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A STUDY OF THE SCATTERING OF 145 MeV PROTONS FROM CARBON USING SPARK CHAMBERS

J. McL. EMMERSON, J. C. W. MADDEN, C. M. P. JOHNSON †
N. MIDDLEMAS, A. B. CLEGG and W. S. C. WILLIAMS
Nuclear Physics Laboratory, Oxford

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One of the first experiments using optical spark chambers was carried out by the Oxford group at the Harwell variable energy synchrocyclotron . Elastic and inelastic differential cross-sections for proton scattering on carbon at an energy of 145 MeV were measured. The results for the elastic scattering are shown in the plot. The data can be fitted by an "optical" model which yields information on the size and shape of the nuclear potential.

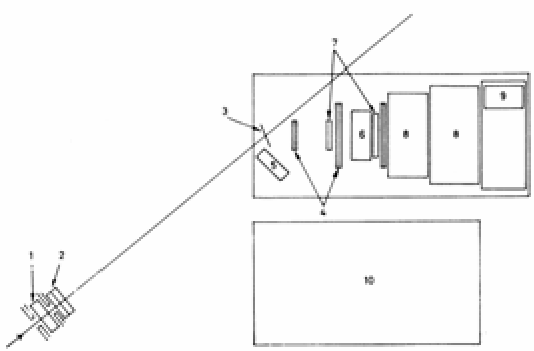

Fig. 1. Plan view of experimental arrangement showing 1–ionization monitor, 2–differential ion chambers, 3–target, 4–angle defining chambers, 5–shielding, 6–absorber, 7–scintillator detectors, 8–range telescope, 9–register and 10–mirror.

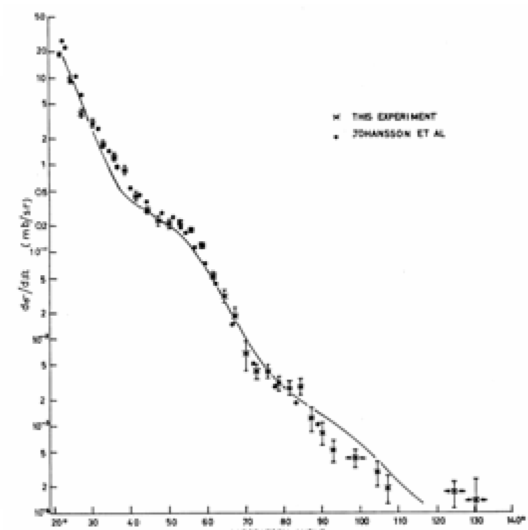

FIG. 4. Differential cross sections for elastic scattering of 145 MeV protons from ^{12}C. Also shown are the results of Johansson *et al.* [10]) at 183 MeV adjusted in angle so that results for the same momentum transfer are plotted at the same abscissa. Results averaged over more than one angular bin are indicated by arrows. The continuous curve shows a preliminary optical model fit to the data

EXTENDED DUTY CYCLE FROM THE HARWELL SYNCHRO-CYCLOTRON

G. L. SALMON

*Clarendon Laboratory, Oxford**

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A rotating target is described which increases the extracted proton pulse duration from the synchrocyclotron by a factor of 20

The beam spill of the cyclotron was very short, usually about 200 microseconds. This gave the machine a "duty cycle" of only 1%. An ingenious device was constructed in Oxford which enabled the pulse to be lengthened to several milliseconds. After the beam was accelerated and was coasting at the maximum radius in the cyclotron, tungsten targets on a rotating wheel gradually scattered the protons out of the machine.

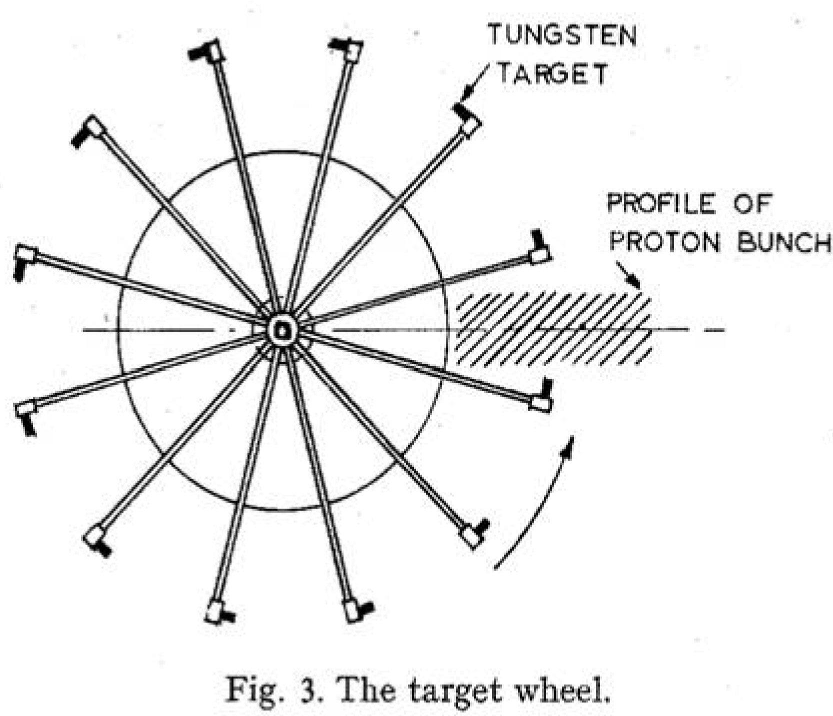

Fig. 3. The target wheel.

