

THE ROLE OF THE INELASTIC CHANNELS FOR THE OCCURRENCE OF INTERMEDIATE
 RESONANCES IN $^{12}\text{C} + ^{12}\text{C}$ AND $^{14}\text{C} + ^{14}\text{C}$

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The elastic scattering of some light heavy ion systems as e.g. $^{12}\text{C}+^{12}\text{C}$ and $^{12}\text{C}+^{16}\text{O}$ has revealed pronounced intermediate structures. Until now their origin is not really understood but most of the proposed reaction mechanisms¹⁾ proceed from a coupling of the elastic entrance channel to some more complex degrees of freedom of the system, especially to inelastic excitations of one or both of the nuclei. It has been the aim of our work to study the role of the inelastic channels for the occurrence of intermediate structures in the systems $^{12}\text{C}+^{12}\text{C}$ and $^{14}\text{C}+^{14}\text{C}$.

The 90° (c.m.) elastic scattering excitation function of $^{14}\text{C}+^{14}\text{C}$ measured between 6 and 35 MeV (c.m.) is dominated by a sequence of regular pronounced gross structures (2-3 MeV broad)²⁾. This scattering behaviour is interpreted

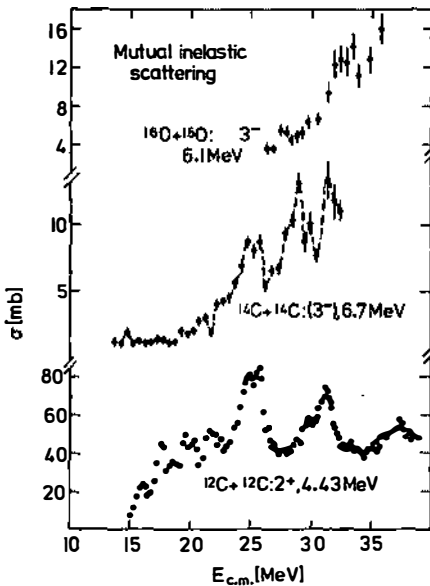


Fig. 1

as a consequence of the extended surface transparency of the system²⁾. Intermediate structures occur only weakly in the elastic scattering and not below about 25 MeV (c.m.) whereas the single and mutual inelastic scattering to the 3^- (6.73 MeV) state in ^{14}C show pronounced structures. Their relative strength is comparable with the scattering to the 2^+ (4.43 MeV) state³⁾ in $^{12}\text{C}+^{12}\text{C}$ (fig.1) but the absolute cross sections are by a factor 5-10 smaller than for $^{12}\text{C}+^{12}\text{C}$. This is presumably due to the smaller collectivity and higher excitation energy of the 3^- state in ^{14}C . Therefore we conclude

that in $^{14}\text{C}+^{14}\text{C}$ (and $^{16}\text{O}+^{16}\text{O}$) the coupling between elastic and inelastic channels is weak and for this reason the regular elastic gross structures are not strongly affected.

Since in $^{12}\text{C}+^{12}\text{C}$ details of the coupling between intrinsic (2^+) and relative orbital angular momenta play an important role for a theoretical interpretation of the intermediate structures (e.g. the band-crossing-model by Abe and coworkers⁴⁾) we have measured⁵⁾ the spin alignment along the scattering normal at energies corresponding to maxima and minima of the $^{12}\text{C}+^{12}\text{C}^*(2^+)$ excitation function. The alignment is defined by $P_{zz} = 1/2 \sum m^2 P_m - 1$ where P_m is the probability of populating the substate with spin projection m . The resulting P_{zz} values are given in fig.2 together with the excitation functions³⁾. We find a large spread

of the measured alignment both at the in-resonance and the off-resonance energies which does not indicate a simple correlation with the observed gross structure. Recent, more detailed measurements designed to examine possible variations of P_{zz} with finer structures in the excitation function are presently being analyzed.

References:

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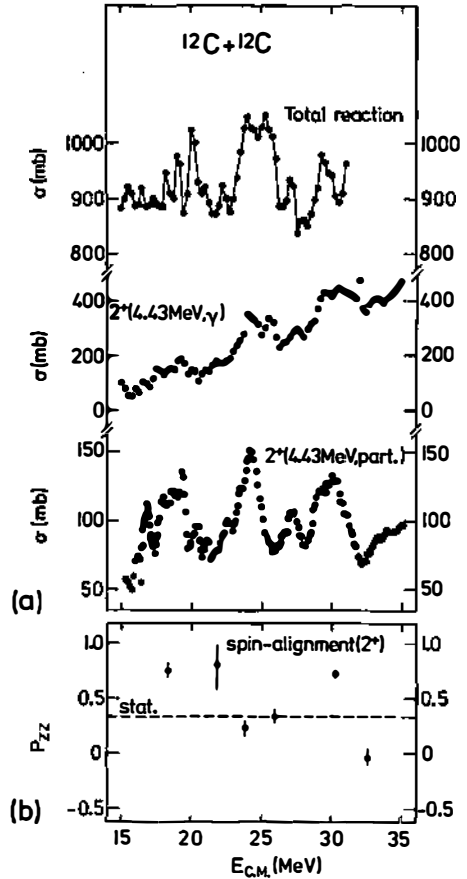


Fig. 2