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Philippe Gorodetzky, G. Rudolf, F. Scheibling, P. Chevallier. QUARTET EXCITATION IN ^{20}Ne MAY BE SEEN THROUGH THE DECAY IN $8\text{Be} + ^{12}\text{C}$. Journal de Physique Colloques, 1971, 32 (C6), pp.C6-197-C6-198. 10.1051/jphyscol:1971639 . jpa-00214857

HAL Id: jpa-00214857

<https://hal.science/jpa-00214857>

Submitted on 1 Jan 1971

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QUARTET EXCITATION IN ^{20}Ne MAY BE SEEN THROUGH THE DECAY IN $^8\text{Be} + ^{12}\text{C}$

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Résumé. — Les résultats préliminaires de l'étude de $^{19}\text{F} + \text{p} \rightarrow ^8\text{Be} + ^{12}\text{C}$ et $^{16}\text{O} + \alpha \rightarrow ^8\text{Be} + ^{12}\text{C}$ dans la région d'excitation de ^{20}Ne $15,3 < E_x < 18,7$ MeV semblent montrer que la plupart des niveaux trouvés sont 8 particule-4 trous et que les deux plus importantes résonances peuvent être la tête de bande du processus 12 particule-8 trous.

Abstract. — Preliminary results of the study of $^{19}\text{F} + \text{p} \rightarrow ^8\text{Be} + ^{12}\text{C}$ and $^{16}\text{O} + \alpha \rightarrow ^8\text{Be} + ^{12}\text{C}$ in the region of excitation of ^{20}Ne $15.3 < E_x < 18.7$ MeV show tentatively that most of the found levels are 8 particle-4 holes, and the two biggest resonances could be the head band of 12 particle-8 holes process.

The preliminary results described here are tentative to show that ^{20}Ne presents 8 p-4 h and 12 p-8 h configurations when decaying in $^8\text{Be} + ^{12}\text{C}$.

The decay of ^{20}Ne , in the energy region $15.3 \text{ MeV} \leq E_x \leq 18.7 \text{ MeV}$ in $^8\text{Be} + ^{12}\text{C}$ (both in g. s.) has been measured by counting the ^8Be particles. This is achieved by counting the two outgoing α -particles in fast coincidence in two counters in a special geometry [1], [2], [3].

The first reaction to be studied was $^{19}\text{F} + \text{p} \rightarrow ^8\text{Be} + ^{12}\text{C}$ [4] (which had never been seen before). Excitation functions at 90° and 120° were performed and angular distributions taken at the interesting points. There are twelve clear resonances, with yield dropping to zero between them. The angular distributions become symmetric through 90° at the resonance energies, indicating compound nucleus process. The cross sections at the top of the resonances go as high as 1.5 mb/sr.

The second reaction was $^{16}\text{O} + \alpha \rightarrow ^8\text{Be} + ^{12}\text{C}$ (*) in the same region of excitation in ^{20}Ne . The excitation functions show the same patterns at the same places as before and angular distributions give the same spin and parity as before. Through the help of $^{19}\text{F} + \text{p} \rightarrow \alpha_0 + ^{16}\text{O}$, recently performed, preliminary ^8Be widths are deduced. They come from preliminary crude one-level fits and error bars of some 50 % can be assumed.

(*) That part of the work was performed at the California Institute of Technology, supported in part by the National Science Foundation (GP-9114) and the Office of Naval Research (Nonr-220 (47)) and two of the authors (P. G. and G. R.) would like to thank Professor R. W. Kavanagh and Dr. W. K. Lin for their hospitality and cooperation.

Arima, Gillet and Ginocchio [5] give for the most probable process (220) an energy of 5.1 MeV, which experimentally comes to 7.2 MeV. (220) corresponds to weak coupling of ^{24}Mg and ^{12}C [8]. So, in the table are indicated the energies of ^{24}Mg and ^{12}C levels, and their energies plus 7.2 MeV. The sequence given by the compilation of Endt and Van der Leun [6], and Ajzenberg and Lauritsen [7] fits very well our sequence of levels.

This good concordance could come from the fact that the levels in ^{24}Mg and ^{12}C are relatively high in excitation. The concordance with the spins is not so good. Also, for most of the levels, the ^8Be widths are in better agreement with the α_π widths recently measured through $^{19}\text{F} + \text{p} \rightarrow \alpha_\pi + ^{16}\text{O}_{6.06}$, than with the α_0 widths.

But the two biggest levels cannot be explained by that process (220). The 0^+ at 15.44 MeV and the 2^+ at 17.22 MeV. (The 0^+ is very near from the threshold of the reaction, and reduced ^8Be width is about three times bigger.) The next process is (130) or 12 particles-8 holes. Arima and coll. put it at 17.0 MeV, not so far from 15.44 MeV. This process is also weak coupling of ^{28}Si and ^8Be . If ^8Be is considered as nearly unbound, then the sequence of levels of ^{28}Si should be the same as the sequence of levels in ^{20}Ne for (130). The first excited level in ^{28}Si is 2^+ at 1.779 MeV, and the difference in energy between the two levels in ^{20}Ne is 1.78 MeV. This is may be too good. The next thing to do will be to see if the 4^+ in ^{28}Si at 4.61 MeV has a big correspondent in ^{20}Ne at 20.05 MeV.

The definitive results are under calculation and should be published soon.

E_x (MeV)	Γ	Γ_{Be}	Γ_{α_0}	Γ_{α_π}	Γ_p	J^π	^{24}Mg or ^{12}C levels J^π	+ 7.2 MeV	^{28}Si levels
15.44	200	35	70	35	4	0^+			0.0 0^+
15.86	180	10	20	7	20	2^+	8.654 2^+ Mg	15.854	
						$(0^+) (1^-)$			
16.20	100	4	2	3	2.5	(2^+)	9.004 2^+ Mg	16.204	
16.33	150	20	11	1	1	$(1^-) (2^+)$	9.148 1^- Mg	13.348	
16.50	100	45	2	21	1	3^-	9.282 Mg	16.482	
16.64	70	1.5	30	3	4	$(2^+) (3^-)$	9.456 Mg	16.656	
16.74	80	2	25	2	1	3^-	9.52 6^+ Mg	16.72	
16.90	100	20	3	3	7	1^-	9.638 3^- C	16.838	
16.99	100	25	2	25	5	$(1^-) (4^-)$	9.826 1^+ Mg	17.026	
17.22	220	120	< 10	< 10	< 5	2^+			1.779 2^+
17.30	100	10	15	25	25	0^+	10.10 (0^+) Mg	17.30	
17.50	200	30	50	150	10	(0^+)	10.3 (0^+) Mg	17.50	
17.65	100	12	6	6	1	4^+	10.353 2^+ Mg	17.553	
17.75	200	13	16	30	8	3^-	10.683 0^+ Mg	17.883	
18.00	70	10	6	6	2	1^-	10.844 1^- C	18.044	
18.20	200	12	35	35	10	$(2^-) (4^+)$	11.018 2^+ Mg	18.218	

All widths are in keV. Tentative spin and parity are between parentheses. Preferred tentatives are underlined.

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