for example, result in the observed shift[7] if equation (1) is valid. Present estimates suggest a magnetic field of the order of one gamma in our galactic system[8].

It should be of modest interest to have an evaluation of the matrix element corresponding to Fig. 1*b* and possibly an experimental investigation of the magnetic redshift.

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[1] Toll, J. S., Princeton dissertation (1952).
[2] Klepikov, N. P., *Zhurn. Exp. and Theor. Phys.*, **26**, 19 (1954).
[3] Roebl, H., *Acta Phys. Austriaca*, **6**, 105 (1952).
[4] Erber, T., *Proc. Intern. Conf. High Magnetic Fields*, 706 (1961).
[5] Stellmacher, K. L., *Math. Ann.*, **115**, 740 (1938).
[6] Javan, A., Ballik, E. A., and Bond, W. L., *J. Opt. Soc.*, **52**, 96 (1962).
[7] Behr, A., *Astron. Nachr.*, **279**, 97 (1951).
[8] Davies, R. D., Verschuur, G. L., and Wild, P. A., *Nature*, **196**, 563 (1962).
[9] Schweber, S. S., Bethe, A., and de Hoffmann, F., *Mesons and Fields* (Row, Peterson and Co., Evanston, Illinois, 1956).

A Stimulated Emission Source at 0·34 Millimetre Wave-length

THE investigation of far infra-red stimulated emission sources at the National Physical Laboratory continues, and some results obtained using hydrogen cyanide and related molecules in pulsed electrical discharges are reported here. The interest attaching to these results is in the long wave-length of the emission and particularly its relation to the wave-length of water vapour absorption lines in the atmosphere.

Using the apparatus described in a previous communication[1], experiments were made with hydrogen cyanide at approximately 1 mm pressure in a 9·3-m long discharge tube. As before, the discharge was pulsed and the radiation intensity measured by a Golay detector. Wave-length measurements and line-width estimates were made interferometrically by the Michelson and Fabry–Perot arrangements as previously described. One difference in these experiments as compared with those described earlier, however, was that the number of pulses for which radiation could be observed with one charge of gas was limited. This led us to reduce the repetition rate of the pulses to about one per sec, and to record each pulse. In this way interferograms of several hundred pulses were recorded, which has allowed us to measure a wave-length of a single line at 0·337 mm with an accuracy of $\pm 0{\cdot}001$ mm. Within these limits a line of the same wave-length has been observed with HCN, CH_3CN and C_2H_5CN as starting materials. No assignment of the transition to energy-levels in any fragment or molecule can be offered at this time.

Fig. 1 shows part of the Fabry–Perot interferogram made with the 0·337-mm line. Each group of about 8 pulses is one multiple beam fringe, and the separation of these is the wave-length. The fringes are fully modulated and the measured 'finesse' is approximately 5. The line-width is therefore less than 10^{-4} cm^{-1}.

An order of magnitude intensity measurement was made which gave a lower limit to the mean energy in each pulse of 10 micro-joules, so assuming that the radiation pulse length is of the same duration (1 μsec) as the applied voltage pulse, the peak power would be of the order of 10 watts. When it is considered that the calculated fraction of the power extracted from the cavity by the dielectric film in our experiment is of the order of 1 per cent and that no efforts have been made to find the optimum value, it can be seen that this discharge source offers very interesting possibilities in the long-standing problem of generating sub-millimetre waves.

It is of interest to consider the wave-length of the line reported here in relation to the known pure rotational absorption lines of water vapour which dominate the attenuation characteristics of the atmosphere in the sub-millimetre range. The positions and strengths of these suggest that the most favourable wave-length to minimize absorption attenuation in this region would be in the vicinity of 0·345 mm[2,3]. The new line is already favourably placed in this respect but a source related to the present one by having isotopic substitutions of carbon-13 or nitrogen-15 would probably be better.

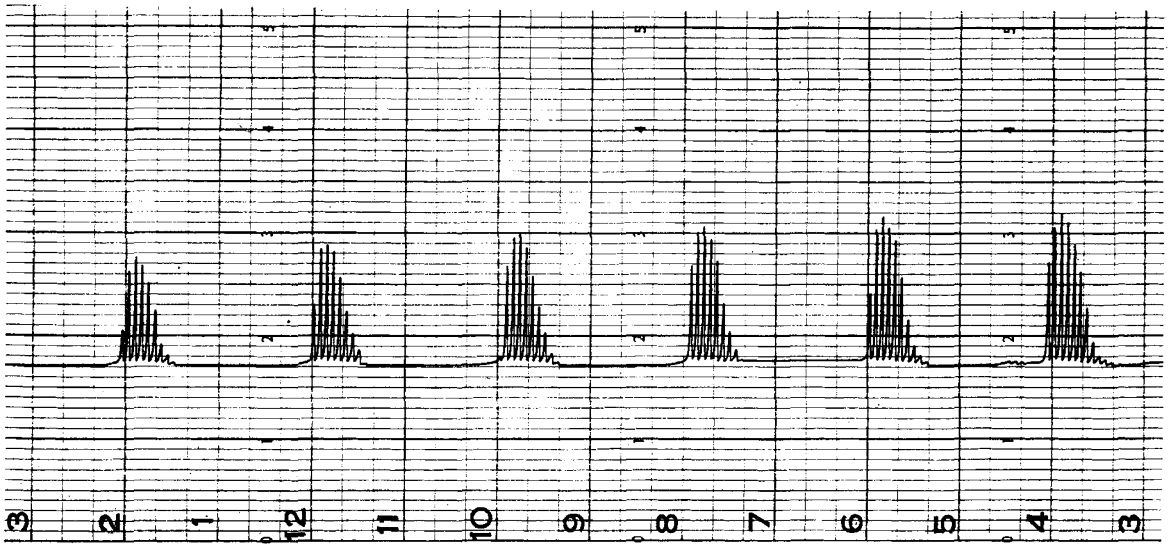

Fig. 1. Fabry–Perot interferogram made with a line of wave-length 0·337 mm. Each group of pulses is one interference fringe

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[1] Gebbie, H. A., Stone, N. W. B., Findlay, F. D., and Robb, J. A., *Nature*, **202**, 169 (1964).
[2] Gebbie, H. A., *Phys. Rev.*, **107**, 1194 (1957).
[3] Yaroslavsky, N. G., and Stanevich, A. E., *Optics and Spectroscopy*, **7**, 380 (1959).