intensity of the 4μ, 8μ and 15μ lines of carbon dioxide compared when the quartz was quiet and when it was set in oscillation, to see if the supersonic energy caused any change in the absorption of these radiations. No positive effect was found, though this was not surprising in view of the limited amount of supersonic energy which one can get into a gas at such frequencies, and the already small residual infra-red energy after the gas had exercised its selective absorption.

In the second experiment, the gas was again irradiated at the three infra-red wave-lengths quoted and measurements made of the wave-length and dissipation of the *supersonic* energy in the gas. No change in wave-length, other than that which could be attributed to the rise of temperature, was found ; but the supersonic attenuation was definitely greater when the gas was irradiated than when it was not, as though the molecules, excited in their natural vibrational states, were able to absorb more supersonic energy.

It is, however, difficult to generalize from this result in respect to the relaxation theory, since Penman[4] and others have shown that a mere increase in thermal agitation of the molecules, induced by rise of temperature and irrespective of any particular natural mode of vibration, produced a change in the supersonic dispersion.

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Mechanism of Excitation of the Forbidden Lines of Oxygen and Nitrogen in the Spectra of the Aurora and the Night Sky

RECENT publications concerning the identification of the $^4S-{}^2P$ forbidden transition of N I in the spectra of the aurora and the night sky require a revision of previously published results. Actually, R. Bernard[1] has shown that the wave-length of the auroral radiation considered is undoubtedly $3466\cdot5 \pm 1$ A., instead of 3470 A. On the other hand, laboratory[2] and theoretical[3] determinations give respectively λ 3466·3 and 3466·5 A. Owing to this fair agreement in wave-length, the attribution of the auroral radiation to the forbidden transition of N I may be accepted fairly safely, whereas this identification is not yet acceptable in the night sky spectrum (owing to unduly high $\Delta\lambda$).

In this communication we want to suggest a new excitation mechanism for the forbidden line of N I and for the increasing intensity of the red O I-line with height and auroral type ; this mechanism does not require polyatomic compounds.

It has been shown[4] that the auroral spectrum exhibits the system of Vegard-Kaplan bands. According to L. Vegard[5], it is not yet proved that the intensity of these bands is increasing with height ; but this may be safely assumed as the initial state is a metastable level. On the other hand, L. Vegard[4] has observed, on many occasions, that the intensity ratio of the red and green lines increases in the spectra of diffuse auroras ; this must be connected with Bernard's observation[6] of a different behaviour of the Vegard-Kaplan bands in the auroras of the diffuse and of the other types. Finally, there must be noticed a close connexion[6] between the Vegard-Kaplan bands and the newly identified N I transition, this meaning that the concentration of the ^2P metastable nitrogen atoms is connected with the forbidden *emission* $A\ {}^3\Sigma\rightarrow{}^1\Sigma$.

The Vegard-Kaplan bands which have been identified with the strongest evidence[7] correspond to the final levels $v'' = 9$ to 15. If we determine the excitation energies corresponding to the vibrational states $v'' = 7$ and 15 of the normal level of N_2, we get the following figures : $E_{v''=7} = 16884\cdot5$ cm.$^{-1}$ = 2·08 ev. $E_{v''=15} = 31103\cdot4$ cm.$^{-1}$ = 4·08 ev. These values exceed the ^1D excitation potential of O I but are inferior to ^1S.

It is therefore justifiable to assume that by collision of a normal O I atom with a N_2 molecule which has emitted the Vegard-Kaplan bands, the oxygen atom is actually only able to be excited to the ^1D state and not to ^1S. As we know that N_2 and O I are the major constituents of the upper atmosphere (above 100 km.), it seems doubtless that collisions must happen between these two constituents. Still this mechanism requires the absence of a spontaneous emission of the vibrational bands of N_2. This is actually the case owing to the fact that N_2 has no electric dipole. Thus N_2 molecules may spend a long time on the excited vibrational levels of the lowest electronic state, and consequently the number of excited ^1D oxygen atoms will be a function of the emission of the Vegard-Kaplan bands.

If N I atoms are present in the high atmosphere, the same mechanism explains the observation of the $^4S-{}^2P$ forbidden transition associated with the emission of the Vegard-Kaplan bands in the spectra of diffuse auroras. As the excitation energy of the ^2P level of N I amounts to 3·56 ev., a certain number of N_2 molecules, after emission of the Vegard-Kaplan bands, will collide with the normal ^4S nitrogen atoms and bring them to the ^2P state.

A more detailed paper concerning the identification and excitation processes of the forbidden transitions in the spectra of the earth's atmosphere will appear in the *Mémoires de l'Institut Royal Météorologique de Belgique*.

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Resistance-Capacity Tuning

VALVE oscillators and selective amplifiers, in which tuning is carried out by a combination of condensers and resistances, have been developed in recent years and provide means of obtaining sinusoidal oscillations of low as well as high frequency.

In an oscillator which I am developing, the lower frequency limit has been brought down one hundred-fold and more by making use of the Miller effect. The principle involved is as follows. If a condenser C be connected between the grid and cathode of a valve and a potential difference V exists between these