on a similar subject has been reported (*Nature*, **174**, 614; 1954).

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Microwave Spectrum of Methyl-Cyanoacetylene

THOUGH methyl-cyanoacetylene (methyl-propiol-nitrile) is a substance of some interest structurally, its preparation has not apparently been described. With the object of studying the microwave spectrum of this substance, we have prepared it by the method used for obtaining higher alkyl-cyanoacetylenes by Grignard and Courtot[1] and Curran and Wenzke[2]. The Grignard reagent, $H_3CCCMgBr$, was treated with cyanogen chloride and a moderate yield of methyl-cyanoacetylene isolated as a colourless, low-melting solid of sweet, penetrating aromatic odour. The best sample obtained to date, by vacuum fractionation, has melting point 16° C., boiling point 101·5° C. (754 mm.) and $n_D^{17°} = 1·4342$, but we regard these values as preliminary ones, pending a closer study of possible traces of impurities.

The microwave pure-rotation spectrum of the substance suffices to identify the molecule with certainty. The spectrum is that of a strictly symmetric-top molecule of moment of inertia compatible only with the expected linear arrangement of the nitrogen and carbon atoms on the figure axis. Quadrupole coupling hyperfine structure is also observed, the splitting being that expected for a nitrogen-14 atom located on the figure axis in the group —C≡N; the *iso*cyanide grouping is thus excluded, since it is not expected to give rise to resolvable quadrupole coupling[3]. Measurements have been made on the $J = 5 \rightarrow 6$, $8 \rightarrow 9$ and $10 \rightarrow 11$ transitions, and spectroscopic constants are derived as follows: $B_0 = 2{,}065·73$ Mc./s., $D_{JK} = 19·8$ kc./s., $D_J = c.\ 0·1$ kc./s. and eq$Q$ of $^{14}N = -4·4 \pm 0·5$ Mc./s. Absorption lines due to molecules in excited bending vibrational states are also observed in the manner expected for this molecule.

The moment of inertia, I_B, derived from B_0 is $406·20 \times 10^{-40}$ gm.cm.^{2}, and is in good agreement with the most probable structural parameters. Thus the structure

$$H_3C\overset{1·458}{\text{—}}\underset{1·203}{C}\equiv\overset{1·379}{C}\underset{1·157}{\text{—}}C\equiv N$$

(distances in A.), with $d_{CH} = 1·10$ A. and the HCH angle 108° 30′, is in accord with I_B. These parameters are close to those found for analogous bonds in cyanoacetylene[4] and methylacetylene[5]. Methyl-cyanoacetylene has a structure very similar to that of penta-1 : 3-diyne[6], and the values of the distortion constants are very similar for the two molecules.

Further measurements on the fine structure of the spectrum are planned, and it is hoped to evaluate the coupling constant more precisely. Work is also in progress on D_3CCCCN, and we hope later to detect spectra of other isotopic combinations and to determine further details of the structure. We are also investigating the possibility of exchange reactions between the hydrogen atoms and deuterium oxide.

Details will be given in a full report to be published elsewhere.

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Thunderstorms and Sporadic *E* Ionization of the Ionosphere

IN the course of the ionospheric observations carried out at Calcutta (lat. 22° 33′ N., long. 88° 21′ E.) for more than two decades, it had always been found that sporadic E ionization (E_s) is greatly increased during the occurrence of thunderstorms. In view of the persistence of the phenomenon, it was thought worth while to make a close study of the increase of E_s ionization during the occurrence of severe thunderstorms of the squall type, known as 'nor'westers', which are a special feature of the weather of this part of India (Bengal) in the pre-monsoon months March–May. During these thunderstorms the wind generally blows from a north-westerly direction with velocity often exceeding 50 miles/hr. The thunderstorms are invariably accompanied by lightning discharges.

Sporadic E ionization during ten such squalls occurring in the months April–May of 1953 and 1954 has been studied. As the squall was seen to be approaching—indicated by the appearance of the towering cumulo-nimbus clouds—special observation on E_s (besides the usual routine ones) was started and continued until the squall passed over. The observation consisted in gradually increasing the frequency of the transmitter and noting the frequency (fE_s) at which the E_s echo disappeared. The E_s's were distinguished by the characteristic fluctuation of the echoes and the simultaneous appearance of the F_2 echoes. The observations were repeated every four minutes during the progress of the squall. Figs. 1 and 2 depict graphically the results of the study for two typical cases. (The meteorological data in the figures regarding the progress of the squall—start, highest gust and end—and the atmospheric pressure variations were obtained from the Meteorological Office, Alipore, six miles south of the ionosphere station.)

It will be seen that with the approach of the squall there is sudden appearance of intense sporadic E ionization over the observing station. fE_s attains values as high as 10 Mc./s., as compared with the

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