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ENERGY MATRICES OF THE f^5 ELECTRON
CONFIGURATION

Berkeley, California

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UNIVERSITY OF CALIFORNIA
Lawrence Radiation Laboratory
Berkeley, California

October 15, 1962

ERRATUM

TO: All recipients of UCRL-10448
FROM: Technical Information Division
SUBJECT: UCRL-10448, "Energy Matrices of the f^5 Electron Configuration,"
by E. G. Wybourne, September 1962.

Since the completion of this report C. W. Nielson⁷ has informed the author that he has now calculated the electrostatic matrices of all the f^n configurations. In the light of his calculations, the following corrections should be made:

Page 9.	14	13	3	546	11	E3
Page 14.	9	8	3	546	11	E3
Page 29.	26	25	12	455	1	E2
Page 36.	16	15	12	455	1	E2
Page 44.	19	17-21	163438	253		E3
Page 49.	11	9-21	163438	253		E3.

Research and Development

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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

B. G. Wybourne

September 1962

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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

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University of California
Berkeley, California

September 1962

ABSTRACT

The complete electrostatic and spin-orbit matrices of the f^5 electron configuration have been calculated and are presented in a tabulated form.

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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

B. G. Wybourne

Lawrence Radiation Laboratory
University of California
Berkeley, California

September 1962

Introduction

In a recent paper¹ the calculation of the complete spin-orbit matrices for the f^5 electron configuration was reported. In an earlier paper² the complete electrostatic matrices were presented. Using the results of these calculations it has been possible to construct the energy matrices of the f^5 configuration. These energy matrices have been applied to the analysis of the crystal spectra of trivalent samarium, dysprosium³ and plutonium ions.⁴ To permit a wider usage of these energy matrices they have been tabulated by a direct print-out of the matrix elements which were checked and stored on punched cards. The results are given in this report.

THE ENERGY MATRICES

The states of the f^5 configuration have been labeled using the group theoretical classification of Racah.⁵ The labeling of the states is performed by introducing two groups which provide two additional sets of quantum numbers W and U . The first is a set of three integral numbers $W \equiv (w_1 w_2 w_3)$ with $w_1 \geq w_2 \geq w_3 \geq 0$ and all $w \leq 2$, while the second is a set of two integers $U \equiv (u_1, u_2)$ with $2 \geq u_1 \geq u_2 \geq 0$. By specifying the quantum numbers $WUSL$ all the states of the f^5 configuration are distinctly labeled with the exception of some of the states labeled with $U \equiv (31)$ and $U \equiv (40)$ where the same LS label occurs twice.⁶ These states can only be separated in an arbitrary manner and in this we shall follow the separation made by Racah and in the tabulation of the matrix elements indicate one of the doubly occurring states with an asterisk.

The matrix elements of electrostatic interaction are expressed in terms of the parameters E^0 , E^1 , E^2 , and E^3 , which have been defined by Racah⁵ in terms of the Slater radial F_k integrals as follows:

$$E^0 = F_0 - 10F_2 - 33F_4 - 286F_6$$

$$E^1 = (70F_2 + 231F_4 + 2002F_6)/9$$

$$E^2 = (F_2 - 3F_4 + 7F_6)/9$$

$$E^3 = (5F_2 + 6F_4 - 91F_6)/3$$

The energy contribution involving the parameter E^0 is a constant for all terms of a given f^n configuration and is omitted from the tabulation. The coefficient associated with E^0 for a given f^n configuration is given by the general expression:

$$e_0 = n(n-1)/2$$

Checking procedures for the electrostatic matrices have been given in an earlier paper.² Recently Nielson and Nutter⁷ have checked the tables of Racah's paper⁵ from which these matrix elements were evaluated and found one misprint. In table VIb of Racah paper the entry $(30 | \chi(K^*) | 31)$ should read $72(1122/23)^{1/2}$. The matrix element $(f^n(221)(30)K | e_2 | f^n(221)(31)K^*)$ apart from the phase, should be $216(2346)^{1/2}/46$. This one matrix element in the f^5 , f^6 , and f^7 electrostatic energy matrices must be corrected in the earlier tabulations.^{2,8}

The spin-orbit matrices were completely checked out by diagonalization of the matrices and requiring that the eigenvalues calculated in jj coupling be reproduced.³

TABULATION OF THE MATRICES

As the energy matrices are real and symmetric only the diagonal elements and the lower half of the off-diagonal elements are reproduced. The first entry is the J value of the energy matrix and immediately below it is the rank of the matrix. In the first and second columns of the tabulation the row and column in which the particular matrix element occurs is specified. The phase of the matrix element is given immediately after the column number (where no phase is indicated it is to be taken as positive). The actual matrix elements are given in the form $a\sqrt{b/d}$ where a is in column three the b in column four and d in column five. The matrices of the coefficients of the parameters are presented in the sequence E^1 , E^2 , E^3 and ZETA where ZETA represents the spin-orbit parameter ζ_f . As the coefficients of E^1 are diagonal in the WUSL scheme the Racah classification has been specified along side of the matrix elements of E^1 . Only the non-zero matrix elements have been tabulated.

ACKNOWLEDGMENTS

These matrices were largely calculated during the authors researches at the University of Canterbury and at the Johns Hopkins University. The work performed at Johns Hopkins University was done with partial support from the U. S. Air Force Office of Scientific Research.

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J = 1/2 ENERGY MATRIX OF F5

RANK OF MATRIX						
1	1+	5	1	1	211,11,4P	E1
2	2+	5	1	1	211,30,4P	
3	3+	8	1	1	221,11,2P	
4	4+	8	1	1	221,30,2P	
5	5+	8	1	1	221,31,2P	
6	6+	12	1	1	210,11,2P	
7	7+	5	1	1	211,20,4D	
8	8+	5	1	1	211,21,4D	
9	9+	9	1	1	111,20,4D	
10	10+	0	1	1	110,10,6F	
2	1	390	11	3		E2
2	2	104	1	1		
4	3-	312	110	12		
4	4	26	1	1		
5	3+	6	1430	1		
5	4+	456	13	4		
5	5-	302	1	1		
7	7+	1144	1	7		
8	7+	156	66	7		
8	8-	1781	1	7		
10	10+	0	1	1		
1	1+	44	1	3		E3
2	1-	5	11	3		
2	2-	14	1	3		
3	3+	121	1	6		
4	3-	5	110	12		
4	4+	193	1	12		
5	3-	1	1430	4		
5	4+	17	13	4		
5	5+	143	1	4		
6	3-	33	2	2		
6	4+	3	55	2		
6	5-	3	715	2		
6	6+	22	1	1		
7	7+	22	1	7		
8	7+	10	66	7		
8	8+	202	1	7		
9	7-	33	7	7		
9	8+	6	462	7		
10	10+	0	1	1		
1	1-	1	1	18		ZETA
2	1-	5	11	18		
2	2-	5	1	18		
3	1	1	5	9		
3	2	1	55	18		
3	3	7	1	18		
4	1	5	22	18		
4	2	1	2	36		
4	3-	1	110	18		
4	4-	11	1	36		
5	2	1	26	4		
5	4	1	13	4		
5	5-	11	1	4		

6	1-	1	10	12
6	2	1	110	12
6	3-	1	2	6
6	4	1	55	3
7	1	5	7	12
7	2	1	77	84
7	3-	1	35	12
7	4	1	154	24
7	5-	1	2002	56
7	6-	1	70	4
7	7-	3	1	28
8	2	1	42	7
8	4-	1	21	2
8	5	1	273	14
8	7-	1	66	14
8	8	5	1	14
9	1	1	1	12
9	2-	1	11	12
9	3	1	5	12
9	4-	1	22	24
9	5-	1	286	8
9	6-	1	10	4
9	7	3	7	28
9	8	1	462	14
9	9-	3	1	4
10	7-	3	21	7
10	8	1	154	7
10	9-	1	3	1
10	10-	2	1	1

J = 3/2 ENERGY MATRIX OF F5

21 RANK OF MATRIX

1	1+	9	1	1	111,00,4S
2	2	0	1	1	110,11,6P
3	3+	5	1	1	211,11,4P
4	4+	5	1	1	211,30,4P
5	5+	8	1	1	221,11,2P
6	6+	8	1	1	221,30,2P
7	7+	8	1	1	221,31,2P
8	8+	12	1	1	210,11,2P
9	9+	5	1	1	211,20,4D
10	10+	5	1	1	211,21,4D
11	11+	9	1	1	111,20,4D
12	12+	8	1	1	221,20,2D
13	13+	8	1	1	221,21,2D
14	14+	8	1	1	221,31,2D
15	15+	12	1	1	210,20,2D
16	16+	12	1	1	210,21,2D
17	17	0	1	1	110,10,6F
18	18+	5	1	1	211,10,4F
19	19+	5	1	1	211,21,4F
20	20+	5	1	1	211,30,4F
21	21+	9	1	1	111,10,4F
4	3+	130	11	1	
4	4+	104	1	1	
6	5-	312	110	12	
6	6+	26	1	1	
7	5+	6	1430	1	
7	6+	456	13	4	
7	7-	302	1	1	
9	9+	1144	1	7	
10	9+	156	66	7	
10	10-	1781	1	7	
12	12+	286	1	7	
13	12+	780	3	7	
13	13-	3055	1	77	
14	12-	216	182	7	
14	13-	180	546	77	
14	14+	2396	1	11	
15	15-	858	1	7	
16	15-	468	33	7	
16	16+	1131	1	7	
19	19-	65	1	1	
20	18+	20	143	1	
20	19-	72	195	3	
20	20-	76	1	1	
21	21+	0	1	1	
2	2	33	1	1	
3	3+	44	1	3	
4	3-	5	11	3	
4	4-	14	1	3	
5	5+	121	1	6	
6	5-	5	110	12	
6	6	193	1	12	
7	5-	1	1430	4	

