1	1	.26992	-.30000	0.	0.	.97321	.91069
15/2	13/2	1	2	-.91417	1.01605	0.	0.		
15/2	13/2	2	2	.05671	-.06303	.50662	.55850	.86752	.58103
15/2	15/2	1	1	-.44458	.49412	0.	0.	.95294	.84314

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
15/2	15/2	1	2	-.18787	.20880	0.	0.		
15/2	15/2	2	2	.30243	-.33613	-.54884	-.60504	.86106	.56303
15/2	17/2	1	1	.18524	-.20588	0.	0.	.97917	.93055
15/2	17/2	1	2	.80744	-.89742	0.	0.		
15/2	17/2	2	2	.23817	-.26471	.26961	.29721	.89671	.66934
15/2	19/2	2	2	-.26463	.29412	-.05055	-.05573	.96285	.87885
15/2	19/2	2	3	.58578	-.65106	-.27975	-.30840		
15/2	19/2	3	3	.18524	-.20588	-.08846	-.09752	.85281	.54405
15/2	21/2	3	3	-.46310	.51471	.02413	.02660	.94972	.83890
17/2	11/2	3	3	-.66074	.73529	.07969	.08824	.91890	.74652
17/2	13/2	2	2	-.37757	.42017	-.16697	-.18487	.95294	.84744
17/2	13/2	2	3	-.58428	.65021	.64595	.71523		
17/2	13/2	3	3	-.20866	.23220	-.10206	-.11300	.81405	.43573
17/2	15/2	1	1	.26430	-.29412	0.	0.	.97917	.93055
17/2	15/2	1	2	-.90951	1.01213	0.	0.		
17/2	15/2	2	2	.06955	-.07740	.49211	.54489	.89671	.66934
17/2	17/2	1	1	-.44513	.49536	0.	0.	.96285	.87616
17/2	17/2	1	2	-.16692	.18576	0.	0.		
17/2	17/2	2	2	.30603	-.34056	-.55363	-.61300	.88994	.64938
17/2	19/2	1	1	.18918	-.21053	0.	0.	.98333	.94444
17/2	19/2	1	2	.81435	-.90623	0.	0.		
17/2	19/2	2	2	.23051	-.25652	.28121	.31137	.91723	.73280
17/2	21/2	2	2	-.27026	.30075	-.05432	-.06015	.96992	.90151
17/2	21/2	2	3	.58810	-.65446	-.29553	-.32723		
17/2	21/2	3	3	.16692	-.18576	-.09100	-.10076	.88062	.62483
17/2	23/2	3	3	-.47295	.52632	.02593	.02871	.95890	.86736
19/2	13/2	3	3	-.64973	.72368	.07526	.08359	.93705	.80036
19/2	15/2	2	2	-.37127	.41353	-.15769	-.17514	.96285	.87885
19/2	15/2	2	3	-.58704	.65385	.62332	.69232		
19/2	15/2	3	3	-.18564	.20677	-.10393	-.11544	.85281	.54405
19/2	17/2	1	1	.25989	-.28947	0.	0.	.98333	.94444
19/2	17/2	1	2	-.90564	1.00872	0.	0.		
19/2	17/2	2	2	.07956	-.08861	.48058	.53377	.91723	.73280
19/2	19/2	1	1	-.44553	.49624	0.	0.	.96992	.89975
19/2	19/2	1	2	-.15019	.16728	0.	0.		

