or betaine.

As with most models anomalies inevitably arise and in this case some of the marine algae raise pertinent questions. In *Valonia ventricosa* the cytoplasmic potassium level has been reported as of the order of 440 mol $m^{-3}$ and the sodium level as about 40 mol $m^{-3}$ whereas the corresponding vacuolar levels are about 620 mol $m^{-3}$ and 40 mol $m^{-3}$ (Gutknecht, *Biol. Bull.*, **130**, 331; 1966). The cytoplasmic potassium concentration in this instance is well above the demonstrated level for inhibition of enzymes from other halophytes. A re-examination of the ion concentrations in the various compartments of this particular alga is clearly indicated. At the same time it would be useful to find whether any metabolic adaptation such as adaptation of enzymes to salt has occurred or whether any compatible organic solutes are present in unexpectedly high quantities.

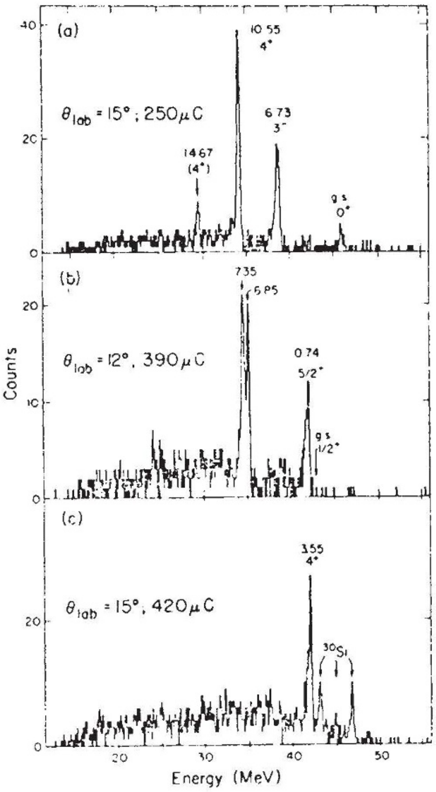
# Nuclear spectroscopy with the (α, ²He) reaction

*from P. E. Hodgson*

NUCLEON transfer reactions are one of the most powerful ways of determining the properties of nuclear states, and over the years very many studies have been made of practically every nucleus in the periodic table. The one-nucleon transfer reactions are particularly useful for determining the single-particle properties of nuclei, while reactions transferring more than one nucleon provide information about their collective properties.

For practical reasons not all nucleon transfer reactions are equally easy to carry out. For example, reactions with incoming or outgoing neutrons cannot be studied with the same energy resolution as those involving charged particles. Any addition to the list of reactions available for nuclear spectroscopy is therefore most welcome, and in recent years use has been made of reactions that have unstable outgoing particles.

One of the first of these unstable particles was the nucleus $^8Be$, which rapidly decays into two alpha particles. The energy of breakup is however very small, only 96 keV, so the two alpha particles are emitted in almost the same direction, and are thus easily detected. Now another such particle, the nucleus $^2He$, consisting of two protons in an $^1S_0$, $T=1$ state, has been shown by a group at Berkeley to be detectable in nuclear reactions. This is important because the (α, $^2He$) reaction can now be studied, and this provides a convenient way of transferring two neutrons to a nucleus.




Energy spectra of $^2He$ nuclei from the (α, $^2He$) reaction on $^{12}C$ (*a*), $^{13}C$ (*b*), and $^{16}O$ (*c*).

In their preliminary studies (*Phys. Rev. Lett.*, **37**, 812; 1976) they show how the $^2He$ nuclei can be detected by a pair of proton counters. Almost as soon as it is emitted from a reaction, the $^2He$ nucleus breaks up into two protons, travelling in almost the same direction, and these can almost simultaneously activate two adjacent proton counters. The number of counts from two unrelated protons is very small.

They have used this detection system to study the (α, $^2He$) reaction on $^{12}C$, $^{13}C$, and $^{16}O$ and find energy spectra very similar to those found for reactions with stable outgoing particles. It is therefore possible to use it to study the structure of the residual nuclei.

Some of their spectra are shown in the figure, and it is notable that very few states are excited, showing that the reaction is very selective. This means that the reaction will only go to states of a particular structure, and this enhances its value as a spectroscopic tool.

Examination of the states excited in the reactions mentioned shows that they are all of high spin. The final nuclei are $^{14}C$, $^{15}C$ and $^{18}O$ and the states excited are the $3^-$ at 6.73 MeV and the $4^+$ at 10.55 MeV in $^{14}C$; the $5/2^+$ at 0.74 MeV in $^{14}C$; the $5/2^+$ at 0.74 MeV in $^{15}C$; and the $4^+$ at 3.55 MeV in $^{18}O$.

The preferential excitation of high spin states has already been observed in the (α, d) reaction and these states are favoured because the kinematics of the reaction are such that the neutron–proton pair is easily captured into a relative triplet state about an undisturbed target core. In the same way the observed selectivity in the (α, $^2He$) reaction corresponds to the capture of a neutron–neutron pair into a relative singlet state. At 65 MeV, the energy of the alpha particles used in this experiment, the angular momentum transferred in a surface reaction is about four or five units of $\hbar$, so that states formed by capturing the two neutrons into d orbitals with the configuration $(d_{5/2}{}^2)_4$ should be preferentially excited. The known spins of the states that are selectively excited are in agreement with this simple picture. Similar arguments can be used to predict the states that will be excited in reactions at different energies and on different nuclei.

These results already show the usefulness of the (α, $^2He$) reaction in exciting states of high spin in nuclei. It is likely to be applied to study the structure of many nuclei throughout the periodic table. □

# Pressure solution

*from K. R. McClay*

The Tectonic Studies Group of the Geological Society held a discussion meeting at Imperial College on the subject of pressure solution and Coble Creep, on November 5, 1976.

THE role of diffusive mass transfer processes in geological deformations, although indisputably important, has always been difficult to assess critically and even more difficult to quantify. Ever since Sorby, in the late 19th century, realised that some rocks exhibit textures and structures that can only be explained by 'solution' at highly stressed grain boundaries and redeposition of minerals in less stressed regions, structural geologists have been trying to understand this phenomenon of 'pressure solution'. This rock deformation mechanism has largely been ignored since the turn of the century, and only in the 1960s was interest in pressure solution revived, chiefly by J. Ramsay.

The meeting was intended to review current research on pressure solution and diffusion processes in rocks and also to evaluate their importance in geological deformations. Although the meeting was concerned with the fundamental aspects of pressure solution processes, these are also of considerable importance in the compaction behaviour of the reservoir rocks