E1

E2

E3

7	6+	17	13	4
7	7+	143	1	4
8	5-	33	2	2
8	6+	3	55	2
8	7-	3	715	2
8	8+	22	1	1
9	9+	22	1	7
10	9+	10	66	7
10	10+	202	1	7
11	9-	33	7	7
11	10	6	462	7
12	12-	44	1	7
13	12-	22	3	7
13	13+	911	1	77
14	13+	3	546	77
14	14+	269	1	11
15	12-	33	1	7
15	13-	132	3	7
15	15+	132	1	7
16	12-	18	33	7
16	13-	171	11	77
16	14+	9	6006	11
16	15-	12	33	7
16	16	183	1	7
19	18-	1	165	3
19	19+	3	1	1
20	19-	2	195	3
20	20+	42	1	1
21	19+	9	11	1
21	21+	0	1	1
2	1	1	6	2
2	2-	7	1	10
3	1	1	6	1
3	2-	3	1	20
3	3-	1	1	45
4	2-	3	11	4
4	3-	1	11	9
4	4-	1	1	9
5	1-	1	3	1
5	3	5	2	18
5	4	5	22	36
5	5-	7	1	36
6	3	5	55	18
6	4	1	5	36
6	5	1	110	36
6	6	11	1	72
7	4	1	65	4
7	6-	1	13	8
7	7	11	1	8
8	1-	1	6	2
8	3-	5	1	12
8	4	5	11	12
8	5	1	2	12
8	6-	1	55	6

ZETA

9	3	1	35	3
9	4	1	385	105
9	5-	1	70	24
9	6	1	77	24
9	7-	1	1001	56
9	8-	1	35	4
9	9-	1	1	14
10	4	4	210	35
10	6-	1	42	4
10	7	1	546	28
10	9-	1	66	21
10	10.	5	1	21
11	2-	3	5	10
11	3	1	5	15
11	4-	1	55	15
11	5	1	10	24
11	6-	1	11	24
11	7-	1	143	8
11	8-	1	5	4
11	9	1	7	14
11	10	1	462	21
11	11-	1	1	2
12	3-	1	35	12
12	4-	1	385	420
12	5	7	70	24
12	6	5	77	168
12	7	1	1001	56
12	8	1	35	4
12	9	1	1	28
12	10	1	66	42
12	11-	1	7	28
12	12-	1	1	14
13	4	1	1155	385
13	6-	31	231	308
13	7	1	3003	308
13	9-	43	3	42
13	10	17	22	231
13	11	1	21	42
13	12	23	3	42
13	13	955	1	924
14	4	3	1430	110
14	6	3	286	44
14	7	3	22	44
14	9	1	182	28
14	10	1	3003	462
14	11	1	26	4
14	12	1	182	28
14	13-	1	546	924
14	14-	1	1	22
15	3	1	35	12
15	4	1	385	420
15	5-	1	70	24
15	6-	11	77	168
15	7	1	1001	56
15	8	1	35	4
15	9-	13	1	28

15 10	4	66	21
15 11	1	7	28
15 12	2	1	7
15 13	17	3	21
15 14	1	182	28
15 15-	1	1	14
16 4-	3	105	35
16 6	3	21	28
16 7	3	273	28
16 9-	1	33	14
16 10	3	2	7
16 11-	1	231	14
16 12-	1	33	14
16 13	9	11	308
16 14-	1	6006	308
16 15	1	33	7
16 16-	19	1	28
17 9-	6	105	35
17 10	2	770	35
17 11-	2	15	5
17 17-	17	1	10
18 9-	8	70	105
18 10-	1	1155	630
18 11-	1	10	15
18 12	13	70	42
18 13	11	210	252
18 15	5	70	42
18 16	1	2310	84
18 17	1	6	10
18 18	23	1	15
19 10-	1	7	3
19 13	1	154	66
19 14-	2	429	33
19 16	1	14	2
19 17	1	110	10
19 18	1	165	90
19 19-	2	1	1
20 9-	1	10010	210
20 10-	1	1365	315
20 11	1	1430	30
20 12-	1	10010	210
20 13	1	30030	6930
20 14-	7	55	55
20 15	1	10010	210
20 16-	1	2730	210
20 19-	1	195	9
20 20-	2	1	3
21 9-	1	42	7
21 10-	1	77	14
21 12	1	42	14
21 13-	11	14	28
21 15-	3	42	14
21 16	1	154	28
21 17-	3	10	10
21 18-	1	15	5

21 19	1	11	2
21 21-	1	1	1

J = 5/2 ENERGY MATRIX OF F5

28 RANK OF MATRIX

1	1	0	1	1	110,11,6P	E1
2	2+	5	1	1	211,11,4P	
3	3+	5	1	1	211,30,4P	
4	4+	5	1	1	211,20,4D	
5	5+	5	1	1	211,21,4D	
6	6+	9	1	1	111,20,4D	
7	7+	8	1	1	221,20,2D	
8	8+	8	1	1	221,21,2D	
9	9+	8	1	1	221,31,2D	
10	10+	12	1	1	210,20,2D	
11	11+	12	1	1	210,21,2D	
12	12	0	1	1	110,10,6F	
13	13+	5	1	1	211,10,4F	
14	14+	5	1	1	211,21,4F	
15	15+	5	1	1	211,30,4F	
16	16+	9	1	1	111,10,4F	
17	17+	8	1	1	221,10,2F	
18	18+	8	1	1	221,21,2F	
19	19+	8	1	1	221,30,2F	
20	20+	8	1	1	221,31,2F	
21	21+	8	1	1	221,31,2F*	
22	22	12	1	1	210,21,2F	
23	23	18	1	1	100,10,2F	
24	24+	5	1	1	211,20,4G	
25	25+	5	1	1	211,21,4G	
26	26+	5	1	1	211,30,4G	
27	27+	9	1	1	111,20,4G	
28	28+	0	1	1	110,11,6H	
3	2+	130	11	1		E2
3	3+	104	1	1		
4	4+	1144	1	7		
5	4+	156	66	7		
5	5-	1781	1	7		
7	7+	286	1	7		
8	7+	780	3	7		
8	8-	3055	1	77		
9	7-	216	182	7		
9	8-	180	546	77		
9	9+	2396	1	11		
10	10-	858	1	7		
11	10-	468	33	7		
11	11+	1131	1	7		
14	14-	65	1	1		
15	13+	20	143	1		
15	14-	72	195	3		
15	15-	76	1	1		
18	18-	1495	1	11		
19	17+	5	143	1		
19	18+	720	4290	132		
19	19-	19	1	1		
20	18-	936	10	11		
20	19-	72	429	11		
20	20+	2210	1	11		

21 17-	15	429	1
21 18	144	1430	44
21 19-	147	3	1
21 20	168	143	11
21 21-	41	1	1
22 22	195	1	1
24 24-	1040	1	7
25 24-	48	2145	21
25 25	3267	1	21
26 24	52	15	1
26 25-	48	143	3
26 26	312	1	3
28 28	0	1	1
1 1	33	1	1
2 2	44	1	3
3 2-	5	11	3
3 3-	14	1	3
4 4	22	1	7
5 4	10	66	7
5 5	202	1	7
6 4-	33	7	7
6 5	6	462	7
7 7-	44	1	7
8 7-	22	3	7
8 8	911	1	77
9 8	3	546	77
9 9	269	1	11
10 7-	33	1	7
10 8-	132	3	7
10 10	132	1	7
11 7-	18	33	7
11 8-	171	11	77
11 9	9	6006	11
11 10-	12	33	7
11 11	183	1	7
14 13-	1	165	3
14 14	3	1	1
15 14-	2	195	3
15 15	42	1	1
16 14	9	11	1
18 17	43	30	30
18 18	240	1	11
19 18	29	4290	132
19 19	24	1	1
20 17	4	3	1
20 18-	9	10	11
20 19-	4	429	11
20 20	442	1	11
21 18-	3	1430	44
21 19	6	3	1
21 20-	20	143	11
21 21	12	1	1
22 17	3	330	10
22 18	27	11	11
22 19-	3	390	4