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
19/2	19/2	2	2	.30859	-.34372	-.55703	-.61869	.91069	.71292
19/2	21/2	1	1	.19239	-.21429	0.	0.	.98636	.95454
19/2	21/2	1	2	.81980	-.91312	0.	0.		
19/2	21/2	2	2	.22421	-.24973	.29063	.32279	.93219	.77980
19/2	23/2	2	2	-.27484	.30612	-.05752	-.06389	.97515	.91838
19/2	23/2	2	3	.58980	-.65694	-.30859	-.34275		
19/2	23/2	3	3	.15188	-.16917	-.09295	-.10324	.90125	.68637
19/2	25/2	3	3	-.48097	.53571	.02745	.03049	.96578	.88895
21/2	15/2	3	3	-.64087	.71429	.07184	.07997	.94972	.83890
21/2	17/2	2	2	-.36621	.40816	-.15052	-.16756	.96992	.90151
21/2	17/2	2	3	-.58902	.65649	.60525	.67377		
21/2	17/2	3	3	-.16718	.18634	-.10516	-.11706	.88062	.62483
21/2	19/2	1	1	.25635	-.28571	0.	0.	.98636	.95454
21/2	19/2	1	2	-.90238	1.00575	0.	0.		
21/2	19/2	2	2	.08757	-.09760	.47120	.52454	.93219	.77980
21/2	21/2	1	1	-.44582	.49689	0.	0.	.97516	.91718
21/2	21/2	1	2	-.13650	.15214	0.	0.		
21/2	21/2	2	2	.31048	-.34605	-.55955	-.62289	.92609	.76087
21/2	23/2	1	1	.19505	-.21739	0.	0.	.98864	.96212
21/2	23/2	1	2	.82423	-.91865	0.	0.		
21/2	23/2	2	2	.21893	-.24401	.29843	.33221	.94344	.81551
21/2	25/2	2	2	-.27864	.31056	-.06026	-.06708	.97913	.93128
21/2	25/2	2	3	.59108	-.65880	-.31957	-.35575		
21/2	25/2	3	3	.13932	-.15528	-.09450	-.10519	.91696	.73419
21/2	27/2	3	3	-.48762	.54348	.02876	.03202	.97106	.90570
23/2	17/2	3	3	-.63359	.70652	.06912	.07708	.95890	.86736
23/2	19/2	2	2	-.36205	.40373	-.14482	-.16149	.97515	.91838
23/2	19/2	2	3	-.59049	.65846	.59049	.65846		
23/2	19/2	3	3	-.15206	.16957	-.10598	-.11818	.90125	.68637
23/2	21/2	1	1	.25343	-.28261	0.	0.	.98864	.96212
23/2	21/2	1	2	-.89960	1.00316	0.	0.		
23/2	21/2	2	2	.09413	-.10497	.46342	.51677	.94344	.81551
23/2	23/2	1	1	-.44605	.49739	0.	0.	.97913	.93043
23/2	23/2	1	2	-.12511	.13951	0.	0.		
23/2	23/2	2	2	.31192	-.34783	-.56146	-.62609	.93783	.79787

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
23/2	25/2	1	1	.19729	-.22000	0.	0.	.99038	.96795
23/2	25/2	1	2	.82788	-.92318	0.	0.		
23/2	25/2	2	2	.21444	-.23913	.30499	.34010	.95211	.84325
23/2	27/2	2	2	-.28184	.31429	-.06263	-.06984	.98222	.94136
23/2	27/2	2	3	.59207	-.66023	-.32893	-.36679		
23/2	27/2	3	3	.12867	-.14348	-.09574	-.10676	.92921	.77200
23/2	29/2	3	3	-.49322	.55000	.02989	.03333	.97521	.91894
25/2	19/2	3	3	-.62750	.70000	.06690	.07470	.96578	.88895
25/2	21/2	2	2	-.35857	.40000	-.14018	-.15652	.97913	.93128
25/2	21/2	2	3	-.59161	.65997	.57821	.64562		
25/2	21/2	3	3	-.13944	.15556	-.10655	-.11897	.91696	.73419
25/2	23/2	1	1	.25100	-.28000	0.	0.	.99038	.96795
25/2	23/2	1	2	-.89722	1.00089	0.	0.		
25/2	23/2	2	2	.09960	-.11111	.45688	.51014	.95211	.84325
25/2	25/2	1	1	-.44622	.49778	0.	0.	.98222	.94074
25/2	25/2	1	2	-.11547	.12881	0.	0.		
25/2	25/2	2	2	.31304	-.34921	-.56294	-.62857	.94698	.82698
25/2	27/2	1	1	.19920	-.22222	0.	0.	.99176	.97253
25/2	27/2	1	2	.83095	-.92696	0.	0.		
25/2	27/2	2	2	.21059	-.23492	.31059	.34680	.95893	.86521
25/2	29/2	2	2	-.28458	.31746	-.06471	-.07225	.98467	.94937
25/2	29/2	2	3	.59285	-.66135	-.33700	-.37629		
25/2	29/2	3	3	.11952	-.13333	-.09676	-.10805	.93893	.80237
25/2	31/2	3	3	-.49801	.55556	.03088	.03448	.97852	.92959
27/2	21/2	3	3	-.62232	.69444	.06507	.07273	.97106	.90570
27/2	23/2	2	2	-.35561	.39683	-.13633	-.15238	.98222	.94136
27/2	23/2	2	3	-.59248	.66115	.56783	.63470		
27/2	23/2	3	3	-.12876	.14368	-.10695	-.11954	.92921	.77200
27/2	25/2	1	1	.24893	-.27778	0.	0.	.99176	.97253
27/2	25/2	1	2	-.89514	.99888	0.	0.		
27/2	25/2	2	2	.10423	-.11631	.45129	.50443	.95893	.86521
27/2	27/2	1	1	-.44636	.49808	0.	0.	.98467	.94891
27/2	27/2	1	2	-.10721	.11964	0.	0.		
27/2	27/2	2	2	.31392	-.35030	-.56411	-.63054	.95426	.85028
27/2	29/2	1	1	.20086	-.22414	0.	0.	.99286	.97619

