hence of the magnetic moment, does not vanish even for ^1S state of the molecule. This causes a loss in diamagnetism the magnitude of which is proportional to the degree of concentration of charge within the region between the nuclei; this concentration is also responsible for the more essential part of the binding energy of a homopolar molecule. Hence for diatomic homopolar molecules we should expect that the loss in diamagnetism on molecule formation will be proportional to the binding energy.

The table given below attempts to test this conclusion. The atomic χ values have been computed by Slater's method. As these values are for isolated atoms, comparison would have been justified if the molecular χ's referred to the gases. Unfortunately, observations are available mostly for solids and liquids. There is also an uncertainty in the spectroscopic determination of the dissociation energy. Considering all these factors, it would seem from a study of the table that the relation holds to a first approximation.

Table I.

	Calc. (atom+atom)	Obs. (molecule)	Percentage loss	Dissociation energy (spectroscopic)	Dissociation energy (thermal)
H_2	4·86	3·99	18	4·42	4·2
C_2	18·82	11·76 (diamond)	37·5	7·0	
N_2	16·20	11·8	27	9·0*	
CN	17·51	11·25	36	9·5	
S_2	44·02	30·72 (rhombic sulphur)	30	4·9	
Cl_2	40·78	40·47	1	2·54	2.47
Br_2	67·56	62·4	7·7	1·96	2·0
I_2	102·86	91·5	11	1·53	1·6

The susceptibility and energy data are taken from the International Critical Tables except * which is from NATURE, vol. 129, 870; 1932). It appears roughly that there is a loss of about four per cent per volt of dissociation energy. Cl_2 does not fall into the scheme. There are reasons for believing that the computed value for I_2 is too high, which if true will improve the agreement. A detailed paper appears elsewhere.

D. P. RAY-CHANDHURI.

University College of Science,
Calcutta. Aug. 18.

Nuclear Structure

IN a recent note in NATURE,[1] Bartlett has shown that the nuclei of the light elements may be represented by a model built up of appropriate numbers of neutrons and protons arranged in independent groups about an α-particle. It seems very significant that the numbers of protons and neutrons thus assigned to the p- and d-shells are the same as those required by the Pauli Exclusion Principle for electrons. This at once suggests that quantised spins and orbital momenta are also associated with the neutrons and protons in the nucleus. From quite another point of view, Heisenberg [2] has found it necessary to assign a spin, $\frac{1}{2}\cdot\frac{h}{2\pi}$, to the neutron.

Considerable support can be found for such an extension of the model by consideration of the nuclear moments of the lightest elements. To obtain complete agreement with experiment, the following assumptions are necessary:—

(1) The protons and neutrons are independently coupled to the central α-particle; as the α-particle has no spin, the nuclear moment is the difference of the resultant momenta of these two systems.

(2) The protons—attracted to the α-particle owing to the nature of the potential curve for small separations—form a quantised system the state of least energy ('ground term') of which may be predicted by analogy with the similar electronic system, the terms of which are inverted with respect to those of the proton system.

(3) For each neutron, the spin vector is parallel to, and coupled with, the orbital momentum vector. The neutrons form groups of two, with opposed total momentum vectors. In the p-shell, the contribution of each neutron to the resultant moment is $\frac{3}{2}\cdot\frac{h}{2\pi}$.

TABLE.

Nucleus.	Structure.	Component Momenta. Neutrons.	Component Momenta. Protons.	Nuclear Moment (I).
H1	π	—	$\frac{1}{2}$	$\frac{1}{2}$
He4	α	—	—	0
Li6	$\alpha+\nu+\pi$	$\frac{3}{2}$	$\frac{3}{2}$ ($^2P_{\frac{3}{2}}$)	0
Li7	$\alpha+2\nu+\pi$	0	$\frac{3}{2}$ ($^2P_{\frac{3}{2}}$)	$\frac{3}{2}$
Cl 2	$\alpha+4\nu+4\pi$	0	0 ($^3P_0$)	0
N14	$\alpha+5\nu+5\pi$	$\frac{3}{2}$	$\frac{1}{2}$ ($^2P_{\frac{1}{2}}$)	1
O16	$\alpha+6\nu+6\pi$	0	0 ($^1S_0$)	0

π = proton; ν = neutron.

As the table shows, this model accounts for all the observed moments of the nuclei up to O^{16}—where the p-shell is completed. It is very striking that the nuclear moments of Li^7 ($I=\frac{3}{2}$) and N^{14} ($I=1$) are no longer exceptional.

It is at present not possible to predict the behaviour of the protons in the d-shell, as the screening effect of the six protons of the p-shell is greater than the attraction of the central charge (+2 units).

E. GWYNNE JONES.

University College,
Nottingham.
Sept. 15.

[1] J. H. Bartlett, Jr., NATURE, 130, 165; 1932.
[2] W. Heisenberg, *Z. Phys.*, 77, 1; 1932.

Absorption of Sound by Porous Materials

SOME time ago, there was a discussion[1] between E. T. Paris and Heyl concerning the dependence of the absorption of sound upon the angle of incidence, which, however, produced no solution to the problem. Since for many practical purposes dependence of absorption upon angle and frequency is very important, investigations have been undertaken in this direction, which confirm qualitatively the angle theory of Rayleigh and Paris and a frequency theory proposed by us.

The relation of absorption to angle of incidence was measured in the open air on the flat roof of the institute. Loudspeaker and microphone were placed directly upon the floor. The sound reflected from the specimen under test was measured and compared with that from a completely reflecting plate (for example, a thick glass plate).

The frequencies used lay between 1,000 and 10,000 Hz., the angle of incidence lay between 10° and 75°. The following materials were tested: Tentest, Celotex B and BB, cotton wool and acoustic board. These materials were generally mounted upon plates of absorbing materials (Insulite). Particularly interesting is a material which functions according to the assumptions of Rayleigh, that is, which consists of a series of parallel lying channels constructed from corrugated paper. By closing a varied amount of surface, for example, changing the number of