E3

22	20-	27	110	11
22	21-	9	130	4
22	22	6	1	1
23	18	36	5	5
23	20-	36	2	1
23	22-	12	55	5
24	24	8	1	7
25	24	5	2145	21
25	25	11	1	21
26	24	4	15	3
26	25	2	143	3
26	26	22	1	3
27	24-	12	7	7
27	25	1	15015	7
27	26-	4	105	1
28	28-	9	1	1
1	1-	1	1	5
2	1-	1	14	20
2	2	1	1	30
3	1-	1	154	4
3	2	1	11	6
3	3	1	1	6
4	2	7	15	12
4	3	1	165	60
4	4-	1	1	84
5	3	3	10	5
5	4-	1	66	126
5	5	5	1	126
6	1-	3	30	10
6	2	1	105	60
6	3-	1	1155	60
6	4	1	7	84
6	5	1	462	126
6	6-	1	1	12
7	2-	1	210	12
7	3-	1	2310	420
7	4	1	14	84
7	5	1	231	63
7	6-	1	2	12
7	7	1	1	21
8	3	3	770	385
8	4-	43	42	126
8	5	34	77	693
8	6	1	6	18
8	7-	23	3	63
8	8-	955	1	1386
9	3	3	2145	55
9	4	1	13	6
9	5	1	858	198
9	6	1	91	6
9	7-	1	182	42
9	8	1	546	1386
9	9	1	1	33
10	2	1	210	12
10	3	1	2310	420

ZETA

10	4-	13	14	84
10	5	8	231	63
10	6	1	2	12
10	7-	4	1	21
10	8-	34	3	63
10	9-	1	182	42
10	10	1	1	21
11	3-	9	70	35
11	4-	1	462	42
11	5	2	7	7
11	6-	1	66	6
11	7	1	33	21
11	8-	3	11	154
11	9	1	6006	462
11	10-	2	33	21
11	11	19	1	42
12	4-	9	30	35
12	5	6	55	35
12	6-	3	210	35
12	12-	6	1	5
13	4-	128	5	315
13	5-	4	330	945
13	6-	16	35	315
13	7	13	70	63
13	8	11	210	378
13	10	5	70	63
13	11	1	2310	126
13	12	3	6	20
13	13	161	1	180
14	5-	8	2	9
14	8	1	154	99
14	9-	4	429	99
14	11	1	14	3
14	12	3	110	20
14	13	7	165	1080
14	14-	7	1	6
15	4-	8	715	315
15	5-	8	390	945
15	6	8	5005	315
15	7-	1	10010	315
15	8	1	30030	10395
15	9-	14	55	165
15	10	1	10010	315
15	11-	1	2730	315
15	14-	7	195	108
15	15-	7	1	18
16	4-	16	3	21
16	5-	4	22	21
16	7	1	42	21
16	8-	11	14	42
16	10-	1	42	7
16	11	1	154	42
16	12-	9	10	20
16	13-	7	15	60
16	14	7	11	24

16 16-	7	1	12
17 4-	25	1	63
17 5	5	66	378
17 6	1	7	63
17 7-	20	14	63
17 8	55	42	756
17 10	8	14	63
17 11-	1	462	252
17 13-	5	5	18
17 14-	5	33	108
17 16-	1	3	6
17 17	14	1	9
18 5-	1	55	99
18 8-	65	35	198
18 9-	1	390	99
18 11	1	385	66
18 13	55	6	216
18 14	1	110	33
18 15-	5	858	1188
18 16-	11	10	24
18 17-	11	30	108
18 18-	35	1	33
19 4	1	143	18
19 5-	1	78	108
19 6-	1	1001	126
19 7-	5	2002	252
19 8	31	6006	16632
19 9	7	11	66
19 10	11	2002	252
19 11-	1	546	504
19 14-	35	39	216
19 15	1	5	18
19 18	31	4290	2376
19 19-	11	1	18
20 4	11	3	63
20 5-	31	22	693
20 6	11	21	63
20 7	11	42	126
20 8	31	14	1386
20 9-	23	39	99
20 10	11	42	126
20 11	31	154	462
20 14-	5	11	198
20 15-	1	2145	99
20 18	1	10	198
20 19-	1	429	99
20 20-	170	1	99
21 4-	1	429	126
21 5-	23	26	252
21 6-	1	3003	126
21 7-	1	6006	252
21 8	23	2002	5544
21 9-	71	33	198
21 10-	1	6006	252
21 11	23	182	168

21 14	5	13	72
21 15-	7	15	18
21 18-	1	1430	792
21 19-	7	3	18
21 20-	7	143	99
21 21	23	1	18
22 5-	1	5	3
22 8	1	385	66
22 9-	1	4290	33
22 11	1	35	6
22 13	5	66	72
22 14-	1	10	3
22 15	5	78	36
22 16	1	110	24
22 17	1	330	180
22 18	5	11	33
22 19-	1	390	72
22 20	1	110	66
22 21-	1	130	24
22 22	1	1	3
23 6	4	42	21
23 10	4	21	21
23 11	4	77	21
23 16	2	2	3
23 22-	4	55	15
23 23-	2	1	3
24 12	1	66	28
24 13-	4	11	21
24 14	1	15	24
24 15	5	13	42
24 16-	1	165	14
24 17	5	55	42
24 18-	43	66	264
24 19	1	65	6
24 20-	10	165	231
24 21-	1	195	42
24 22-	1	6	8
24 24-	5	1	28
25 12-	1	130	28
25 13-	1	195	168
25 15-	5	165	84
25 16-	15	13	56
25 17-	5	39	84
25 19	5	33	24
25 20	11	13	42
25 21-	47	11	168
25 24-	1	2145	168
25 25-	73	1	42
26 14-	5	1	4
26 18	1	110	44
26 20-	13	11	33
26 21-	2	13	3
26 22-	3	10	4
26 24	1	15	6
26 25	1	143	12

26 26-	5	1	6
27 12	1	462	84
27 13-	1	77	42
27 14-	1	105	24
27 15-	5	91	42
27 17-	1	385	210
27 18	1	462	264
27 19-	1	455	42
27 20-	10	1155	231
27 21-	1	1365	42
27 22-	1	42	8
27 23-	2	2310	35
27 24	5	7	28
27 25	1	15015	168
27 26-	1	105	6
27 27-	5	1	4
28 26	1	7	1
28 27	2	15	3
28 28-	3	1	1

J = 7/2 ENERGY MATRIX OF F5

30 RANK OF MATRIX							
1	1	0	1	1	110,11,6P	E1	
2	2	5	1	1	211,20,4D		
3	3	5	1	1	211,21,4D		
4	4	9	1	1	111,20,4D		
5	5	0	1	1	110,10,6F		
6	6	5	1	1	211,10,4F		
7	7	5	1	1	211,21,4F		
8	8	5	1	1	211,30,4F		
9	9	9	1	1	111,10,4F		
10	10	8	1	1	221,10,2F		
11	11	8	1	1	221,21,2F		
12	12	8	1	1	221,30,2F		
13	13	8	1	1	221,31,2F		
14	14	8	1	1	221,31,2F*		
15	15	12	1	1	210,21,2F		
16	16	18	1	1	100,10,2F		
17	17	5	1	1	211,20,4G		
18	18	5	1	1	211,21,4G		
19	19	5	1	1	211,30,4G		
20	20	9	1	1	111,20,4G		
21	21	8	1	1	221,20,2G		
22	22	8	1	1	221,21,2G		
23	23	8	1	1	221,30,2G		
24	24	8	1	1	221,31,2G		
25	25	12	1	1	210,20,2G		
26	26	12	1	1	210,21,2G		
27	27	0	1	1	110,11,6H		
28	28	5	1	1	211,11,4H		
29	29	5	1	1	211,21,4H		
30	30	5	1	1	211,30,4H		
2	2	1144	1	7		E2	
3	2	156	66	7			
3	3-	1781	1	7			
7	7-	65	1	1			
8	6	20	143	1			
8	7-	72	195	3			
8	8-	76	1	1			
11	11-	1495	1	11			
12	10	5	143	1			
12	11	720	4290	132			
12	12-	19	1	1			
13	11-	936	10	11			
13	12-	72	429	11			
13	13	2210	1	11			
14	10-	15	429	1			
14	11	144	1430	44			
14	12-	147	3	1			
14	13	168	143	11			
14	14-	41	1	1			
15	15	195	1	1			
17	17-	1040	1	7			
18	17-	48	2145	21			
18	18	3267	1	21			

19 17	52	15	1
19 18-	16	143	1
19 19	312	1	3
21 21-	260	1	7
22 21-	240	390	42
22 22	2943	1	21
23 21-	13	15	1
23 22	40	26	1
23 23	26	1	1
24 21	45	1365	7
24 22	2208	14	28
24 23	30	91	1
24 24-	122	1	1
25 25	780	1	7
26 25	24	4290	7
26 26-	1683	1	7
29 28-	10	182	1
29 29	197	1	1
30 28-	30	39	3
30 29-	66	42	3
30 30-	176	1	1
1 1	33	1	1
2 2	22	1	7
3 2	10	66	7
3 3	202	1	7
4 2-	33	7	7
4 3	6	462	7
7 6-	1	165	3
7 7	3	1	1
8 7-	2	195	3
8 8	42	1	1
9 7	9	11	1
11 10	43	30	30
11 11	240	1	11
12 11	29	4290	132
12 12	24	1	1
13 10	4	3	1
13 11-	9	10	11
13 12-	4	429	11
13 13	442	1	11
14 11-	3	1430	44
14 12	6	3	1
14 13-	20	143	11
14 14	12	1	1
15 10	3	330	10
15 11	27	11	11
15 12-	3	390	4
15 13-	27	110	11
15 14-	9	130	4
15 15	6	1	1
16 11	36	5	5
16 13-	36	2	1
16 15-	12	55	5
17 17	8	1	7
18 17	5	2145	21