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
27/2	29/2	1	2	.83356	-.93016	0.	0.		
27/2	29/2	2	2	.20724	-.23125	.31542	.35256	.96439	.88289
27/2	31/2	2	2	-.28694	.32020	-.06653	-.07437	.98665	.95585
27/2	31/2	2	3	.59348	-.66226	-.34402	-.38454		
27/2	31/2	3	3	.11159	-.12452	-.09762	-.10911	.94679	.82712
27/2	33/2	3	3	-.50215	.56034	.03175	.03549	.98121	.93828
29/2	23/2	3	3	-.61788	.68966	.06352	.07106	.97521	.91894
29/2	25/2	2	2	-.35307	.39409	-.13308	-.14888	.98467	.94937
29/2	25/2	2	3	-.59318	.66209	.55896	.62531		
29/2	25/2	3	3	-.11959	.13348	-.10723	-.11995	.93893	.80237
29/2	27/2	1	1	.24715	-.27586	0.	0.	.99286	.97619
29/2	27/2	1	2	-.89333	.99710	0.	0.		
29/2	27/2	2	2	.10820	-.12077	.44647	.49946	.96439	.88289
29/2	29/2	1	1	-.44647	.49833	0.	0.	.98665	.95551
29/2	29/2	1	2	-.10006	.11168	0.	0.		
29/2	29/2	2	2	.31463	-.35118	-.56506	-.63213	.96013	.86920
29/2	31/2	1	1	.20231	-.22581	0.	0.	.99375	.97917
29/2	31/2	1	2	.83582	-.93291	0.	0.		
29/2	31/2	2	2	.20430	-.22803	.31963	.35757	.96883	.89731
29/2	33/2	2	2	-.28901	.32258	-.06816	-.07625	.98827	.96117
29/2	33/2	2	3	.59399	-.66299	-.35020	-.39177		
29/2	33/2	3	3	.10464	-.11680	-.09833	-.11001	.95322	.84753
29/2	35/2	3	3	-.50576	.56452	.03253	.03639	.98343	.94546
31/2	25/2	3	3	-.61402	.68548	.06219	.06962	.97852	.92959
31/2	27/2	2	2	-.35087	.39171	-.13031	-.14588	.98665	.95585
31/2	27/2	2	3	-.59375	.66285	.55128	.61714		
31/2	27/2	3	3	-.11164	.12463	-.10742	-.12026	.94679	.82712
31/2	29/2	1	1	.24561	-.27419	0.	0.	.99375	.97917
31/2	29/2	1	2	-.89172	.99551	0.	0.		
31/2	29/2	2	2	.11164	-.12463	.44226	.49510	.96883	.89731
31/2	31/2	1	1	-.44656	.49853	0.	0.	.98827	.96090
31/2	31/2	1	2	-.09380	.10471	0.	0.		
31/2	31/2	2	2	.31522	-.35191	-.56583	-.63343	.96495	.88477
31/2	33/2	1	1	.20358	-.22727	0.	0.	.99449	.98162
31/2	33/2	1	2	.83778	-.93529	0.	0.		

JI	JF	L1	L2	F2	B2F2	F4	B4F4	U2	U4
31/2	33/2	2	2	.20170	-.22518	.32333	.36196	.97249	.90924
31/2	35/2	2	2	-.29083	.32468	-.06961	-.07792	.98961	.96558
31/2	35/2	2	3	.59441	-.66360	-.35567	-.39816		
31/2	35/2	3	3	.09851	-.10997	-.09895	-.11077	.95855	.86456
31/2	37/2	3	3	-.50894	.56818	.03322	.03719	.98527	.95146