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THE ROLE OF THREE-BODY COULOMB FIELDS VERSUS FINAL STATE INTERACTIONS IN THE DECAY $^{12}C - \alpha - {}^{12}C$

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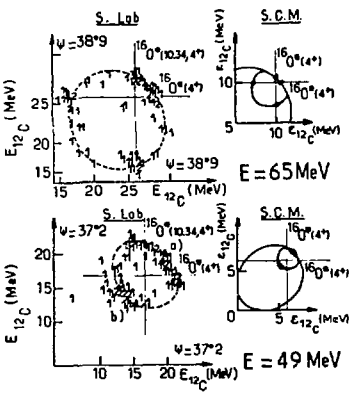
J.L. Québert, D. Bertault, J.N. Scheurer and J.P. Fouan[*]
Centre d'Etudes Nucléaires de Bordeaux-Gradignan/33170 Gradignan, FRANCE
[*]Centre d'Etudes Nucléaires de Saclay/91190 Gif-sur-Yvette, FRANCE

In a three-body break-up such as the $^{12}C-\alpha-^{12}C$ decay, a fragment like the α particle may be detected at rest[1]. Its origin may be due to a direct disintegration, involving a real negligible velocity, or to a two-step process, in which there is compensation of velocities to yield a final negligible energy. The latter emission is a very specific case of a well known mechanism which is not expected with a high probability. On the contrary, a direct decay may be highly favoured when the structure is close to alignment[1,2]. In such a process, Coulomb fields perturb the initial angular momenta ; they also give rise to two kinds of emissions, namely : i) a fragment (α) at rest, due to alignment ; ii) a focusing effect, in which the two associate ^{12}C's have equal energies when the α particle has a few MeV. A recent result, shown at the bottom of the figure (49 MeV), confirms this statement, i.e. accumulation of events in a) and b).



The other aspect of emission (final state interaction) has also been observed[3] at higher incident energy. We also found such a result at 65 MeV in which the ^{16}O transient nucleus is excited in the 4^+ state (10.34 MeV). The experiment was set up in exactly same conditions as it was at 49 MeV. Comparison of both results shows the striking feature that one mechanism seems to disappear when the other is observed.

This intriguing transition from one process to the other, with a kinematic overlap in the Dalitz plot, raises the question to know whether or not there is a unique explanation of the decay in terms of structure effects. Coulomb trajectories, as well as coupling of angular momenta, seem to give a good picture of the emissions.

[1] J.N. Scheurer and al, Nucl. Physics A 319 (1979) 274
J.N. Scheurer, Thèse d'Etat, Bordeaux n° 582, 1979

[2] H.J. Wiebicke, Phys. Lett. 84 B (1979) 379

[3] K. Furuno and al, Nucl. Physics A 321 (1979) 250