232), viz., I wished to show that an accurate estimate of e could be made, which was *independent* of any direct estimate, but which confirmed Millikan's value.

(III) Birge's chief disagreement with my work is in his adopting as the value for e/m (1.761 ± 0.001) or $(1.759 \pm 0.001) \times 10^7$ e.m.u., and consequently disagreeing with both Eddington's theoretical numbers 137 and 1847.6. This estimate of e/m is the *only* experimental evidence against *either* of Eddington's theories. I would point out that, though e/m has now been measured for 35 years, it is only during the last three years that any appreciable number of physicists have accepted the value Birge advocates. Moreover, I understand from Sir Arthur Eddington that the discovery of the neutron makes it seem likely that the equations used in deducing the spectroscopic estimates of e/m are in error.

(IV) In section 4 of Birge's letter he speaks of the probable error of an estimate of e that I had given as being much larger than the error he estimates. I believe Birge's estimate must be wrong, as it would make his estimate of e ten times more accurate than the data from which it is obtained.

W. N. Bond

Department of Physics,
University of Reading, England.
May 11, 1932.

The Relation of Relative Humidity to the Absorption of Supersonic Waves in Various Mixtures of CO_2.

A sputtered quartz crystal with a frequency of 4.096×10^5 vps was used as source for supersonic waves. The absorption of these waves by a column of air mixed with different percentages of CO_2 was measured with an acoustic radiometer of the torsion vane type. A constant relative humidity of 10 percent for one set of runs was maintained with P_2O_5, 15 percent relative humidity for another set was obtained using LiCl and 35 percent for the remaining runs was obtained using CrO_3 as a dryer.

Curves plotting log of deflection ($\log D_x$) against height (x) of radiometer from crystal face were plotted from the data and values for the absorption constant (k) were obtained by taking the slope of the straight lines thus plotted.

The following values of k were taken from these curves:

	10% R.H.	15% R.H.	35% R.H.
5% CO_2	0.053	0.09	0.11
50% CO_2	0.51	0.64	0.69
95% CO_2	0.97	1.19	1.29

These values indicate that relative humidity has a very marked and important effect upon the absorption in CO_2 or in air containing large percentages of CO_2.

Henry H. Rogers

Pennsylvania State College,
May 26, 1932.

Constants of the N_2O Molecule

In a recent paper on N_2O[1] the vibration frequencies as indicated by infrared absorption bands were correlated, and the anharmonic coefficients determined, employing an equation developed by Dennison for linear triatomic molecules. It now appears that this relation is too limited in its application, and should have been written in the more general form

$$\begin{aligned} W_l = V_1\nu_1 + V_2\nu_2 + V_3\nu_3 + x_{11}V_1^2 + x_{22}V_2^2 \\ + x_{LL}L^2 + x_{33}V_3^2 + x_{12}V_1V_2 + x_{13}V_1V_3 \\ + x_{23}V_2V_3 + A \end{aligned}$$

TABLE I.

ν observed	transition	anharmonic coef. symbol	anharmonic coef. value	ν^0	ν computed
1285.4	$(0 \rightarrow 1)\,V_1$	x_{11}	-3.3	1288.7	1285.4
2564.2	$(0 \rightarrow 2)\,V_1$				2564.2
589.0	$(0_0 \rightarrow 1_1)\,V_2$	x_{22}	-2.2	588.3	589.1
579.5	$(1_1 \rightarrow 2_0)\,V_2$	x_{LL}	$+3.0$		578.7
590.5	$(1_1 \rightarrow 2_2)\,V_2$				590.7
1167.3	$(0_0 \rightarrow 2_0)\,V_2$				1167.8
2224.1	$(0 \rightarrow 1)\,V_3$	x_{33}	-13.8	2237.9	2224.1
4420.7	$(0 \rightarrow 2)\,V_3$				4420.6

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[1] Barker, Phys. Rev. **38**, 1827 (1931).

expressing in first approximation the dependence of the vibration terms upon the various quantum numbers, A being a common constant. As a consequence it is necessary to revise the values of ν^0 and of certain of the coefficients, the results being more consistent than before. Table I supercedes parts of Tables IV and V in our report. The values of x_{13} and x_{23} remain unchanged. Those of x_{12} are somewhat modified, but as before fail to agree well among themselves.

