No great absorption of the beam by any ionized strata lower than the E layer need be anticipated, since the absorption of an extraordinary gyro wave is inversely proportional to the collision frequency and so diminishes very rapidly with the height; this is also indicated by the experiments[3] on radio interaction mentioned above. By generating the gyro waves in a series of pulses, a corresponding series of glow discharges could be produced by means of a much less powerful station or with a much smaller aerial system than is indicated above.

Such artificial auroras would be of great scientific value, as they would allow those parts of the atmosphere which lie nearly 90 km. high to be studied by means of *controllable* spectroscopic and other observations. It is therefore to be hoped that means may be found to use the 500-kilowatt broadcasting station at Cincinnati, or that at Moscow, to attempt to produce such auroras.

It can also be deduced that with an aerial array similar to, but much less extended than, that mentioned above, and with gyro waves radiated at the rate of about one million kilowatts, it is possible on clear nights to provide over an area of about 10,000 square kilometres the minimum illumination of 0·02 foot candles prescribed for roadways[5]; this illumination is approximately the same as that provided by the full moon when overhead. Only a small fraction of the energy in the form of radio waves would be reflected down to the ground where it might otherwise disturb ordinary radio reception.

The above conclusions are supported by the experiments of Mr. Gill[6], who found that the oscillating potential required to start a discharge in a bulb containing air at low pressure can be very much reduced by applying that magnetic field which causes electrons to gyrate with the same frequency as that of the starting potential.

The details of the arguments which lead to these conclusions are in the course of publication in the *Philosophical Magazine*.

V. A. Bailey.

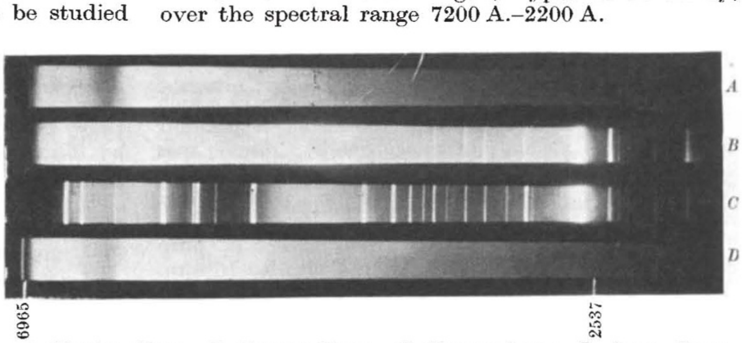
School of Physics,
University of Sydney.

[1] Bailey, V. A., Nature, **139**, 68 (Jan. 9, 1937); *Phil. Mag.*, **23**, 774 (April 1937); *Phil. Mag.*, **23**, 929 (May 1937).
[2] Bailey, V. A., and Martyn, D. F., *Phil. Mag.*, **28**, 381 and 382 (Aug. 1934).
[3] Bailey, V. A., Nature, **139**, 838 (May 15, 1937).
[4] Wilson, H. A., *Proc. Camb. Phil. Soc.*, **11**, 249 and 391 (1902).
[5] This method of producing useful illumination was described in a Australian Patent Application filed on Nov. 27, 1936.
[6] Gill, E. W. B., Nature, **140**, 1061 (Dec. 18, 1937).

Spectral Continua of the Rare Gases

It is known that most of the rare gases emit spectral continua under certain conditions of excitation. The most favourable conditions for excitation are obtained in the uniform positive column of an electric discharge using wide tubes, high pressures and low density currents. In the range of pressures, p, over which the continua predominate, the ratio of the axial force Z to the pressure p is small and decreases slowly with increase of pressure. As the pressure increases, the intensity of the continua emitted increases with respect to the intensity of the line spectra, and the intensity of the lines requiring the higher energies to excite them decreases rapidly with increase of pressure compared with that of the lines requiring the lower energies. For example, in argon and krypton at 40 mm. pressure, the only lines with intensities comparable with that of the continuum are those which emanate from the $2p$ levels requiring about 13 electron volts to excite them.

The accompanying photograph shows the spectra of the light emitted from the positive column in a tube 3 cm. in diameter in argon, krypton and mercury, over the spectral range 7200 A.–2200 A.



A. Krypton, 42mm. *B*. Mercury, 30 mm. *C*. Mercury, 2 mm. *D*. Argon, 43 mm.

It will be seen that these gases have the same long-wave spectral limit at about 6850 A., which is about the value of the limit in helium. That this long-wave limit is not due to lack of sensitivity of the photographic plate has been shown with long-range plates sensitive to 8800 A.

The theory suggested for the well-known hydrogen continua, namely, that the radiation is emitted by an unstable molecule consisting of an excited and a neutral atom, appears to be suitable to the explanation of the phenomena in the rare gases. It would explain the long-wave limit observed and would suggest a short-wave limit in the far ultra-violet corresponding to the energy of the excited state involved in the formation of the unstable molecule. It is interesting that the long-wave limit should be the same for helium, argon and krypton, and it is remarkable that mercury, in spite of essential differences, should also have a limit at nearly the same value.

S. P. McCallum.

Electrical Laboratory,
Oxford.
Aug. 14.

Correlations between Electronic States of Atoms and Molecules in the Alkali Earth Hydrides

In a recent paper, More and Cornell[1] discuss the potential energy curves for strontium hydride (SrH) based on some absorption investigations of the C and D band systems of this hydride. Two years ago, in a similar investigation (not mentioned in the paper of More and Cornell), I obtained[2] somewhat different results concerning the correlation between the energy levels of SrH and Sr+H. More and Cornell suggest that the C, $^2\Sigma$ state of SrH predissociates into the ^3D level of Sr. Correspondingly, the D, $^2\Sigma$ and E, $^2\Pi$ are connected with ^3D, and the A, $^2\Pi$ and B, $^2\Sigma$ with the ^3P state of Sr. In my previous work, on the contrary, I proposed the ^3P level of Sr as the