E3

18 18	11	1	21
19 17	4	15	3
19 18	2	143	3
19 19	22	1	3
20 17-	12	7	7
20 18	1	15015	7
20 19-	4	105	1
21 21-	16	1	7
22 21-	11	390	42
22 22	356	1	21
23 21	8	15	3
23 22-	29	26	12
23 23	37	1	3
24 22	7	14	28
24 23	1	91	1
24 24	41	1	1
25 21-	12	1	7
25 22-	11	390	7
25 23-	8	15	1
25 25	48	1	7
26 21-	3	4290	14
26 22	15	11	7
26 23	3	286	4
26 24	3	154	4
26 25-	1	4290	7
26 26	22	1	7
27 27-	9	1	1
28 28-	4	1	1
29 29	26	1	1
30 28-	5	39	3
30 29	4	42	3
30 30	14	1	1
1 1+	1	1	2
2 2+	1	1	14
3 2+	1	66	21
3 3-	5	1	21
4 1-	3	1	1
4 2-	1	7	14
4 3-	1	462	21
4 4+	1	1	2
5 2-	9	2	14
5 3+	1	33	7
5 4-	3	14	14
5 5-	1	1	2
6 2-	8	6	21
6 3-	1	11	42
6 4-	1	42	21
6 5+	1	3	4
7 3-	1	15	3
7 5+	1	55	4
8 2-	1	858	42
8 3-	1	13	21
8 4+	1	6006	42
9 2-	3	10	7
9 3-	1	165	14

ZETA

9	5-	3	5	4
10	2-	25	2	42
10	3+	5	33	126
10	4+	1	14	42
10	6-	5	3	12
10	7-	1	55	24
10	9-	3	5	20
10	10-	7	1	6
11	3-	1	110	66
11	6+	11	10	48
11	7	1	66	22
11	8-	1	1430	264
11	9-	11	6	16
11	10	11	30	144
11	11+	35	1	44
12	2+	1	286	12
12	3-	1	39	36
12	4-	1	2002	84
12	7-	7	65	48
12	8+	1	3	12
12	11-	31	4290	3168
12	12+	11	1	24
13	2	11	6	42
13	3-	31	11	231
13	4	11	42	42
13	7-	1	165	132
13	8-	1	143	22
13	11-	1	10	264
13	12+	1	429	132
13	13+	85	1	66
14	2-	1	858	84
14	3-	23	13	84
14	4-	1	6006	84
14	7+	1	195	48
14	8-	7	1	4
14	11+	1	1430	1056
14	12	7	3	24
14	13+	7	143	132
14	14-	23	1	24
15	3-	1	10	2
15	6+	1	110	16
15	7-	1	6	2
15	8+	1	130	8
15	9	1	66	16
15	10-	1	330	240
15	11-	5	11	44
15	12+	1	390	96
15	13-	1	110	88
15	14+	1	130	32
15	15-	1	1	4
16	4+	4	21	7
16	9+	1	30	5
16	15	1	55	5
16	16+	1	1	2
17	5+	3	33	28

17 6-	16	11	63
17 7+	1	15	18
17 8+	10	13	63
17 9-	2	165	21
17 10	25	33	252
17 11-	43	110	528
17 12	5	39	36
17 13-	25	11	231
17 14-	5	13	84
17 15-	1	10	16
17 17-	2	1	21
18 5-	3	65	28
18 6-	1	195	126
18 8-	5	165	63
18 9-	5	13	14
18 10-	5	65	168
18 12	5	55	48
18 13	11	195	252
18 14-	47	165	1008
18 17-	1	2145	315
18 18-	292	1	315
19 7-	5	1	3
19 11+	5	66	264
19 13-	13	165	198
19 14-	1	195	9
19 15-	5	6	8
19 17+	4	15	45
19 18+	2	143	45
19 19-	4	1	9
20 5+	.1	231	28
20 6-	2	77	63
20 7-	1	105	18
20 8-	10	91	63
20 10-	1	231	252
20 11	1	770	528
20 12-	5	273	252
20 13-	25	77	231
20 14-	5	91	84
20 15-	1	70	16
20 16-	1	154	7
20 17+	2	7	21
20 18+	1	15015	315
20 19-	4	105	45
20 20-	2	1	3
21 6-	13	385	252
21 7-	1	21	72
21 8-	1	455	126
21 9-	1	231	84
21 10-	2	1155	63
21 11-	23	154	528
21 12+	5	1365	252
21 13+	5	385	231
21 14+	1	455	84
21 15+	1	14	16
21 17+	1	35	84

21 18+	1	3003	504
21 19-	1	21	18
21 20-	1	5	12
21 21-	5	1	42
22 6-	5	6006	1008
22 8-	5	42	504
22 9+	1	10010	112
22 10+	5	2002	336
22 12+	155	14	672
22 13+	1	6006	504
22 14-	47	42	2016
22 17-	43	546	1008
22 18	11	770	630
22 19+	1	910	360
22 20+	1	78	144
22 21+	23	390	1008
22 22-	145	1	252
23 7-	7	35	48
23 11+	31	2310	1056
23 13+	13	231	396
23 14+	1	273	18
23 15-	1	210	32
23 17-	7	21	36
23 18+	7	5005	720
23 19+	1	35	36
23 20+	7	3	36
23 21+	5	15	36
23 22-	31	26	288
23 23-	55	1	72
24 7+	1	65	16
24 11-	1	4290	352
24 13+	1	429	132
24 14	1	3	6
24 15-	3	390	32
24 17+	1	39	12
24 18+	19	55	240
24 19-	7	65	60
24 20+	1	273	12
24 21+	1	1365	84
24 22-	19	14	672
24 23-	1	91	24
24 24+	3	1	8
25 6-	5	385	252
25 7-	1	21	9
25 8+	1	455	126
25 9+	1	231	28
25 10+	4	1155	315
25 11-	17	154	264
25 12-	11	1365	252
25 13+	5	385	231
25 14+	1	455	84
25 15-	1	14	8
25 16+	1	770	35
25 17-	13	35	84
25 18+	1	3003	63

25 19+	1	21	18
25 20+	1	5	12
25 21+	10	1	21
25 22+	17	390	504
25 23-	11	15	36
25 24+	1	1365	84
25 25-	5	1	42
26 6-	5	546	336
26 8+	5	462	168
26 9-	1	910	112
26 10-	1	182	112
26 12-	5	154	224
26 13+	11	546	168
26 14-	47	462	672
26 16+	1	273	7
26 17-	1	6006	336
26 18-	19	70	210
26 19-	1	10010	120
26 20-	1	858	48
26 21-	1	4290	336
26 22	13	11	84
26 23+	1	286	96
26 24-	19	154	224
26 25+	1	4290	168
26 26+	1	1	28
27 19+	3	14	5
27 20+	2	30	5
27 27-	23	1	10
28 17+	7	10	18
28 19-	7	6	45
28 20+	1	70	90
28 21+	5	14	18
28 23-	1	210	9
28 25-	5	14	18
28 27-	1	21	10
28 28-	1	1	5
29 17+	1	455	90
29 18-	1	231	15
29 19+	1	273	45
29 20-	7	65	90
29 21+	1	13	18
29 22+	1	30	30
29 23-	7	195	180
29 24+	1	105	20
29 25+	4	13	9
29 26+	1	330	10
29 29-	1	1	5
30 17+	1	390	90
30 18	4	22	15
30 20-	1	2730	90
30 21+	1	546	126
30 22-	4	35	105
30 24-	1	10	5
30 25-	1	546	126
30 26	4	385	35

30 27-	1	91	10
30 28-	1	39	15
30 29+	2	42	15
30 30-	1	1	1

J = 9/2 ENERGY MATRIX OF F5

29 RANK OF MATRIX					
1	1	0	1	1	110,10,6F
2	2	5	1	1	211,10,4F
3	3	5	1	1	211,21,4F
4	4	5	1	1	211,30,4F
5	5	9	1	1	111,10,4F
6	6	5	1	1	211,20,4G
7	7	5	1	1	211,21,4G
8	8	5	1	1	211,30,4G
9	9	9	1	1	111,20,4G
10	10	8	1	1	221,20,2G
11	11	8	1	1	221,21,2G
12	12	8	1	1	221,30,2G
13	13	8	1	1	221,31,2G
14	14	12	1	1	210,20,2G
15	15	12	1	1	210,21,2G
16	16	0	1	1	110,11,6H
17	17	5	1	1	211,11,4H
18	18	5	1	1	211,21,4H
19	19	5	1	1	211,30,4H
20	20	8	1	1	221,11,2H
21	21	8	1	1	221,21,2H
22	22	8	1	1	221,30,2H
23	23	8	1	1	221,31,2H
24	24	8	1	1	221,31,2H*
25	25	12	1	1	210,11,2H
26	26	12	1	1	210,21,2H
27	27	5	1	1	211,20,4I
28	28	5	1	1	211,30,4I
29	29	9	1	1	111,20,4I
3	3-	65	.1	1	
4	2	20	143	1	
4	3-	72	195	3	
4	4-	76	1	1	
6	6-	1040	1	7	
7	6-	48	2145	21	
7	7	3267	1	21	
8	6	156	15	3	
8	7-	48	143	3	
8	8	312	1	3	
10	10-	260	1	7	
11	10-	240	390	42	
11	11	2943	1	21	
12	10-	39	15	3	
12	11	480	26	12	
12	12	26	1	1	
13	10	45	1365	7	
13	11	2208	14	28	
13	12	30	91	1	
13	13-	122	1	1	
14	14	780	1	7	
14	13	24	4290	7	
15	15-	1683	1	7	
18	17-	10	182	1	

