

levels was limited to fourteen, because transition probabilities were available for only this number⁴. In the Harvard investigations no such limitation was imposed⁶.

The following table⁷ summarizes some of the Harvard results. The observed data, quoted from Berman⁸, have been corrected for the effect of space reddening.

	5000°	40,000°	Obs.	80,000°
H α ..	2.43	2.71	2.77	2.83
H β ..	1.00	1.00	1.00	1.00
H ..	0.53	0.49	0.50	0.48
H δ ..	0.33	0.29	0.26	0.27
H ϵ ..	0.223	0.179	0.18	0.169
H ..	0.157	0.120	0.12	0.112
H ..	0.115	0.085	0.09	0.078

The decrement proves to be extremely insensitive to the electron temperatures, indicated at the head of the column. Any temperature between 40,000° and 80,000° will fit the observations satisfactorily. Since the decrement proves to be very sensitive to the radiation field, an even wider range of electron temperatures may be considered. Page⁹ has derived a temperature of 1000° from intensity measures of the Balmer continuum. My own independent measures¹⁰ indicate a value at least ten times higher.

In view of the large number of implicit assumptions involved in Page's work, I feel that the outlook for eventually interpreting the nebular and laboratory spectra of hydrogen on the basis of wave mechanics is hopeful. We shall not have to abandon the useful Kramers' formula, in so far as it is compatible with the more precise wave-mechanical expression. Also, since I see no distinction in the present instance between 'astrophysical' and 'physical', I have dropped the qualifying 'astro' from the title of this letter.

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¹ Page, NATURE, 141, 1137 (1938).

² Carroll, Mon. Not. Roy. Astro. Soc., 90, 588 (1930).

³ Cillié, *ibid.*, 92, 820 (1932); 96, 771 (1938).

⁴ Series: *Physical Processes in Gaseous Nebulae*.

Menzel I Absorption and Emission of Radiation. *Astrophys. J.*, 85, 330 (1937).

Menzel and Baker II Theory of the Balmer Decrement, *ibid.*, 86, 70 (1937).

Baker and Menzel III The Balmer Decrement, *ibid.* In Press.

Menzel, Aller, and Baker IV The Mechanistic and Equilibrium Treatment of Nebular Statistics, *ibid.* In Press.

Baker, Menzel, and Aller V Electron Temperatures, *ibid.* In Press.

⁵ Menzel and Pekeris, Mon. Not. Roy. Astro. Soc., 96, 77 (1935).

⁶ In paper III complete transition probabilities up to $n = 35$ are tabulated.

⁷ Abbreviated from paper III of reference 4.

⁸ Berman, Mon. Not. Roy. Astro. Soc., 96, 890 (1936).

⁹ Page, *ibid.*, 96, 604 (1936).

¹⁰ Unpublished.

Ultra-Violet Band System of Silicon Monoselenide

As a result of recent observations of band spectra of monoxides, monosulphides, monoselenides, and monotellurides of the group IV(b) elements, the spectroscopic investigation of this group of molecules has now reached a stage at which data are available for the ground states and one or more excited states of all the monoxides, all the monosulphides, three of the five monoselenides (namely, CSe¹, SnSe² and PbSe²) and one of the five monotellurides (namely, PbTe²). A recent study³ of the related band systems enabled the character and approximate position of the corresponding system of SiSe to be predicted.

It was observed³ that the ultra-violet system of SiS is well developed in a heavy-current discharge through Al₂S₃ vapour in a silica tube. An analogous method has now been successfully employed to develop the corresponding system of SiSe. In a 2.5-amp. discharge through a silica tube containing aluminium selenide a system of some 30 bands degraded to the red has been observed in the region λ 2914– λ 3671, the 0 \rightarrow 0 band being at λ 3089.3 and comparatively weak. The heads are approximately represented by

$$\nu_{\text{head}} = 32,448.7 + (404.3 u'^2 - 3.24 u'^2) - (580.0 u'' - 1.78 u''^2),$$

where $u = v + \frac{1}{2}$. There can be no doubt that the system is emitted by SiSe formed by the interaction of aluminium selenide and silica at the high temperature (c. 1,000° C.) of the positive-column tube.

The ratios of coefficients discussed in connexion with SiS³ have values of the order of magnitude expected. Thus $I_M I_X / E_e = 19.3$, as compared with 19.4 for SiS and 20.8 for SiO, I_M and I_X being the ionization potentials of the atoms, and E_e the electronic energy of the excited molecular state (all in electron volts). Secondly, the ratio $\omega_e' / \omega_e'' = 0.697$ for SiSe, as compared with 0.683 and 0.686 for SiS and SiO. Finally, the ratio $(\omega_e \text{ of SiSe}) / (\omega_e \text{ of SiS})$ has the values 0.790 and 0.774 for the excited and ground states respectively, as compared with 0.778 and 0.873 respectively for $(\omega_e \text{ of CSe}) / (\omega_e \text{ of CS})$.

Judged by the data for related band systems in this group, the value 3.24 for $x_e' \omega_e'$ in SiSe is surprisingly large; the discrepancy is due to the existence of perturbations in one or more of the excited vibrational levels $v' = 3, 4$ and 5, and the consequent difficulty in evaluating $x_e' \omega_e'$ correctly. With this one exception the coefficients are of the same orders of magnitude as those of the iso-electronic molecule GeS).

Work on the corresponding system of SiTe by an analogous method is in hand.

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¹ Rosen, B., and Désirant, M., C.R., Paris, 200, 1659 (1935).

² Walker, J. W., Straley, J. W., and Smith, A. W., Phys. Rev., 53, 140 (1938).

³ Barrow, R. F., and Jevons, W., NATURE, 141, 833 (1938); and forthcoming paper.

Structure of the Triterpenes

THE tetracyclic triterpene alcohol basseol, which readily cyclizes to give β -amyrenol¹, which in its turn is related to erythrodiol, gypsogenin and hederagenin², on dehydrogenation with selenium gives as major product a phenanthrene homologue, m.p. 125° (Found: C, 92.7; H, 7.2. C₁₇H₁₆ requires C, 92.7; H, 7.3; C₁₈H₁₈ requires C, 92.25; H, 7.75 per cent), characterized as its picrate, m.p. 165° (Found: C, 61.7; 61.8; H, 4.2, 4.3; N, 9.3. C₂₃H₁₉O₇N₃ requires C, 61.45; H, 4.3; N, 9.35; C₂₄H₂₁O₇N₃ requires C, 62.2; H, 4.6; N, 9.1 per cent). It is apparently identical with the hydrocarbon "C₁₈H₁₈" obtained by Ruzicka, Hösli and Ehmman³ from hederagenin. Our analyses favour a trimethyl- rather than a tetramethyl-phenanthrene formulation, but the latter cannot be excluded. The hydrocarbon gives a marked depression in melting point on admixture with 1:6:7-trimethylphenanthrene, and