THE DISPUTED 2·86 MeV LEVEL OF B^{10}

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THE energy spectrum of neutrons from $Be^9(d, n)$ B^{10} has been investigated by many workers. Evidence has been produced for energy levels of B^{10} at excitations of 0·72, 1·74, 2·15 and 3·58 MeV besides the ground state. Many contradictory reports concerning the possible existence of a level at 2·86 MeV in B^{10} have been published since Dyer and Bird (1953) presented evidence for such a level from a study of the above reaction using nuclear emulsions. Again using the emulsion as detector this level was not reported by Green *et al.* (1955) and Shpetnyi *et al.* (1957).

The 2·86 MeV level has been suggested by Galloway and Sillitto (1961) using γ-ray coincidence and by Coombe and Walker (1962) using Diffusion Chamber as detector. Following the time of flight method for coincident γ-rays Neilson *et al.* (1958) and Maydan and Vass (1965) found no indication of this level. The neutron spectrometer experiment of Siemsses *et al.* (1965) also led to the same result while the same experiment performed by Reid (1954) had produced evidence for the 2·86 MeV level.

In view of this conflicting evidence it was thought that a further investigation of the level scheme of B^{10} using a modified procedure (Sah, 1965) for scanning the photographic emulsions would be useful.

A Be target (200 μ gm./cm.^{2}) supported by 3/16" copper backing was bombarded with 650 + 5 KeV deuterons from the Cockcroft and Walton generator of the Tata Institute of Fundamental Research, Bombay. The outgoing neutrons were detected by 200 μ Ilford K 2 nuclear research plates (7·62 cm. × 2·54 cm.) held radially at a distance of 15·10 cm. from the target at angles of 0°, 90° and 150° to the direction of the deuteron beam. After irradiation the plates were processed using the method of temperature development.

The plates were examined on a Cooke Troughton and Simms Nuclear Research Microscope and the modified procedure for scanning (Sah, 1965) was followed.

A total of 3,000 proton recoil tracks were recorded at 0°, 90° and 150°. Only 9 tracks ran out of the emulsions.

The energy corresponding to the measured ranges of the recoil protons was obtained from the range energy relation given by Wilkins (1951). After necessary corrections, the data at each angle were collected in the form of a histogram where the number of tracks were plotted against the neutron energy in intervals of 100 KeV. The neutron energy spectra for 0° and 90° are shown in Figs. 1 and 2.

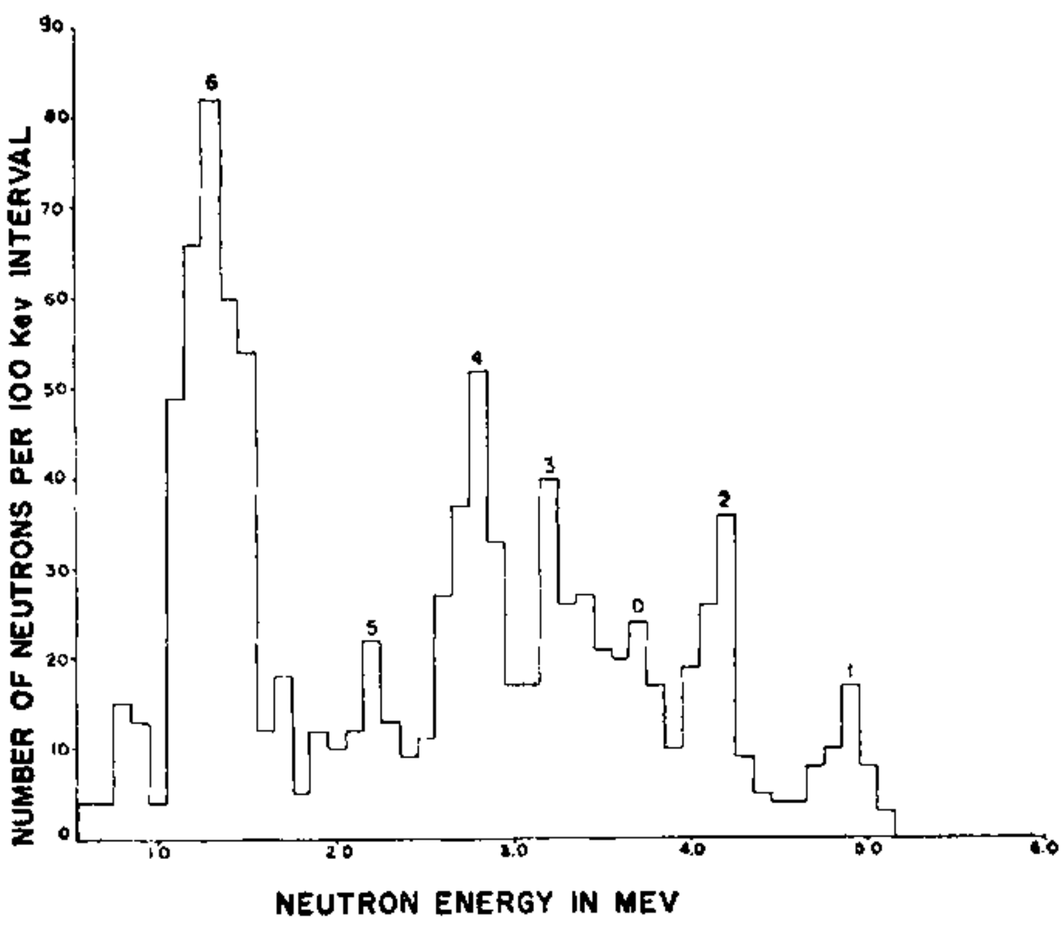

FIG. 1. Neutron energy spectrum at 0°.

