

## SECTION 4 – SIMPLE PARTICLE SYSTEMS

**4.1. Study of three particle reactions on light nuclei induced by 14.4 MeV neutrons**B. ANTOLKOVIĆ, *Institute »Ruder Bošković«, Zagreb*

Neutron induced breakup processes on some light elements have been studied in kinematically complete experiment. The correlation measurement has been performed by use of nuclear emulsions. In addition to the much higher yield which is allowed by the  $4\pi$  detection geometry, the measurements performed by this technique include also events extended to the whole momentum space. This seems to be of great importance for the study of the reaction mechanism.

The experimental data of the correlation spectra of  $n+{}^7\text{Li} \rightarrow n+\alpha+t$  and  $n+{}^{10}\text{B} \rightarrow t+\alpha+\alpha$  are presented in Dalitz diagrams. The analysis of contributions of different reaction mechanisms has been performed and data on some particle unstable states extracted. The spectra have been fitted with the Phillips, Griffy and Biedenharn theory for the sequential decay via  $t-\alpha$ ,  $n-\alpha$  and  $\alpha-\alpha$  two particle states. It has been found that in both reactions studied, the contribution of the simultaneous breakup process is less than 10% of the total reaction crosssection.

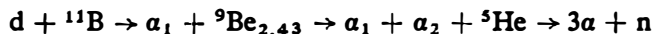
**4.2. Four-body break-up  $d + {}^{11}\text{B} \rightarrow 3\alpha + n$  and states in  ${}^9\text{Be}^*$** D. RENDIĆ and V. VALKOVIĆ, *Institute »Ruder Bošković«, Zagreb*N. D. GABITZSCH, W. von WITSCH and G. C. PHILLIPS, *Rice University, Houston, USA*

The four-body break-up of  $d+{}^{11}\text{B}$  system into  $3\alpha+n$  has been studied in order to obtain information about the decay properties of the excited states in  ${}^9\text{Be}$ . Experiment was performed using the tandem Van de Graaff accelerator and existing TOF facilities at Rice University, Houston, Texas.  $\alpha-\alpha$  and  $\alpha-n$  coincidences have been measured simultaneously at two bombarding energies 10.425 and 12.0 MeV.

Measured spectra reveal the importance of sequential decay mechanisms in the reaction; the process of the type

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is the most favoured one.

The decay structure of low-lying levels in  ${}^9\text{Be}$  is discussed with regard to the  $n + {}^8\text{Be}$  and  $\alpha + {}^5\text{He}$  clustering; while the 2.43 MeV state decays preferably to the  $\alpha + {}^5\text{He}_{g.s.}$ , 3.03 MeV state shows purely  $n + {}^8\text{Be}_{g.s.}$  decay structure. Decay properties of 4.70, 6.66 and 7.94 MeV levels are also studied.

#### 4.3. Three-body break-up in the reaction $d + {}^7\text{Li} \rightarrow \alpha + \alpha + n$

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The reaction  $d + {}^7\text{Li} \rightarrow \alpha + \alpha + n$  has been studied at deuteron bombarding energy  $E_d = 180$  keV, with a target of natural lithium fluoride. The electronic set-up used is a standard slow-fast coincidence arrangement which enables a simultaneous measurement of  $\alpha - \alpha$  and  $\alpha - n$  coincidence.

The experimental results show an evidence of a sequential decay mechanism of the reaction, through the  ${}^8\text{Be}$  first excited state (2.9 MeV) and the ground state of  ${}^5\text{He}$ . The coincidence spectra have been analyzed with the Breit-Wigner resonant term and the  $\rho^1(E_{rel})$  density of states function of Phillips-Griffy-Biedenharn. However, in both cases the shape of the spectra can be reproduced only approximately. In order to approve the agreement between the experimental and theoretical curves, a contribution of the direct three-body break-up has to be included, with lower limit of 5%.

#### 4.4. The effect of the quasifree scattering process on the shape of kinematically incomplete spectra at forward angles in the deuteron breakup\*

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In the deuteron breakup the quasifree scattering (QFS) process appears alongside the final state interaction process (FSI) even at low incident energies. In the measurement of the  $D(n, p) 2n$  reaction at forward angles with single counter, the proton spectra should include both the effects of  $n-p$  and of  $n-n$  QFS. The  $n-n$  QFS effect on the spectra is limited to very low proton energies. The  $n-p$  QFS effect at small proton angles of detection overlaps kinematically with the location of the enhancement due to the FSI.

We present a preliminary calculation of the proton spectrum which has been performed taking into account only the  $n-p$  QFS in the  $D(n, p) 2n$  reaction for  $\Theta = 0^\circ$ . A simple impulse approximation has been used at this stage. The result shows a marked maximum at high proton energies. The importance of the QFS effect for the extraction of the  $n-n$  scattering length is discussed.

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