metastable (and excited) atoms and molecules, produced under irradiation. An important general result established by Prof. Joshi over a wide range of conditions, is that this phenomenon does not occur at potentials less than V_m,[1,5] 'the minimum threshold potential' when the gas breaks down as a dielectric.[5] In fact, it was from the observation by Prof. Joshi of a photo-increase of V_m[1] that (arguing from the finding that the current depends upon $V - V_m^0$), he predicted that the corresponding current should decrease under light. Whatever be the actual mechanism of this phenomenon, it has significance for the current theories of photo-electric action and represents a hitherto unrecognised factor in conduction under electrical discharge.

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THE BANDS OF PO MOLECULE

A VIBRATIONAL quantum analysis of the bands of phosphorous monoxide in the region λ 2600 has been published by Ghosh and Ball[1] and a rotational analysis of some bands of this system has been given by Sen Gupta.[2] The bands are shown to be due to $^2\Sigma \rightarrow {}^2\pi$ transition. Besides this system, the PO molecule is well known to give rise to other characteristic groups of bands in the region λ 3300. The vibrational analysis of these bands does not appear to have been published so far. In the course of investigations, in this Laboratory, on the P_2 bands[3] excited under different conditions, the above-mentioned bands of the PO molecule have been obtained. These bands are found to be strongly emitted in a wide open heavy current arc between carbon poles containing phosphorous pentoxide. Some of the bands are degraded to the red and some to the violet. Several attempts to include all the bands into one system having failed, the red degraded bands are analysed into one vibrational system and the violet degraded bands into another system. The two systems have presumably a common final level 2π identical with the ground state of the ultraviolet system.

The following vibrational constants for the two systems are obtained.

Violet degraded system	Red degraded system
$\nu_e = 30606 \cdot 5$	$\nu_e = 30260 \cdot 8$
$\omega'_e = 1151 \cdot 9$	$\omega'_e = 1094$
$x'_e\omega'_e = 14 \cdot 19$	$x'_e\omega'_e = 14 \cdot 5$
$\omega_e'' = 1223 \cdot 9$	$\omega''_e = 1234$
$x''_e\omega_e'' = 6 \cdot 46$	$x''_e\omega''_e = 9 \cdot 5$

A detailed account of the work will be published elsewhere.

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ON THE ULTRA-VIOLET BANDS OF K

BESIDES the three systems of K_2 in the infrared and visible regions studied by a number of workers, Yoshinaga[1] measured about 110 band heads in absorption between λ 4160 and λ 3480 A. and arranged them into five different systems, all arising on account of transitions from the $^1\Sigma_g$ ground state to different upper states. The only data at wave-lengths below λ 3480 A. are due to Chakraborty,[2] who noted some bands of K_2 accompanying each member of the principal series line of potassium. Since he worked with an instrument of high dispersion, only few bands could be recorded in his spectrogram.

While working with an Intermediate quartz spectrograph, a large number of bands, not reported earlier between wave-lengths 3690 and 2920 A., has been noted in the present case. Of these, the bands between λ 3200 and λ 3100 A. are much better developed than those lying in the rest of the region. The experimental arrangement consists of an iron tube heated by an electric current flowing through a nichrome wire wound round an asbestos covering over the tube. The ends were closed by quartz windows and were water-cooled. Light from a hydrogen continuum was passed through potassium vapour obtained by heating a purified sample of the metal kept in an auxiliary iron cell inside the furnace tube and analysed by an Intermediate quartz spectrograph. Spectrograms were taken at several temperatures and pressures, the value of the latter being regulated by introducing dry nitrogn gas from a cylinder. The bands given in the table below (being more intense than those appearing in the rest of the region) were obtained at 700° C. when the pressure inside the furnace as read by a mercury manometer was 30 cm. The intensities were estimated from a micro-photogram of the spectrum.

ν cm.$^{-1}$ vac.	v″–v′	Int.	ν cm.$^{-1}$ vac.	v″–v′	Int.
31115	10–4	2	31467	5–2	1
31163	10–5	4	31517	5–3	2
31212	9–4	4	31557	4–2	2
31251	8–3	4	31606	4–3	2
31290	7–2	2	31679	2–1	1
31339	7–3	2	31726	1–0	1
31388	7–4	4	31818	0–0	1
31428	6–3	1	31868	0–1	1

The above bands can be represented by

$$31818 + 51v' - \cdot 5v'^2 - 92v'' + \cdot 3v''^2.$$

The agreement between the values of w_0'' and $x_0'' w_0''$ with those given by others is reasonably good.