The original report also contained a regrettable error in the value of the moment of inertia of the N_2O molecule, which should have been given as 66.0×10^{-40}.

E. F. Barker

University of Michigan,
June 30, 1932.

Raman Effect of Methyl Acetylene

The Raman spectrum of methyl acetylene ($CH_3 \cdot C \vdots CH$) has been studied and ten lines have been found as shown in Table I. A mercury light source was employed in the usual way and was used both unfiltered and with $\lambda = 4358A$ reduced by 2 mm of a solution of iodine in carbon tetrachloride. The photographs were taken on a Steinheil spectrograph. The expected Raman frequencies of the monosubstituted acetylene $C \vdots C \cdot$ bond (2128 cm^{-1}) and the $\vdots C \cdot H$ bond (3306 cm^{-1}) were found and are in agreement with the values of Bourguel and Daure.[1] Furthermore, lines for the aliphatic $C \cdot H$ bond (2928 cm^{-1}) and the $C \cdot C$ bond (618, 931 cm^{-1}) were found for this molecule. Some lines in Table I are not yet identified, although they also appear in other hydrocarbon molecules.[1] The ten lines mentioned are quite definite, but others are possible and it is expected to extend the work by using monochromatic excitation.

Table I. *Raman lines in methyl acetylene.*

Frequency cm^{-1}	Intensity	Frequency cm^{-1}	Intensity
310	weak	2871	medium
618	weak	2928	strong
931	medium	3144	medium
1384	weak	3207	weak
2128	strong	3306	weak

The methyl acetylene was made available through the kindness of Dr. G. B. Heisig of this laboratory.

Geo. Glockler
H. M. Davis

University of Minnesota,
Minneapolis, Minn.,
July 1, 1932.

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[1] Bourguel and Daure, Comptes Rendus **190,** 1298 (1930); and Bull. Soc. Chim. **47/48,** 1365 (1930).

Structure of Atomic Nuclei

For some time, there has been speculation as to whether or not the atomic nucleus can be regarded as consisting of shells of protons, just as the external structure is known to consist of shells of electrons. The writer has recently pointed out[1] that the experimental evidence seems to demand a modification of this view, in that *s*, *p*, *d* (etc.) shells do exist, but that a closed shell of azimuthal quantum number l consists of $2l+1$ protons and $2l+1$ neutrons. It was shown that the facts are well represented for elements of mass number (M) less than 36. It is of interest to inquire if this scheme is capable of extension to elements of higher mass number.

Detailed questions of stability must be left until later, but a qualitative analogy proves to be of help. In the outer atom, the normal state with one electron missing from a closed shell is of the same symmetry character as the normal state with just one electron in the closed shell. In the *p* shell, for instance, the ground states are ^2P, ^3P, ^4S, ^3P, and ^2P. There is symmetry about the middle element, which corresponds to a half-completed shell. If we make the hypothesis that such a symmetry exists for nuclei, then it is to be expected that this symmetry will be of a two-dimensional character, when the number of neutrons is plotted against the number of protons (or better, when the excess of neutrons over protons is plotted against the number of protons). For the *s* shell, H^3 is missing, and one cannot say very much about the symmetry. For the *p* and *d* shells, symmetries of an elementary type exist. The *f* shell, corresponding to the mass range 37 to 64, shows some symmetry, but so many points are missing that it is difficult to decide on the location of the center of symmetry. Either $M=50$ or $M=52$ will serve the purpose, the excess of neutrons over protons being four. The *g* shell corresponds

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[1] J. H. Bartlett Jr., Nature (in press).