

STRUCTURE IN THE $^{12}\text{C}+^{18}\text{O}$ REACTION CROSS SECTIONS

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Strong presence of narrow structures has recently been discovered in a few non- α -particle systems. Notably, the composite nucleus ^{30}Si exhibits pronounced structures in elastic, inelastic and direct transfer channels (binary channels) when formed in $^{14}\text{C}+^{16}\text{O}$ 1) and $^{12}\text{C}+^{18}\text{O}$ 2) collisions. The present paper reports on a continuation of the previous work on the $^{12}\text{C}+^{18}\text{O}$ collision done at the tandem laboratory of CRN Strasbourg²⁾.

Characteristic γ rays were detected using two large Ge(Li) detectors placed at 55° and 90° with respect to the beam direction. A $75 \mu\text{g}/\text{cm}^2$ thick ^{12}C target on Au backing was bombarded with an ^{18}O beam whose energy ranged from 50.0 to 81.0 MeV(lab). in steps of 500 keV. Special attention was payed to γ transitions fed by the binary channels, so that γ rays with energies as high as 8 MeV were collected.

The results of the binary channels are displayed in fig.1. All excitation functions exhibit structures; they are especially regular for the ^{18}O and ^{14}C channels. The most prominent bumps are present in the inelastic ^{18}O excitation functions. These anomalies are less obvious towards the highest measured energies owing to the masking by the exponentially rising Coulomb background. We have also analysed the dominant fusion-evaporation channels. Fusion-evaporation excitation functions (not shown in the figure) are structured for $k\cdot\alpha$ (^{26}Mg and ^{22}Ne) and $2n\alpha$ (^{28}Si , ^{27}Al , ^{24}Mg and ^{20}Ne) exit channels; the summed data of these channels display regular oscillations which are, typically, 1.5-2 MeV(c.m.) wide. The most striking feature is the almost one-to-one correspondence of the fusion-data peaks to the binary peaks.

The question of the mechanism responsible for the observed structures remains open, especially in view of the connection between the binary and fusion structures. As for the fusion channels, the dominance of α -particle emission is due to its ability to carry out the excess angular momentum; this by itself

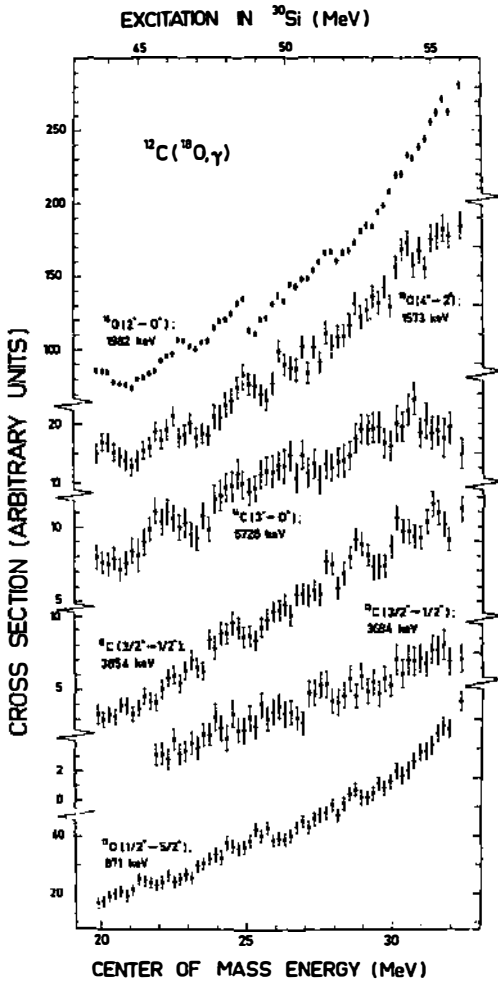


Fig.1. Inelastic and direct transfer excitation functions

cannot explain the occurrence of structured excitation functions. However, preequilibrium α -particle emission (incomplete fusion) might be able to explain the regularity of the observed oscillations. It should be mentioned that the low-lying states of ^{18}O have a surprisingly large "di-neutron" amplitude³⁾. Therefore, the role of the "di-neutron" cluster cannot be ruled out a priori. The connection between binary- and fusion-channel structures might not be provided by the direct α -amplitude (α -particle stripping leading to

^{14}C and $k\cdot\alpha$ fusion-evaporation channels) but by the $2n$ -type states (^{18}O inelastic excitation, $2n$ transfer leading to ^{14}C and $2nx$ fusion-evaporation channels).

References

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