Further work is in progress to classify the bands at wave-lengths both higher and lower than those given in the above table.

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A POSSIBLE "TERRESTRIAL EFFECT" IN THE ATMOSPHERIC OXYGEN SPECTRUM

IN a previous communication to this *Journal*[1] the author pointed out that if we were to accept, generally, current theories of the origin of the earth's magnetism and electricity, and of the internal geophysical structure, then it must follow that there exists an exceedingly strong electric field at the surface of the earth's internal core, and a variable charge in the uppermost atmosphere, as a result of which the electric potential of the earth's surface was not a fixed quantity, but that it varied over a wide range of values. Further, we should have to consider the terrestrial electric field system as being made up of three distinct components (1) the electric field at the surface of the internal spherical core (whose radius is 3,500 km.) of the order of 6×10^8 volts per cm.[2]; (2) the intermediate electric field within the crust or shell of thickness 2,900 km. indicated by the entrance at the under-surface of the crust of thermoelectrons and negative ions, and by the exit at the upper surface of air-earth current electrons and negative ions; and (3) the electric field at the earth's surface which owed its existence and magnitude also to the variable charge in the upper atmosphere.

Since the three are causally interdependent and spherically concentric, it must follow that the field as registered by an electrograph at the earth's surface must represent in magnitude, the resultant arising from all the three components, and we should be justified in representing the combined system for simplicity, as having a magnitude of 6×10^8 volts per cm. (or about 10^{11} volts per metre) at the core's surface, a value of 10^2 volts per metre at the earth's surface, and a negligibly small value at the lowermost levels of the upper atmosphere. The following relationship will be found to satisfy these values:

$$y = 10^{11} e^{-\cdot 0075\, x}$$

where y is the strength in volts per metre at any point in the composite field system at a height of x km. from the core's surface[3]; and integrating the expression between the values $x = 0$ and $x = 2{,}900$ km. (thickness of the crust), would now give us an approximate measure of the electric potential of the earth's surface with respect to the core, on a basis of 100 volts per metre as the recorded atmospheric field. It is of the order of 10^{13} volts. Should the atmospheric field be doubled or quadrupled, as it does in its usual course for example, the combined electric field throughout would be doubled or quadrupled, as also the potential of the earth's surface by a factor of 10^{13} volts. In other words, for every 100 volts per metre change in the recorded field, the electric potential energy of the earth's surface and of every molecule on it, would undergo a change of 10^{13} volts. And this would be identical with the action of an equivalent, hypothetical, applied, uniform, electric field at the earth's surface of the order of 10^{13} divided by 10^9 cm. (radius of the earth), or 10^4 volts per cm. acting on the molecule.

It would be interesting to investigate the possible spectroscopic implications of such an effect on molecules at the earth's surface. Changes in the potential energy of a molecule brought about by a strong applied, uniform, electric field are accompanied, in the main,[4] by a proportional shift in the position of the band lines, and a corresponding change in spectral intensity. It is, hence, significant that Perot[5] detected a diurnal change in wave-lengths in the A band of atmospheric oxygen which he did not account for adequately but which, on examination, will be found to coincide with diurnal changes in the magnitude of the universal component of the earth's electric field, namely, a secondary maximum of field strength at dawn corresponding to a maximum spectral frequency, a primary minimum around mid-day, and a primary maximum towards midnight. There is also a secondary minimum in field strength at about 4 a.m. by Indian standard time. In regard to intensity, the author found, particularly in the region of the atmospheric spectrum in which the oxygen bands predominate (the red), that intensity variations followed remarkably closely on changes in the atmospheric potential gradient at night,[6] and that these could not possibly be attributed either to atmospheric pollution or to any possible changes in the night sky light which was used as a background source in the course of the observations. Action by an electric field on the oxygen molecule is thus strongly suggested.

While quantitative work on verification of these findings is, at present, unfortunately held up for want of suitable equipment, it is important to note for the guidance of other workers, that the use of the solar spectrum and the usual interferometric methods[7] are liable to offset the effect under certain conditions, and that the most suitable means would seem to be the use, on a *clear* night, of a powerful source of artificial light, with an air path of several kilometers, for it is during the night that the earth's electric field undergoes its most striking changes. A series of half-hourly exposures during the same night should be recorded on one photographic plate, and corresponding changes in intensity and spectral location noted carefully.