

$^{249}\text{Cf}(\text{d},\text{d}')$  1975Ya11

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**1975Ya11:** Deuteron beam (E(d)=15 MeV) from the Argonne FN tandem Van de Graaff accelerator bombarded a  $^{249}\text{Cf}$  target.

Deuterons scattered from the target were analyzed with the Enge split-pole magnetic spectrograph and recorded on emulsion plates with FWHM $\approx$ 7 keV. Measured spectra at 90°, 125° and 140° with respect to beam direction. Angular distribution of the scattered deuterons were measured at  $\theta$  from 20° to 140° at 10° intervals.

 $^{249}\text{Cf}$  Levels

All the observed levels were analyzed on the assumption that they belong to collective states coupled to the 9/2<sup>-</sup>[734] neutron state.

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Cross section data from 1975Ya11

E_level(keV)	$d\sigma/d\Omega$ ( $\mu\text{b}/\text{sr}$ )		
	(90°)	(125°)	(140°)
0	8.97E+4 45	11910 10	1.24E+4 7
61	206 21	1310 14	1210 13
135	640 64	330 33	340 34
186	17 9	132	8 3
220	41 6	44 5	30 3
241	19 5	8 2	6 2
315	23 7	22 3	19 4
384	a	a	2 2
425	6 3	7 2	8 2
668	15 5	9 2	8 3
751	5 3	5 1	4 1
812	19 6	102	7 2
851	12 4	5 1	8 1
902	8 25	5 2	4 2
920	31 3	17 2	19 3
962	4 2	4 1	2 1
992	18 6	13 4	13 2
1007	a	6 2	7 2
1031	12 4	a	6 2
1063	42 7	20 4	16 2
1078	21 5	16 4	17 2
1115	4 1	4 1	1 1
1145	17 4	12 4	11 2
1164	a	7 3	5 1
1178	20 3	19 2	13 2
1192	15 3	6 2	4 1
1218	18 3	5 2	$\alpha$
1236	17 5	6 1	5 1
1251	10 3	2 1	3 1
1304	a	3 1	4 1
1340	a	4 1	3 1
1415	b	19 3	18 2
1463	22 8	23 3	17 2
1482	8 5	7 2	4 1
1498	7 4	9 2	6 1
1530	16 3	19 2	14 2
1541	10 2	8 2	4 1
1603	19 4	17 4	11 2
1648	4 2	6 3	4 1
1674	8 3	8 3	6 1
1709	a	6 2	6 2
1914	20 4	21 4	18 2

Footnote:

a- Insufficient population of the state for identification in the spectrum (1975Ya11)  
 b- Obscured by impurity

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E(level)	$J^\pi$ <sup>†</sup>	Comments
0 <sup>‡</sup>	9/2 <sup>-</sup>	
61 <sup>‡</sup>	11/2 <sup>-</sup>	
135 <sup>‡</sup>	13/2 <sup>-</sup>	
(145 <sup>d</sup> )	5/2 <sup>+</sup>	E(level): Level obscured by the strong 13/2 <sup>-</sup> member of g.s. band.
186 <sup>d</sup>	7/2 <sup>+</sup>	
220 <sup>‡</sup>	15/2 <sup>-</sup>	
241 <sup>d</sup>	9/2 <sup>+</sup>	
315 <sup>‡</sup>	17/2 <sup>-</sup>	E(level): Probably includes the weaker 11/2 <sup>+</sup> member of the 5/2 <sup>+</sup> band.
384 <sup>d</sup>	13/2 <sup>+</sup>	Level not identified at 125°.
425 <sup>‡</sup>	19/2 <sup>-</sup>	
668 <sup>#</sup>	13/2 <sup>-</sup>	
751 <sup>#</sup>	15/2 <sup>-</sup>	
812 <sup>@</sup>	5/2 <sup>-</sup>	
851 <sup>@</sup>	7/2 <sup>-</sup>	
902 <sup>@</sup>	9/2 <sup>-</sup>	
920 <sup>&amp;</sup>	11/2 <sup>+</sup>	
962 <sup>@</sup>	11/2 <sup>-</sup>	
992 <sup>&amp;</sup>	13/2 <sup>+</sup>	
1007	4	
1031	5	E(level): Level not identified at 125°.
1063 <sup>a</sup>	13/2 <sup>+</sup>	
1078 <sup>b</sup>	15/2 <sup>+</sup>	
1115	4	
1145 <sup>a</sup>	15/2 <sup>+</sup>	
1164	4	
1178 <sup>b</sup>	17/2 <sup>+</sup>	
1192	4	
1218	4	
1236 <sup>a</sup>	17/2 <sup>+</sup>	
1251	5	
1304	5	
1340 <sup>a</sup>	19/2 <sup>+</sup>	
1415 <sup>c</sup>	7/2 <sup>+</sup>	
1463 <sup>c</sup>	9/2 <sup>+</sup>	
1482	4	
1498	4	
1530 <sup>c</sup>	11/2 <sup>+</sup>	
1541	4	
1603 <sup>c</sup>	13/2 <sup>+</sup>	
1648	4	
1674	4	
1709	4	
1914	3	

