12C(4He, 6Li) Reaction at 33.8 MeV.

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Summary. — The 12C(4He, 6Li) reaction has been studied at (33.8 ± 0.2) MeV alpha energy using CR-39 passive solid-state nuclear track detectors. The differential cross-sections for 12C(4He, 5Li)11B and 12C(4He, 6Li)10B at a laboratory angle of 35° have been measured to be (12.9 ± 2.6) mb/sr and (12.0 ± 2.4) mb/sr, respectively.

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The 12C+α reaction is of considerable importance from an astrophysical point of view. We had previously studied this reaction at 28.2 MeV using passive CR-39 solid-state nuclear track detectors and detected the heavy ions emitted from the reaction (1).

CR-39, the detector used to study this 12C+α reaction, is the most sensitive of the SSNTD detectors. It has the unique feature that it can detect, identify and perform spectrometry of all charged particles from protons to heavy ions with remarkable accuracy and precision over a wide dynamic range (2). When

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etched under standard conditions and prescriptions, the measurement of i) the diameter, ii) the variation of diameter with etch time, iii) the ranges/lengths of the etch pits and iv) the profiles of the etch pits produced by (normally) incident charged particles yields information on the charge, mass and energy of the incident particle. Being a passive integrating type of detector with a charge resolution better than $\pm 0.25$ e, it overcomes the difficulties associated with problems inherent in the active detectors (such as pulse pile-up, etc.) and produces and retains a permanent record. The identification is unique and unambiguous. It can also detect and sort out very-low-intensity heavy ions amidst a background of high-intensity alpha-particles and protons. From etch pit characteristics it can differentiate between heavy ions produced through recoils in elastic and inelastic scattering of the incident alpha-particles and those produced through nuclear reactions. Moreover, the use of CR-39 detectors has the added advantage that the dynamic range of detection is increased and the entire spectrum of heavy ions emitted in the reaction can be sorted and detected and we get the actual reaction cross-section value.

The experiment was carried out in a scattering chamber at the Variable Energy Cyclotron, Calcutta. The experimental arrangement is shown in fig. 1.

Fig. 1. – Experimental arrangement.