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

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Résumé. — Les résultats préliminaires de l'étude de ^{19}F + p → ^{8}Be + ^{12}C et ^{16}O + α → ^{8}Be + ^{12}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}F + p → ^{8}Be + ^{12}C and ^{16}O + α → ^{8}Be + ^{12}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}Be + ^{12}C.

The decay of ^{20}Ne, in the energy region 15.3 MeV $\leqslant E_x \leqslant$ 18.7 MeV in ^{8}Be + ^{12}C (both in g. s.) has been measured by counting the ^{8}Be 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}F + p → ^{8}Be + ^{12}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}O + α → ^{8}Be + ^{12}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 spinand parity as before. Through the help of ^{19}F + p → α_0 + ^{16}O , recently performed, preliminary ^{8}Be widths are deduced. They comme from preliminary crude one-level fits and error bars of some 50 % can be assumed.

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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 ^{8}Be widths are in better agreement with the α_π widths recently measured through ^{19}F + p → α_π + $^{16}O_{6.06}$, 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 ^{8}Be 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 ^{8}Be. If ^{8}Be 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	
16.20	100	4	2	3	2.5	(0^+) (1^-) $(\underline{2^+})$	9.004	2^+ Mg	16.204	
16.33	150	20	11	1	1	(1^-) $(\underline{2^+})$	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	$(\underline{2^+})$ (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	$(\underline{1^-})$ (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^-) $(\underline{4^+})$	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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