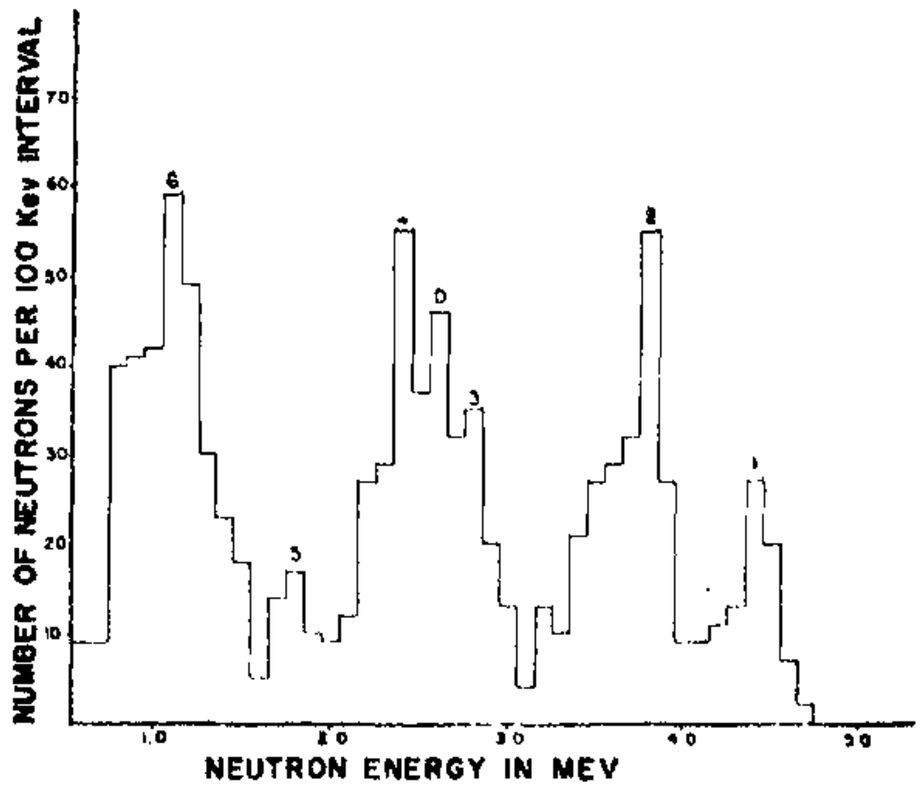

FIG. 2. Neutron energy spectrum at 90°.

Result.—In Figs. 1 and 2, the six neutron groups numbered 1 to 6 correspond to the formation of B^{10} at different excitation energies. The neutron group from the D-D reaction has been marked D on the histograms.

TABLE I

Q-values in MeV at the different angles for the energy levels of B^{10}

Angle	Neutron group	1	2	3	4	5	6
0°	..	4·37±0·11	3·02±0·10	2·59±0·08	2·18±0·06	1·56±0·10	0·65±0·05
90°	..	4·32±0·10	3·66±0·06	2·56±0·06	2·12±0·05	1·46±0·11	0·69±0·09
150°	..	4·39±0·09	3·60±0·06	2·66±0·08	2·20±0·06	1·50±0·07	0·66±0·09

The Q-values for the various levels of B^{10} at the different angles have been tabulated in Table I along with the probable error. The Q-value for transition to the ground state 4·36 ± 0·1 MeV is in good agreement with the value of 4·36 MeV reported by Ajzenberg *et al.* (1959) from recent nuclear masses.

Evidence has thus been produced for levels in B^{10} at excitations of 0·73, 1·76, 2·19, 2·85 and 3·69 MeV besides the ground state. The neutron group corresponding to the 2·85 MeV level is clearly resolved. Further evidence for this level is being sought from plates at angles of 45°, 60°, 120° and 135° which are now being scanned.

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INCREASED EFFICIENCY OF TREATMENTS WITH ETHYL METHANE SULPHONATE ADMINISTERED UNDER PRESSURE

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SEVERAL chemical mutagens have proved rather effective in barley and wheat but not in rice presumably because of the hull or the inability of the chemical to penetrate the water-resistant corky layer of the bran.[1] The seedcoat barrier in rice was overcome by using dehulled seeds suitably treated with effective fungicides such as captan.[2] Further studies on the effect of dehusking on mutation frequency also revealed that treatments with mutagens, chemicals in particular, showed an enhanced mutation frequency in dehusked seeds.[3] By getting the seeds into a metabolically active state by presoaking for longer periods, Mikaelsen and Navaratna[1] could enhance treatment efficiency. Experiments on the use of the chemical carrier di-methyl sulphoxide in combination with chemical mutagens and colchicine revealed that the cell permeability is enhanced by the treatment in rice and barley.[4,5] The present report gives the results of treatments of seeds with chemical mutagens under varied pressure levels.

Seeds of the *japonica* rice variety, Tainan 3, presoaked in water for four hours were treated with 0·5% aqueous solution of EMS for five hours under pressure levels ranging from vacuum to 20 atmospheres (including normal atmosphere). Another set soaked in water and subjected to the same range of pressure levels was kept as control.

The material thus treated was germinated under controlled light and temperature. The effects of treatments were measured by percentage reduction of survival and growth rate. The results are presented in Figs. 1, 2 and 3.

It is evident from the data that treatment with EMS under different pressure levels invariably showed more reduction in survival and growth rate than treatments under normal pressure level. Further, the data indicated