LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the twenty-eighth of the preceding month; for the second issue, the thirteenth of the month. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

The Molecular Scattering of Light from Ammonia Solutions

During the course of an investigation of the molecular scattering of light from substances in their pure and dissolved states, solutions of ammonia have given such interesting results that it seems advisable to communicate them at once. Results have previously been given for gaseous ammonia by Wood,[1] and Dickinson, Dillon and Rasetti;[2] for liquid ammonia by Daure,[3] Bhagavantam[4] and Dickinson, Dillon and Rasetti;[2] and for water solutions by Carelli, Pringsheim and Rosen.[5] Their data with those of the writers, are given in Table I.

TABLE I

State	Reference	$\Delta\nu_1$	$\Delta\nu_2$	$\Delta\nu_3$	$\Delta\nu_4$	$\Delta\nu_5$
Gas	1				3309	
Gas	2				3337	
Liquid	3	1070	1580	3210	3310	3380
Liquid	4	1070		3216	3304	3380
Liquid	2			3214	3298	
Solution	5				3314	3385
Solution (16N)	Authors	*1073*	(*1615*)?	*3219*	*3311*	*3390*

The excitation was by means of a quartz mercury arc. The instrument used was a Steinheil glass spectrograph. The plates were photometered using a Moll microphotometer, kindly loaned by the Department of Physics. Lines corresponding to the frequency differences 1073, 3219, 3311, and 3394 have been found to be excited by both Hg 4046 and Hg. 4358. The line corresponding to 3311 appears to have been excited by Hg 4078 as well. The line corresponding to 1615 could be observed when excited by Hg 4358 after the exciting line Hg 4046 had been filtered out. Even under these conditions it is extremely faint and an exact determination of its position has not as yet been possible. The relative intensities of the lines can be judged from the accompanying microphotograph. (Fig. 1).

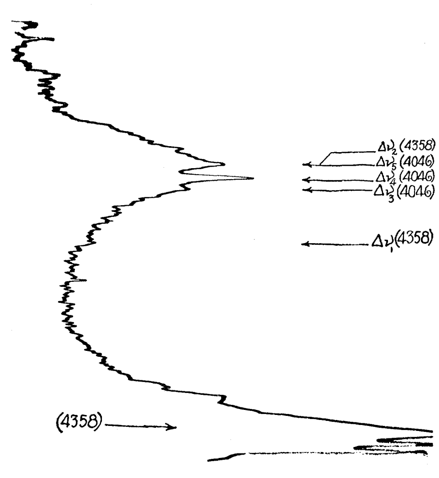

Fig. 1.

It is interesting to note that all the lines which have been reported from gaseous and

[1] Wood, Phil. Mag. **7,** 744 (1929).

[2] Dickinson, Dillon and Rasetti, Phys. Rev. **34,** 582 (1929).

[3] Daure, Trans. Farad. Soc. **25,** 825 (1929).

[4] Bhagavantam, Ind. J. Physics **5,** 59 (1930).

[5] Carelli, Pringsheim and Rosen, Zeits. f. Physik **51,** 511 (1928).

liquid ammonia have now been found in the concentrated solution (16 normal) as well. The times of exposure necessary to observe the ammonia frequencies, $\Delta\nu_3$, $\Delta\nu_4$, and $\Delta\nu_5$ were short enough to avoid difficulty due to the excitation of the water bands, although the latter could not be entirely avoided.

One can hardly decide from the figures given in the table whether or not there is a change in the characteristic frequencies when ammonia is dissolved in water from those observed for the pure substance. It appears that it will always be difficult to make a decision concerning this point because the frequency differences may depend upon the concentration of the scattering substance in the solution and other factors.

Complete details of the experimental work and a critical discussion of the data particularly with regard to changes taking place in solution will be given at a later date.

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Capture of Electrons by Swiftly Moving Alpha-Particles

Capture of electrons by α-particles when the kinetic energy of the electron with respect to the α-particle was equal to that of an energy level of the helium atom were reported by Bergen Davis and A. H. Barnes (Phys. Rev. July 1929) and by A. H. Barnes (Phys. Rev. Feb. 1930).

The results reported depended on observations made by counting scintillations visually. The scintillations produced by α-particles on a zinc sulphide screen are a threshold phenomenon. It is possible that the number of counts may be influenced by external suggestion or autosuggestion to the observer. The possibility that the number of counts of scintillation might be greatly influenced by suggestion had been realized, and a test of their reliability had been made by two methods: (a) The voltage applied to the electrons was altered without the knowledge of the observer (Barnes); (b) the direction of the electron stream with respect to the α-particle path was altered by a small electro-magnet. Such changes in voltage and direction of electron stream were noted at once by the observer. These checks were thought at the time to be entirely adequate.

In examining the data of observation made in our laboratory Dr. Irving Langmuir concluded that the checks applied had not been sufficient, and convinced us that the experiments should be repeated by wholly objective methods. Accordingly we have investigated the matter by means of the Geiger counter. Four additional experimental electron α-ray tubes have been constructed for this purpose.

Capture of the kind reported was often observed over a considerable period of time, but following prolonged observation the effect seemed to disappear. The results deduced from visual observations have not been confirmed. If such capture of electrons does take place, it must depend on unknown critical conditions which we were not able to reproduce at will in the new experimental tubes.

We wish in particular to acknowledge our obligations to Mr. J. R. Dunning who has improved the Geiger counter to such an extent that it is almost an instrument of precision.

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April 25, 1931.

The Results of a Least-Square Adjustment of Cosmic-Ray Observations

Millikan and Cameron have recently published[1] a new series of depth-ionization measurements on the cosmic-rays, from which they conclude that there are four components or "bands" of widely varying intensity and absorption coefficient, the latter probably increasing at first with depth on account of the Compton effect. In a paper read before the Physical Society in December, 1929, the writer showed how least-squared adjustment may be adapted to the analysis of such a combination of rays, provided they obey the assumed absorption law, and provided also that approximate values of the initial intensity and absorption coefficient of each component, such as Millikan and Cameron have estimated, are available. The method uses, as the unknowns

[1] Millikan and Cameron, Phys. Rev. **37,** 235 (1931).