<sup>†</sup> The  $J^\pi$  assignments are from 1975Ya11 and are based on rotational structure, deduced K-value from the level spacing, and

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 $^{249}\text{Cf}(\text{d,d}')$  **1975Ya11** (continued) $^{249}\text{Cf}$  Levels (continued)

- previously identified level assignments according to:  $(E_{K+1}-E_K)/(E_{K+2}-E_{K+1})=(K+1)/(K+2)$ .
- $\ddagger$  Band(A):  $9/2[734]$ .
  - # Band(B):  $9/2[734]+2^+$ .
  - @ Band(C):  $9/2[734]-2^+$ .
  - & Band(D):  $9/2[734]+1^-$ .
  - <sup>a</sup> Band(E):  $9/2[734]+2^-$ .
  - <sup>b</sup> Band(F):  $9/2[734]+3^-$ .
  - <sup>c</sup> Band(G):  $9/2[734]-1^-$ .
  - <sup>d</sup> Seq.(H):  $5/2[622] + 9/2[734]-2^-$ .

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			<b>Band(E): 9/2[734]+2<sup>-</sup></b>	
			<u>19/2<sup>+</sup>      1340</u>	
			<u>17/2<sup>+</sup>      1236</u>	<b>Band(F): 9/2[734]+3<sup>-</sup></b>
				<u>17/2<sup>+</sup>      1178</u>
			<u>15/2<sup>+</sup>      1145</u>	
			<u>13/2<sup>+</sup>      1063</u>	<u>15/2<sup>+</sup>      1078</u>
		<b>Band(D): 9/2[734]+1<sup>-</sup></b>		
	<b>Band(C): 9/2[734]-2<sup>+</sup></b>	<u>13/2<sup>+</sup>      992</u>		
	<u>11/2<sup>-</sup>      962</u>			
		<u>11/2<sup>+</sup>      920</u>		
	<u>9/2<sup>-</sup>      902</u>			
	<u>7/2<sup>-</sup>      851</u>			
	<u>5/2<sup>-</sup>      812</u>			
	<b>Band(B): 9/2[734]+2<sup>+</sup></b>			
	<u>15/2<sup>-</sup>      751</u>			
	<u>13/2<sup>-</sup>      668</u>			
	<b>Band(A): 9/2[734]</b>			
	<u>19/2<sup>-</sup>      425</u>			
	<u>17/2<sup>-</sup>      315</u>			
	<u>15/2<sup>-</sup>      220</u>			
	<u>13/2<sup>-</sup>      135</u>			
	<u>11/2<sup>-</sup>      61</u>			
	<u>9/2<sup>-</sup>      0</u>			

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$^{249}\text{Cf}(\text{d,d}') \quad 1975\text{Ya11 (continued)}$

Band(G):  $9/2[734]-1^-$

$13/2^+ \quad 1603$

$11/2^+ \quad 1530$

$9/2^+ \quad 1463$

$7/2^+ \quad 1415$

Seq.(H):  $5/2[622] +$   
 $9/2[734]-2^-$

$13/2^+ \quad 384$

$9/2^+ \quad 241$

$7/2^+ \quad 186$

$5/2^+ \quad 145$

$^{249}_{98}\text{Cf}_{151}$