further regions of selective continuous absorption in the far ultra-violet, measured for some such molecules, are capable of interpretation on these lines, comprising higher repulsive states of a similar character.

Substance	Process	Energy required: calculated K.cal./mol.	observed: λ (A.)	observed: K.cal./mol.	Remarks	Author
Carbon tetra-iodide	(1)	70	3930	72	L. W. L.	Samuel and Parti[1]
Formaldehyde	(2)	104·5	2750	103	Pr. D.	Henri and Schou[3]
Diacetyl	(3)	66	4395	64·5	Pr. D.	Henri[2]
Ethylacetate	(4)	108	2630–2420	108–117	L. W. L.	Present paper
Dithioacetic acid	(5)	84	∫ 3010	94	L. W. L.	,, ,,
			⌊ 3360	84	Min. Sol.	,, ,,

L. W. L. = Beginning of continuous absorption (vapour). Pr. D. = Predissociation of band spectrum. Min. Sol. = Minimum of absorption curve of hexane solution.

In all such cases two bonds of the absorbing molecule appear to be broken simultaneously without involving two single bond energies, but by the direct transition from the ground state to a repulsive term, correlated to a saturated molecule of lower valency. A strict application of the pair bond theory seems, therefore, to offer an explanation of certain features of the spectra of organic molecules and, as we hope, of certain photochemical reactions and processes at the same time. This will be discussed at greater length in a forthcoming paper.

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Band Spectrum of Silicon Monosulphide

IN a recent paper[1] on the ultra-violet band system of GeO, a survey was made of the band systems of the monoxides and monosulphides of the Group IV (*b*) elements which appear to be analogous to the "Fourth Positive" system ($A^1\Pi \rightarrow X^1\Sigma$) of CO and the well-known ultra-violet systems of CS and SiO. For SiS, the only molecule of the sub-group for which no data were available, the character and approximate position of the corresponding band system were predicted graphically.

Using heavy-current (3–5 amp.) discharges through a mixture of SiS vapour and argon in a tube of the type recently described by Pearse and Gaydon[2] and also in an all-silica tube, we have observed in the region λ2576–λ3876 a system of some seventy to eighty bands degraded to the red. The heads are approximately represented by $\nu_{head} = 35028{\cdot}5 + (512{\cdot}9u' - 2{\cdot}88u'^2 - 0{\cdot}006u'^3) - (749{\cdot}6u'' + 2{\cdot}58u''^2)$ where u is written for $v + \frac{1}{2}$. The rotational structure of the stronger bands in high dispersion appears to be of the well-known three-branch type given by a $^1\Pi \rightarrow {}^1\Sigma$ transition. That the lower state is the ground state of SiS is proved by our further observation of a few of the bands (about eight strong bands with $v'' = 0$ and 1) in absorption by SiS vapour at about 1000° C.

In the SiS discharge also are some seventy to eighty bands extending from λ3491 to λ6169, which are similar in appearance and distribution to bands in the longer-λ sequences of the above system. They appear to form part of another system, the upper and lower states of which are different from, but have vibrational frequencies of the same order as those of the ultra-violet system. The emitter may be SiS, which is expected to have triplet as well as singlet states.

The ultra-violet system of SiS is well developed also in a heavy-current discharge through Al_2S_3 vapour in a silica tube. In this source, however, the well-known $^3\Sigma \rightarrow {}^3\Sigma$ system of S_2 (of which there is, fortunately, no trace in the SiS discharge) is prominent, and the second set of bands cannot be detected.

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Fluctuation Noise in Thermionic Valves

IN a recent paper[1], I put forward the theory that the noise generated by a thermionic valve is alternatively (*a*) of the shot noise type if the valve anode current is temperature-limited, *or* (*b*) of the thermal or 'Johnson noise' type if the current is fully space-charge limited. (Contrast Llewellyn's theory that the noise in the presence of space-charge is the *sum* of shot and thermal noise, with a smoothing factor applied to the shot noise.) In the paper quoted, however, there was no quantitative treatment of the practical case of a valve which is partially space-charge limited, that is, does not correspond exactly to either of the simple states of temperature or space-charge limitation.

It has now been found possible to treat this practical case with moderate accuracy by dividing the current into two parts. Assuming the law of the valve under investigation to be known for the fully space-charge limited condition (for example, $i_a = bV_a^{3/2}$ for a diode), the proportion of the observed anode current which is fully space-charge limited can be deduced by comparing the slope of the measured i_a/V_a characteristic with the calculated value for an equal current with full space-charge limitation; when the current so calculated has been subtracted from the total measured current, the residue is current which is temperature-limited. The total noise output of the valve is then the sum of (*a*) the thermal noise in the measured resistance (calculated in accordance with the methods given in the paper already quoted), and (*b*) simple shot noise arising from the residual current which is temperature-limited.

This method has been applied numerically to two diodes, and it is hoped to extend it to triodes before full details are published.

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[1] "A Theory of Fluctuation Noise", paper read before the Wireless Section of the Institution of Electrical Engineers on Jan. 5, 1938.