E2

18 18	197	1	1
19 17-	30	39	3
19 18-	66	42	3
19 19-	176	1	1
21 20	14	10010	11
21 21-	977	1	11
22 20	2	390	1
22 21	10	231	1
22 22-	44	1	1
23 20	2	3315	1
23 21	31	7854	11
23 22-	30	34	1
23 23-	92	1	1
24 20-	600	3003	132
24 21	103	30	11
24 22-	528	770	88
24 23-	192	6545	88
24 24	10720	1	88
26 26	21	1	1
27 27	40	1	1
28 27-	120	3	1
28 28-	50	1	1
29 29	0	1	1
3 2-	1	165	3
3 3	3	1	1
4 3-	2	195	3
4 4	42	1	1
5 3	9	11	1
6 6	8	1	7
7 6	5	2145	21
7 7	11	1	21
8 6	4	15	3
8 7	2	143	3
8 8	22	1	3
9 6-	12	7	7
9 7	1	15015	7
9 8-	4	105	1
10 10-	16	1	7
11 10-	11	390	42
11 11	356	1	21
12 10	8	15	3
12 11-	29	26	12
12 12	37	1	3
13 11	7	14	28
13 12	1	91	1
13 13	41	1	1
14 10-	12	1	7
14 11-	11	390	7
14 12-	8	15	1
14 14	48	1	7
15 10-	3	4290	14
15 11	15	11	7
15 12	3	286	4
15 13	3	154	4
15 14-	1	4290	7

E3

15 15	22	1	7
16 16-	9	1	1
17 17-	4	1	1
18 18	26	1	1
19 17-	5	39	3
19 18	4	42	3
19 19	14	1	1
20 20-	11	1	2
21 21-	59	1	11
22 20-	5	390	12
22 21-	29	231	33
22 22	41	1	4
23 20-	1	3315	12
23 21-	1	7845	66
23 22	1	34	8
23 23	13	1	8
24 20-	11	3003	132
24 21-	37	30	66
24 22	31	770	88
24 23-	5	6545	88
24 24	2199	1	88
25 20	9	2	2
25 22	3	195	2
25 23-	1	6630	4
25 24-	1	6006	4
25 25-	6	1	1
26 21-	45	11	11
26 22	3	21	1
26 23-	1	714	2
26 24-	37	330	22
26 26	21	1	1
27 27-	2	1	1
28 27	2	3	1
28 28-	11	1	1
29 27	3	7	1
29 28-	6	21	1
29 29	0	1	1
1 1	2	1	5
2 1	1	66	20
2 2-	23	1	20
3 1	11	10	20
3 2-	1	165	120
3 3	3	1	2
4 3	1	195	12
4 4	1	1	2
5 1-	3	110	20
5 2	3	15	20
5 3-	3	11	8
5 5	3	1	4
6 1	3	2310	140
6 2-	44	35	315
6 3	1	231	72
6 4	1	5005	126
6 5-	11	21	42
6 6	1	1	84

ZETA

7	1-	3	182	28
7	2-	1	3003	504
7	4-	55	21	252
7	5-	1	5005	56
7	6	1	2145	2520
7	7	73	1	630
8	3-	1	385	12
8	6-	1	15	90
8	7-	1	143	180
8	8	1	1	18
9	1	1	330	20
9	2-	11	5	90
9	3-	7	33	72
9	4-	1	715	18
9	6-	1	7	84
9	7-	1	15015	2520
9	8	1	105	90
9	9	1	1	12
10	2-	13	385	126
10	3-	1	21	36
10	4-	1	455	63
10	5-	1	231	42
10	6	1	11	42
10	7	11	195	1260
10	8-	1	165	45
10	9-	1	77	42
10	10	2	1	21
11	2-	5	6006	504
11	4-	5	42	252
11	5	1	10010	56
11	6-	43	4290	2520
11	7	121	2	315
11	8	1	286	180
11	9	1	30030	2520
11	10-	23	390	1260
11	11	29	1	63
12	3-	7	35	24
12	6-	7	165	90
12	7	77	13	360
12	8	1	11	18
12	9	1	1155	90
12	10-	1	15	9
12	11	31	26	360
12	12	11	1	18
13	3	1	65	8
13	6	1	15015	210
13	7	209	7	840
13	8-	1	1001	30
13	9	1	2145	30
13	10-	1	1365	105
13	11	19	14	840
13	12	1	91	30
13	13-	3	1	10
14	2-	5	385	126
14	3-	2	21	9

14 4	1	455	63
14 5	1	231	14
14 6-	13	11	42
14 7	22	195	315
14 8	1	165	45
14 9	1	77	42
14 10-	8	1	21
14 11-	17	390	630
14 12	11	15	45
14 13-	1	1365	105
14 14	2	1	21
15 2-	5	546	168
15 4	5	462	84
15 5-	1	910	56
15 6-	11	390	840
15 7-	19	22	105
15 8-	11	26	60
15 9-	11	2730	840
15 10	1	4290	420
15 11-	13	11	105
15 12-	1	286	120
15 13	19	154	280
15 14-	1	4290	210
15 15-	1	1	35
16 8	3	1001	55
16 9	2	2145	55
16 16-	7	1	5
17 6	8	385	99
17 8-	16	231	495
17 9	8	55	495
17 10	1	35	9
17 12-	2	21	9
17 14-	1	35	9
17 16-	1	39	10
17 17-	1	1	10
18 6	4	1430	495
18 7-	8	6	15
18 8	8	858	495
18 9-	4	10010	495
18 10	1	130	90
18 11	1	3	15
18 12-	7	78	180
18 13	1	42	20
18 14	4	130	45
18 15	1	33	5
18 18-	1	1	10
19 6	8	15015	3465
19 7	64	7	105
19 9-	8	2145	495
19 10	1	1365	315
19 11-	4	14	105
19 13-	2	1	5
19 14-	1	1365	315
19 15	4	154	35
19 16-	13	1	10

19 17-	1	39	30
19 18	1	42	15
19 19-	1	1	2
20 6	1	231	99
20 8	2	385	165
20 9-	1	33	99
20 10	7	21	18
20 12-	1	35	15
20 14-	1	21	18
20 17	1	15	3
20 19	1	65	30
20 20	7	1	6
21 6	43	390	990
21 7-	1	22	55
21 8	1	26	165
21 9-	1	2730	990
21 10-	23	4290	1980
21 11-	65	11	110
21 12-	31	286	1320
21 13	3	154	440
21 14-	17	4290	990
21 15	3	1	10
21 18	2	33	15
21 19	1	154	165
21 21	7	1	6
22 6-	1	10010	330
22 7	2	42	15
22 9	1	1430	330
22 10	1	910	84
22 11-	31	21	105
22 13	1	6	10
22 14-	11	910	420
22 15	1	231	35
22 17	1	26	6
22 18	7	7	30
22 19	1	6	12
22 20-	1	390	90
22 21-	31	231	990
22 22-	11	1	12
23 6	1	85085	2310
23 7-	2	357	315
23 8	2	51051	495
23 9	1	12155	330
23 10	1	7735	420
23 11	1	714	630
23 12	1	4641	90
23 13-	4	51	15
23 14	1	7735	420
23 15	1	7854	210
23 18	1	238	20
23 19-	13	51	60
23 21-	1	7854	660
23 22-	13	34	120
23 23-	59	1	120
24 6	7	13	66

24 7-	14	165	495
24 8-	2	195	99
24 9	7	91	66
24 10	7	143	132
24 11	7	330	990
24 12-	1	2145	198
24 13-	1	1155	165
24 14	7	143	132
24 15	7	30	30
24 18-	1	110	20
24 19	1	1155	132
24 21	1	30	60
24 22+	1	770	264
24 23-	13	6545	1320
24 24-	23	1	24
25 6	1	462	33
25 8	1	770	55
25 9	1	66	33
25 10	1	42	6
25 12	1	70	5
25 14	1	42	6
25 17-	1	30	4
25 19	1	130	20
25 20-	1	2	2
25 22	1	195	15
26 6	1	4290	330
26 7-	3	2	5
26 8-	1	286	55
26 9	1	30030	330
26 10	1	390	60
26 11	3	1	10
26 12	1	26	40
26 13	9	14	40
26 14-	1	390	30
26 15	3	11	10
26 18	2	3	5
26 19-	1	14	5
26 21	1	11	10
26 22	1	21	30
26 23-	1	714	20
26 24	1	330	20
26 26-	9	1	10
27 17	1	15015	132
27 18-	1	330	66
27 19	1	385	44
27 20-	1	1001	132
27 21	43	10	66
27 22	7	2310	264
27 23-	1	19635	264
27 24	19	3	264
27 25-	1	2002	44
27 26	1	110	22
27 27-	1	1	4
28 16-	1	1155	55
28 17-	1	5005	165