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THE $^{12}C(p, p')^{12}C^*$ (12.71 AND 15.11 MeV) REACTION FROM THRESHOLD TO 50 MeV

D. F. MEASDAY †, P. S. FISHER, A. KALMYKOV ††, F. A. NIKOLAEV ‡ and A. B. CLEGG
Nuclear Physics Laboratory, Oxford

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The Rutherford Laboratory Proton Linear Accelerator could accelerate protons to 10, 30 or 50 MeV. In an experiment carried out by the Oxford group the gamma rays accompanying inelastic proton scattering on carbon were studied. The variation with energy of the cross-section (the excitation function) for the 15.1 MeV state was found to have a sharp peak. This was interpreted as the excitation of a collective oscillation of the nucleus in its excited state.

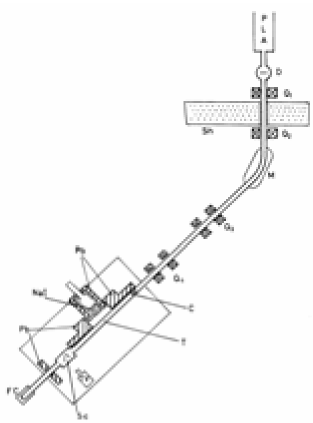
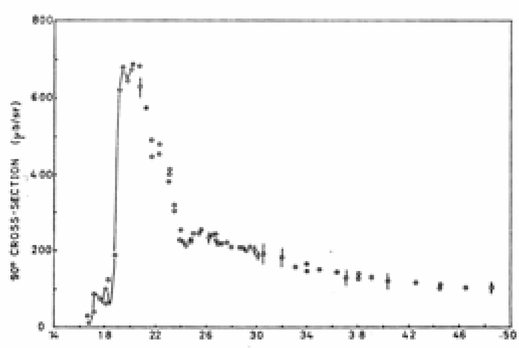


Fig. 1. The experimental layout. The labels identify the parts of the apparatus as follows: Q1–4 Quadrupole lenses, M the bending magnet, D the variable degrader, C the collimator, T the target, Sc a retractable scintillator viewed by the television camera TV, Pb indicates lead shielding, Sh concrete shielding, and NaI is the sodium iodide spectrometer.



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STRUCTURE OF STATES IN ^{20}Ne FROM THE REACTIONS ^{18}O(^{11}B, ^{9}Li)^{20}Ne AND ^{16}O(^{11}B, ^{7}Li)^{20}Ne

D. STROTTMAN*[1], N. ANYAS-WEISS*[2], J.C. CORNELL,
P.S. FISHER, P.N. HUDSON, A. MENCHACA-ROCHA*[3],
A.D. PANAGIOTOU*[4] and D.K. SCOTT
Nuclear Physics Lab., Keble Road, Oxford, UK

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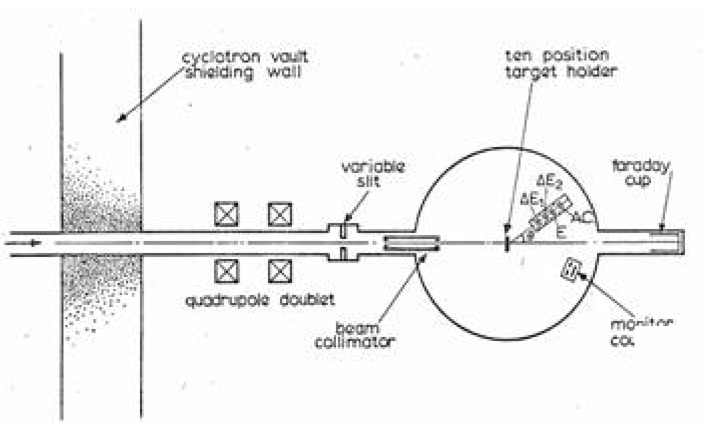
The energy of the Harwell synchrocyclotron was sufficiently high that if carbon ions were accelerated and directed onto an oxygen target, then the ions could penetrate the Coulomb barrier so that the nuclei could come into contact. It was found that at the energy of the Harwell synchrocyclotron the reactions could be explained by the transfer of one or several nucleons between the projectile and target.



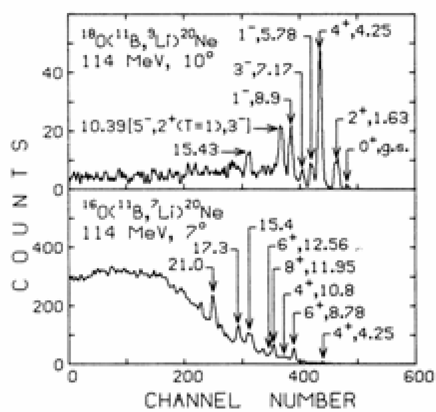


Fig. 1. (a) ^{9}Li spectrum for the ^{18}(^{11}B, ^{9}Li)^{20}Ne reaction obtained at 10° in the lab. (b) ^{7}Li spectrum from the ^{16}(^{11}B, ^{7}Li)^{20}Ne reaction obtained at 7° in the lab.