28 18-	2	110	33
28 20-	1	3003	99
28 21	2	30	99
28 23-	1	6545	66
28 24-	107	1	66
28 25-	1	6006	66
28 26-	2	330	33
28 27	1	3	6
28 28-	7	1	6
29 16-	3	55	55
29 17	1	2145	660
29 18	1	2310	66
29 19-	7	55	44
29 20	1	143	132
29 21-	1	70	66
29 22-	7	330	264
29 23-	7	2805	264
29 24	19	21	264
29 25-	1	286	44
29 26	1	770	22
29 27	1	7	4
29 28-	1	21	6
29 29-	7	1	4

J = 11/2 ENERGY MATRIX OF F5

26		RANK OF MATRIX				
1	1	0	1	1	110,10,6F	E1
2	2	5	1	1	211,20,4G	
3	3	5	1	1	211,21,4G	
4	4	5	1	1	211,30,4G	
5	5	9	1	1	111,20,4G	
6	6	0	1	1	110,11,6H	
7	7	5	1	1	211,11,4H	
8	8	5	1	1	211,21,4H	
9	9	5	1	1	211,30,4H	
10	10	8	1	1	221,11,2H	
11	11	8	1	1	221,21,2H	
12	12	8	1	1	221,30,2H	
13	13	8	1	1	221,31,2H	
14	14	8	1	1	221,31,2H*	
15	15	12	1	1	210,11,2H	
16	16	12	1	1	210,21,2H	
17	17	5	1	1	211,20,4I	
18	18	5	1	1	211,30,4I	
19	19	9	1	1	111,20,4I	
20	20	8	1	1	221,20,2I	
21	21	8	1	1	221,30,2I	
22	22	8	1	1	221,31,2I	
23	23	8	1	1	221,31,2I*	
24	24	12	1	1	210,20,2I	
25	25	5	1	1	211,21,4K	
26	26	5	1	1	211,30,4K	
2	2-	1040	1	7		E2
3	2-	48	2145	21		
3	3	3267	1	21		
4	2	156	15	3		
4	3-	16	143	1		
4	4	312	1	3		
8	7-	10	182	1		
8	8	197	1	1		
9	7-	30	39	3		
9	8-	22	42	1		
9	9-	176	1	1		
11	10	14	10010	11		
11	11-	977	1	11		
12	10	2	390	1		
12	11	10	231	1		
12	12-	44	1	1		
13	10	2	3315	1		
13	11	31	7854	11		
13	12-	240	34	8		
13	13-	92	1	1		
14	10-	600	3003	132		
14	11	103	30	11		
14	12-	528	770	88		
14	13-	192	6545	88		
14	14	10720	1	88		
16	16	21	1	1		
17	17	40	1	1		

18	17-	120	3	1
18	18-	50	1	1
20	20	10	1	1
21	20	30	3	1
21	21-	25	1	2
22	20	270	1	1
22	21-	171	3	2
22	22-	1151	1	10
23	21	27	102	1
23	22-	153	34	5
23	23	788	1	5
24	24-	30	1	1
25	25-	219	1	1
26	25	8	17	1
26	26	188	1	1
2	2	8	1	7
3	2	5	2145	21
3	3	11	1	21
4	2	4	15	3
4	3	2	143	3
4	4	22	1	3
5	2-	12	7	7
5	3	1	15015	7
5	4-	4	105	1
6	6-	9	1	1
7	7-	4	1	1
8	8	26	1	1
9	7-	5	39	3
9	8	4	42	3
9	9	14	1	1
10	10-	11	1	2
11	11-	59	1	11
12	10-	5	390	12
12	11	29	231	33
12	12	41	1	4
13	10-	1	3315	12
13	11-	1	7854	66
13	12	1	34	8
13	13	13	1	8
14	10-	11	3003	132
14	11-	37	30	66
14	12	31	770	88
14	13-	5	6545	88
14	14	2199	1	88
15	10	9	2	2
15	12	3	195	2
15	13-	1	6630	4
15	14-	1	6006	4
15	15-	6	1	1
16	11-	45	11	11
16	12	3	21	1
16	13-	1	714	2
16	14-	37	330	22
16	16	21	1	1
17	17-	2	1	1

E3

18	17	2	3	1
18	18-	11	1	1
19	17	3	7	1
19	18-	6	21	1
20	20	4	1	1
21	20	4	3	1
21	21-	1	1	2
22	21	15	3	2
22	22-	11	1	10
23	22	12	34	5
23	23	53	1	5
24	20	3	1	1
24	21-	12	3	1
24	24-	12	1	1
25	25-	13	1	3
26	25	8	17	3
26	26	16	1	3
1	1+	3	1	2
2	1+	1	462	14
2	2+	1	1	7
3	1-	1	910	14
3	2+	1	2145	210
3	3+	146	1	105
4	2-	2	15	15
4	3-	1	143	15
4	4+	2	1	3
5	1+	1	66	6
5	2-	1	7	7
5	3-	1	15015	210
5	4+	2	105	15
5	5+	1	1	1
6	4+	7	286	110
6	5+	1	30030	165
6	6-	3	1	10
7	2+	1	10010	66
7	4-	1	6006	165
7	5+	1	1430	330
7	6-	3	21	20
7	7+	1	1	45
8	2+	13	55	330
8	3-	1	39	5
8	4+	13	33	165
8	5-	13	385	330
8	8+	1	1	45
9	2+	13	2310	2310
9	3	4	182	35
9	5-	13	330	330
9	6-	3	91	20
9	7+	1	39	135
9	8-	2	42	135
9	9+	1	1	9
10	2+	1	385	66
10	4+	1	231	33
10	5-	1	55	66
10	7+	5	26	18

ZETA

10	9+	13	6	108
10	10-	35	1	36
11	2+	43	26	132
11	3-	1	330	110
11	4+	1	390	330
11	5-	1	182	132
11	8+	1	1430	45
11	9+	1	15015	1485
11	11-	35	1	36
12	2-	1	6006	132
12	3	1	70	5
12	5+	1	858	132
12	7+	13	15	54
12	8+	7	2730	540
12	9+	1	65	36
12	10+	1	390	108
12	11+	31	231	1188
12	12+	55	1	72
13	2+	1	51051	924
13	3-	1	595	105
13	4+	1	85085	165
13	5+	1	7293	132
13	8+	1	23205	180
13	9-	13	2210	360
13	11+	1	7854	792
13	12+	13	34	144
13	13+	59	1	144
14	2+	7	195	132
14	3-	7	11	33
14	4-	5	13	33
14	5+	7	1365	132
14	8-	1	429	36
14	9+	5	2002	792
14	11-	1	30	72
14	12-	5	770	1584
14	13	13	6545	1584
14	14+	115	1	144
15	2+	1	770	22
15	4+	1	462	22
15	5+	1	110	22
15	7-	5	13	12
15	9+	13	3	36
15	10+	5	2	12
15	12-	1	195	18
16	2+	1	286	44
16	3-	3	30	10
16	4-	1	4290	110
16	5+	1	2002	44
16	8+	1	130	15
16	9-	1	1365	45
16	11-	1	11	12
16	12-	1	21	36
16	13+	1	714	24
16	14-	1	330	24
16	16+	3	1	4

17 7+	35	11	99
17 8-	10	2002	1287
17 9+	35	429	1287
17 10-	7	286	792
17 11+	43	35	198
17 12+	49	165	792
17 13-	7	5610	1584
17 14+	19	42	1584
17 15-	7	143	132
17 16+	1	385	66
17 17-	5	1	42
18 6-	3	77	22
18 7-	28	33	297
18 8-	40	6006	3861
18 10-	7	858	594
18 11+	2	105	297
18 13-	7	1870	396
18 14-	107	14	396
18 15-	7	429	198
18 16-	2	1155	99
18 17+	5	3	63
18 18-	5	1	9
19 6-	3	33	22
19 7+	1	77	99
19 8+	70	286	1287
19 9-	35	3003	1287
19 10+	1	2002	792
19 11-	7	5	198
19 12-	7	1155	792
19 13-	7	39270	1584
19 14+	133	6	1584
19 15-	1	1001	132
19 16	7	55	66
19 17+	5	7	42
19 18-	5	21	63
19 19-	5	1	6
20 7-	5	7	36
20 8+	5	26	234
20 9-	5	273	468
20 10+	7	182	72
20 11+	23	55	198
20 12+	5	105	72
20 13+	1	3570	144
20 14-	19	66	1584
20 15+	1	91	12
20 16-	1	5	6
20 17+	1	77	84
20 18-	1	231	126
20 19-	1	11	12
20 20-	1	1	6
21 7+	5	21	27
21 8-	35	78	702
21 10-	1	546	54
21 11	31	165	594
21 13	1	1190	72

21 14+	107	22	792
21 15+	1	273	9
21 16-	1	15	18
21 17-	1	231	36
21 18+	1	77	36
21 19+	1	33	36
21 20+	5	3	36
21 21-	77	1	72
22 8+	5	455	546
22 9+	5	390	234
22 11-	5	154	924
22 12+	5	6	36
22 13-	5	51	18
22 14-	4	1155	693
22 16-	5	14	28
22 17-	1	110	21
22 18+	17	330	252
22 19-	1	770	21
22 20-	1	70	21
22 21+	17	210	504
22 22-	5	1	12
23 8-	1	15470	273
23 9-	2	3315	117
23 11+	1	1309	231
23 12-	1	51	9
23 13-	11	6	72
23 14+	59	39270	5544
23 16+	1	119	7
23 17-	1	935	84
23 18-	1	2805	252
23 19-	1	6545	84
23 20-	1	595	84
23 21-	1	1785	504
23 22-	5	34	24
23 23-	7	1	24
24 7+	5	7	36
24 8+	20	26	117
24 9+	5	273	468
24 10-	1	182	72
24 11+	34	55	198
24 12-	11	105	72
24 13+	1	3570	144
24 14-	19	66	1584
24 15+	1	91	12
24 16+	1	5	3
24 17-	13	77	84
24 18+	1	231	126
24 19+	1	11	12
24 20+	2	1	3
24 21-	11	3	36
24 22-	1	70	21
24 23-	1	595	84
24 24-	1	1	6
25 17-	1	4290	273
25 18+	3	1430	91

25 19+	1	30030	273
25 20-	1	2730	273
25 21-	3	910	52
25 22+	29	39	182
25 23-	5	1326	364
25 24-	8	2730	273
25 25-	29	1	21
26 17+	1	72930	546
26 19-	1	510510	546
26 20+	1	46410	546
26 22+	1	663	91
26 23-	25	78	91
26 24-	1	46410	546
26 25+	4	17	21
26 26-	4	1	3

J = 13/2 ENERGY MATRIX OF F5

20 RANK OF MATRIX							
1	1	0	1	1	110,11,6H		E1
2	2	5	1	1	211,11,4H		
3	3	5	1	1	211,21,4H		
4	4	5	1	1	211,30,4H		
5	5	5	1	1	211,20,4I		
6	6	5	1	1	211,30,4I		
7	7	9	1	1	111,20,4I		
8	8	8	1	1	221,20,2I		
9	9	8	1	1	221,30,2I		
10	10	8	1	1	221,31,2I		
11	11	8	1	1	221,31,2I*		
12	12	12	1	1	210,20,2I		
13	13	5	1	1	211,21,4K		
14	14	5	1	1	211,30,4K		
15	15	8	1	1	221,21,2K		
16	16	8	1	1	221,30,2K		
17	17	8	1	1	221,31,2K		
18	18	8	1	1	221,31,2K*		
19	19	12	1	1	210,21,2K		
20	20	5	1	1	211,21,4L		
3	2-	10	182	1			E2
3	3	197	1	1			
4	2-	30	39	3			
4	3-	22	42	1			
4	4-	176	1	1			
5	5	40	1	1			
6	5-	120	3	1			
6	6-	50	1	1			
8	8	10	1	1			
9	8	30	3	1			
9	9-	25	1	2			
10	8	270	1	1			
10	9-	171	3	2			
10	10-	1151	1	10			
11	9	27	102	1			
11	10-	153	34	5			
11	11	788	1	5			
12	12-	30	1	1			
13	13-	219	1	1			
14	13	8	17	1			
14	14	188	1	1			
15	15	6273	1	33			
16	15-	20	374	11			
16	16	47	1	1			
17	15-	156	14858	253			
17	16-	741	4807	253			
17	17	61753	1	253			
18	15-	2016	759	253			
18	16	216	2346	46			
18	17	72	21318	253			
18	18-	3868	1	23			
19	19-	135	1	1			
20	20	85	1	1			

1	1-	9	1	1
2	2-	4	1	1
3	3	26	1	1
4	2-	5	39	3
4	3	4	42	3
4	4	14	1	1
5	5-	2	1	1
6	5	2	3	1
6	6-	11	1	1
7	5	3	7	1
7	6-	6	21	1
8	8	4	1	1
9	8	4	3	1
9	9-	1	1	2
10	9	15	3	2
10	10-	11	1	10
11	10	12	34	5
11	11	53	1	5
12	8	3	1	1
12	9-	12	3	1
12	12-	12	1	1
13	13-	13	1	3
14	13	8	17	3
14	14	16	1	3
15	15-	281	1	33
16	15-	29	374	33
16	16-	5	1	3
17	15-	7	14858	253
17	16	23	4807	253
17	17	2675	1	253
18	15	21	759	253
18	17	24	21318	253
18	18-	32	1	23
19	15-	6	11	11
19	16	3	34	1
19	17-	21	16348	253
19	18	63	69	23
19	19-	5	1	1
20	20-	23	1	1
1	1	1	1	1
2	1-	1	6	4
2	2	1	1	6
3	3	1	1	6
4	1-	1	26	4
4	2	1	39	18
4	3-	1	42	9
4	4	5	1	6
5	2	5	7	12
5	3-	5	26	78
5	4	5	273	156
5	5	1	1	28
6	1-	1	14	2
6	2-	1	21	9
6	3-	10	78	117
6	5-	1	3	42

ZETA

6	6	1	1	6
7	1-	1	6	2
7	2	1	1	12
7	3	5	182	78
7	4-	35	39	156
7	5-	1	7	28
7	6	1	21	42
7	7	1	1	4
8	2-	1	70	12
8	3	1	65	39
8	4-	1	2730	156
8	5	1	10	28
8	6-	1	30	42
8	7-	1	70	28
8	8	1	1	7
9	2	1	210	9
9	3-	7	195	117
9	5-	1	30	12
9	6	1	10	12
9	7	1	210	84
9	8-	5	3	42
9	9	11	1	12
10	3	5	182	182
10	4	5	39	39
10	5-	10	7	49
10	6	85	21	294
10	7-	10	1	7
10	8	2	70	49
10	9-	17	210	588
10	10	5	1	14
11	3-	2	1547	91
11	4-	2	1326	39
11	5-	5	238	196
11	6-	5	714	588
11	7-	5	34	28
11	8	1	595	98
11	9	1	1785	588
11	10	5	34	28
11	11	1	1	4
12	2	1	70	12
12	3	8	65	39
12	4	1	2730	156
12	5-	13	10	28
12	6	1	30	42
12	7	1	70	28
12	8-	4	1	7
12	9	11	3	42
12	10	2	70	49
12	11	1	595	98
12	12	1	1	7
13	5-	16	26	273
13	6	16	78	91
13	7	16	182	273
13	8-	4	65	273
13	9-	1	195	13

13 10	29	182	637
13 11-	5	1547	637
13 12-	32	65	273
13 13-	319	1	504
14 5	8	442	273
14 7-	8	3094	273
14 8	2	1105	273
14 10	2	3094	637
14 11-	100	91	637
14 12-	2	1105	273
14 13	11	17	126
14 14-	11	1	18
15 5-	43	22	231
15 6	1	66	77
15 7	1	154	231
15 8	23	55	231
15 9-	31	165	308
15 10	29	154	2156
15 11-	5	1309	2156
15 12	34	55	231
15 13	223	143	2772
15 14	1	2431	693
15 15	635	1	1386
16 5-	1	17	6
16 7	1	119	42
16 8	5	170	84
16 10-	1	119	98
16 11	25	14	98
16 12-	11	170	84
16 13	1	442	36
16 14	1	26	18
16 15-	31	374	1386
16 16-	11	1	9
17 5	67	1463	7546
17 6-	4	4389	3773
17 7	67	209	1078
17 8	67	14630	15092
17 9-	1	43890	3773
17 10	9	209	1078
17 11-	15	7106	1078
17 12	67	14630	15092
17 13	47	38038	15092
17 14-	9	646646	7546
17 15-	47	266	7546
17 16-	9	24871	3773
17 17-	2113	1	3773
18 5	2	714	343
18 6	30	238	343
18 7	2	102	49
18 8	2	1785	343
18 9	15	595	343
18 10	1	102	49
18 11	25	3	49
18 12	2	1785	343
18 13-	19	4641	4116

18 14-	53	273	1029
18 15	19	3927	22638
18 16-	53	42	1029
18 17-	25	21318	3773
18 18	54	1	343
19 5-	1	2	7
19 6-	3	6	7
19 7-	1	14	7
19 8-	1	5	7
19 9	3	15	28
19 10	87	14	196
19 11-	15	119	196
19 12	2	5	7
19 13-	1	13	84
19 14-	1	221	21
19 15	85	11	462
19 16	1	34	42
19 17-	141	2926	7546
19 18	19	357	686
19 19-	9	1	14
20 13-	1	663	24
20 14	1	39	6
20 15	1	561	132
20 16-	7	6	12
20 17	3	149226	2156
20 18-	79	7	196
20 19	1	51	4
20 20-	15	1	8

J = 15/2 ENERGY MATRIX OF F5

RANK OF MATRIX						
1	1	0	1	1	110,11,6H	E1
2	2	5	1	1	211,20,4I	
3	3	5	1	1	211,30,4I	
4	4	9	1	1	111,20,4I	
5	5	5	1	1	211,21,4K	
6	6	5	1	1	211,30,4K	
7	7	8	1	1	221,21,2K	
8	8	8	1	1	221,30,2K	
9	9	8	1	1	221,31,2K	
10	10	8	1	1	221,31,2K*	
11	11	12	1	1	210,21,2K	
12	12	5	1	1	211,21,4L	
13	13	8	1	1	221,21,2L	
14	14	8	1	1	221,31,2L	
15	15	12	1	1	210,21,2L	
16	16	5	1	1	211,30,4M	
2	2	40	1	1		E2
3	2-	120	3	1		
3	3-	50	1	1		
5	5-	219	1	1		
6	5	8	17	1		
6	6	188	1	1		
7	7	6273	1	33		
8	7-	60	374	33		
8	8	47	1	1		
9	7-	156	14858	253		
9	8-	741	4807	253		
9	9	61753	1	253		
10	7-	2016	759	253		
10	8	216	2346	46		
10	9	72	21318	253		
10	10-	3868	1	23		
11	11-	135	1	1		
12	12	85	1	1		
13	13-	1285	1	11		
14	13-	144	95	11		
14	14-	2356	1	11		
15	15	105	1	1		
16	16-	50	1	1		
1	1-	9	1	1		E3
2	2-	2	1	1		
3	2	2	3	1		
3	3-	11	1	1		
4	2	3	7	1		
4	3-	6	21	1		
5	5-	13	1	3		
6	5	8	17	3		
6	6	16	1	3		
7	7-	281	1	33		
8	7-	29	374	33		
8	8-	5	1	3		
9	7-	7	14858	253		
9	8	23	4807	253		

9	9	2675	1	253
10	7	21	759	253
10	9	24	21318	253
10	10-	32	1	23
11	7-	6	11	11
11	8	3	34	1
11	9-	21	16348	253
11	10	63	69	23
11	11-	5	1	1
12	12-	23	1	1
13	13-	115	1	11
14	13-	3	95	11
14	14-	160	1	11
15	13	18	11	11
15	14-	9	1045	11
15	15-	21	1	1
16	16-	23	1	1
1	1	5	1	2
2	2	3	1	14
3	1-	1	7	1
3	2-	1	3	7
3	3	1	1	1
4	1-	1	3	1
4	2-	3	7	14
4	3	1	21	7
4	4	3	1	2
5	2-	1	34	21
5	3	1	102	7
5	4	1	238	21
5	5	29	1	126
6	2	17	2	42
6	4-	17	14	42
6	5-	2	17	63
6	6	2	1	9
7	2-	43	77	231
7	3	1	231	77
7	4	1	11	33
7	5	223	2618	11088
7	6	17	154	2772
7	7-	635	1	1584
8	2-	1	238	12
8	4	1	34	12
8	5	17	7	72
8	6	1	119	36
8	7	31	374	1584
8	8	77	1	72
9	2	67	418	2156
9	3-	2	1254	539
9	4	67	2926	2156
9	5	47	3553	4312
9	6-	153	209	2156
9	7	47	266	8624
9	8	9	24871	4312
9	9	2113	1	4312
10	2	2	51	49

ZETA

10	3	30	17	49
10	4	2	357	49
10	5-	323	6	2352
10	6-	53	102	588
10	7-	19	3927	25872
10	8	53	42	1176
10	9	25	21318	4312
10	10-	27	1	196
11	2-	1	7	7
11	3-	3	21	7
11	4-	1	1	1
11	5-	1	238	336
11	6-	17	14	84
11	7-	85	11	528
11	8-	1	34	48
11	9	141	2926	8624
11	10-	19	357	784
11	11	9	1	16
12	5-	1	7	2
12	6	2	119	17
12	7	1	374	176
12	8-	7	1	8
12	9	9	24871	4312
12	10-	79	42	784
12	11	3	34	16
12	12-	5	1	6
13	5-	1	2310	528
13	6	1	39270	2244
13	7-	65	255	528
13	8-	31	330	528
13	9	3	67830	8624
13	10-	79	385	8624
13	11	1	2805	176
13	12	31	330	528
13	13	35	1	176
14	5-	1	8778	176
14	6	1	149226	748
14	7	1	969	176
14	8	1	1254	88
14	9-	261	714	4312
14	10-	117	1463	2156
14	11	3	10659	176
14	12	5	1254	528
14	13-	1	95	176
14	14	5	1	44
15	5-	1	210	16
15	6-	1	3570	68
15	7	1	2805	176
15	8	1	30	16
15	9	9	746130	8624
15	10-	237	35	784
15	11	1	255	16
15	12-	1	30	16
15	13	39	11	176
15	14-	3	1045	176

15 15-	9	1	16
16 12	1	3230	51
16 13-	1	10659	561
16 14	26	2805	561
16 15	1	969	17
16 16-	5	1	3

J = 17/2 ENERGY MATRIX OF F5

9 RANK OF MATRIX

1	1	5	1	1	211,21,4K	E1
2	2	5	1	1	211,30,4K	
3	3	5	1	1	211,21,4L	
4	4	8	1	1	221,21,2L	
5	5	8	1	1	221,31,2L	
6	6	12	1	1	210,21,2L	
7	7	5	1	1	211,30,4M	
8	8	8	1	1	221,30,2M	
9	9	8	1	1	221,31,2M	
1	1-	219	1	1		E2
2	1	8	17	1		
2	2	188	1	1		
3	3	85	1	1		
4	4-	1285	1	11		
5	4-	144	95	11		
5	5-	2356	1	11		
6	6	105	1	1		
7	7-	50	1	1		
8	8-	25	1	2		
9	8-	63	35	2		
9	9-	43	1	2		
1	1-	13	1	3		E3
2	1	8	17	3		
2	2	16	1	3		
3	3-	23	1	1		
4	4-	115	1	11		
5	4-	3	95	11		
5	5-	160	1	11		
6	4	18	11	11		
6	5-	9	1045	11		
6	6-	21	1	1		
7	7-	23	1	1		
8	8-	43	1	2		
9	8-	3	35	2		
9	9	11	1	2		
1	1	29	1	24		ZETA
2	1-	1	17	6		
2	2	7	1	6		
3	1-	1	95	8		
3	2	1	1615	34		
3	3	25	1	72		
4	1-	1	55	44		
4	2	1	935	187		
4	3	31	209	396		
4	4-	35	1	198		
5	1-	3	209	44		
5	2	3	3553	187		
5	3	19	55	396		
5	4	1	95	198		
5	5-	10	1	99		
6	1-	3	5	4		
6	2-	3	85	17		
6	3-	1	19	12		

6	4-	13	11	66
6	5	1	1045	66
6	6	1	1	2
7	3	16	170	153
7	4-	1	35530	1683
7	5	130	374	1683
7	6	1	3230	51
7	7-	13	1	18
8	3	7	1	9
8	4-	31	209	396
8	5-	13	55	99
8	6	1	19	12
8	7	1	170	36
8	8-	55	1	36
9	3	1	35	9
9	4-	1	7315	396
9	5	5	77	99
9	6-	1	665	12
9	7-	1	238	36
9	8-	1	35	36
9	9	11	1	36

J = 19/2 ENERGY MATRIX OF F5

5 RANK OF MATRIX

1	1	5	1	1	211,21,4L	E1
2	2	5	1	1	211,30,4M	
3	3	8	1	1	221,30,2M	
4	4	8	1	1	221,31,2M	
5	5	8	1	1	221,31,2N	
1	1	85	1	1		E2
2	2-	50	1	1		
3	3-	25	1	2		
4	3-	63	35	2		
4	4-	43	1	2		
5	5	76	1	1		
1	1-	23	1	1		E3
2	2-	23	1	1		
3	3-	43	1	2		
4	3-	3	35	2		
4	4	11	1	2		
5	5-	37	1	1		
1	1	5	1	3		ZETA
2	1	1	14	3		
2	2	1	1	3		
3	1	7	6	12		
3	2	1	21	12		
3	3	11	1	8		
4	1	1	210	12		
4	2-	7	15	60		
4	3	1	35	40		
4	4-	11	1	40		
5	2-	1	165	10		
5	3-	1	385	20		
5	4-	9	11	20		
5	5-	3	1	5		

J = 21/2 ENERGY MATRIX OF F5

3 RANK OF MATRIX

1	1	5	1	1
2	2	8	1	1
3	3	8	1	1
1	1-	50	1	1
2	2	76	1	1
3	3	10	1	1
1	1-	23	1	1
2	2-	37	1	1
3	3-	26	1	1
1	1	3	1	2
2	1-	1	22	2
2	2	6	1	11
3	2	1	690	11
3	3-	6	1	11

211,30,4M
221,31,2N
221,31,2O

E1

E2

E3

ZETA

J = 23/2 ENERGY MATRIX OF F5

1 RANK OF MATRIX

1	1	8	1	1
1	1	10	1	1
1	1-	26	1	1
1	1	1	1	2

221,31,2O

E1

E2

E3

ZETA

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