Table 1. NEUTRON CAPTURE IN THE ISOTOPES OF SAMARIUM

Samarium isotopes at 30 (±7) keV

A	N(Atom%)	Class	σ_c(mb)	$N_s\sigma_c$	N_s	N_r	A
144	2·87	$p(m)$	119± 55				
147	14·94	rs	1,173±192	(2,850)	2·4±0·4	12·5±0·4	147
148	11·24	s–0	258± 48	2,930±540			
149	13·85	rs	1,622±279	(2,850)	1·8±0·3	12·1±0·3	149
150	7·36	s–0	370± 72	2,770±535			
152	26·90	rs	411± 71	(2,850)	6·9±1·0	20·0±1·0	152
154	22·84	r–0	325± 61	0	0	22·84	154

The production process (column 3) is from ref. 1. The r-process abundances are derived by assuming $N_s\sigma_c$ constant for all the isotopes of samarium.

more sensitive indicator is found in the $N\sigma_c(150)/N\sigma_c(148)$ ratio. First, the r-process is shielded, and secondly the abundance of samarium-150 is only about half that of samarium-149. The samarium-149 depletion is then:

$$\frac{\Delta N\,(149)}{N\,(149)} = \frac{7{\cdot}36}{13{\cdot}85}\,[(1{\cdot}02 \pm 0{\cdot}06) - 1]$$

which gives an upper limit of 4 per cent for selective depletion, applicable to solar system material as discussed here. It should be mentioned[7] that inclusion of minor secondary processes such as (p,γ) and (γ,n) reactions and neutron resonance effects can increase the uncertainties in this limit by perhaps a factor of two.

In summary the following conclusions may be drawn from the samarium results.

(1) The near equivalence of $N\sigma_c$ for samarium-148 and samarium-150 is in excellent agreement with the predictions of Burbidge *et al.*[1].

(2) At the same time these results provide some constraints for nucleosynthesis models[1,2].

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[1] Burbidge, E. M., Burbidge, G. R., Fowler, W. A., and Hoyle, F., *Revs. Mod. Phys.*, **29**, 547 (1957).
[2] Fowler, W. A., Greenstein, J. L., and Hoyle, F., *Geophys. J. Roy. Astron. Soc.*, **6**, 148 (1962).
[3] Macklin, R. L., Inada, T., and Gibbons, J. H., *Nature*, **194**, 1272 (1962).
[4] Clayton, D. D. (private communication).
[5] Murthy, V. R., and Schmitt, R. A., *J. Geophys. Res.* (in the press).
[6] Pattenden, N. J. (unpublished results).
[7] Fowler, W. A. (private communication).

A New $^2\Pi$–$X^2\Pi$ Band System of Nitrogen Sulphide

THE spectrum of nitrogen sulphide is excited by means of a micro-wave oscillator of 2,450 Mc/s in sealed quartz discharge tubes containing a few mm of nitrogen and traces of sulphur. Besides the β- and γ-bands, a number of hitherto unassigned bands, degraded to the red, are recorded in the region 2650–2850 Å. These are photographed on a 6·6-m concave grating spectrograph in the second order at a dispersion of 0·57 Å/mm. Rotational structure of seven bands has been analysed and the results are reported in the present communication.

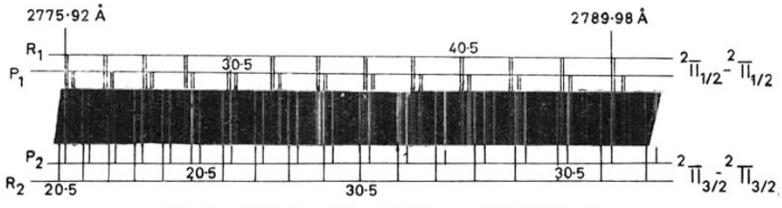

Fig. 1. $(v' + 1) - 0$ band of the new $^2\Pi$–$X^2\Pi$ system

Each band consists of two sub-bands with an average separation of 107 cm^{-1}. One such band at 2775 Å is shown in Fig. 1, where the rotational structure of the two sub-bands extends towards the longer wave-lengths as indicated by leading lines. The sub-band shown at the top in the spectrogram has two P and two R branches while the other sub-band with leading lines drawn below has only single series of P and R branches. Such a doubling in the case of P and R branches of only one sub-band is obtained in the $^2\Pi_{1/2}$–$^2\Pi_{1/2}$ component of a $^2\Pi$–$^2\Pi$ transition with an appreciable Λ-type doubling in the $^2\Pi_{1/2}$ states while in the $^2\Pi_{3/2}$–$^2\Pi_{3/2}$ component the Λ-doubling is negligible.

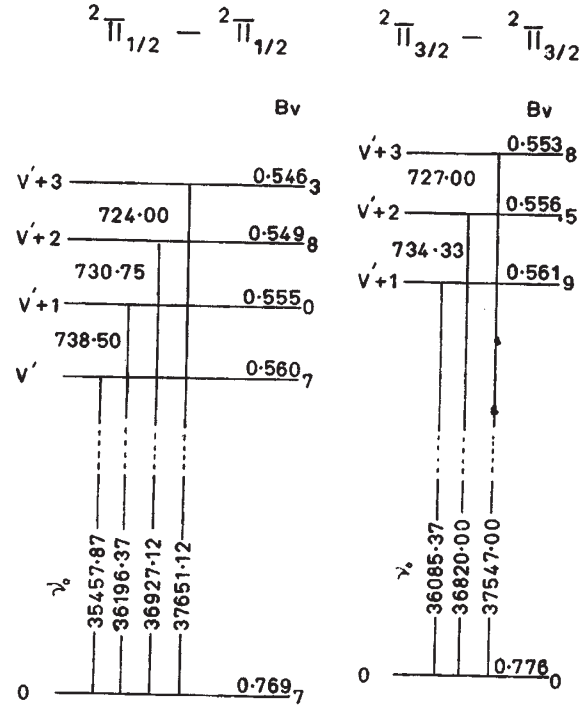

Fig. 2. Energy-level diagram of the vibrational levels of the $^2\Pi$–$X^2\Pi$ band system

Four bands of $^2\Pi_{1/2}$–$^2\Pi_{1/2}$ and three of $^2\Pi_{3/2}$–$^2\Pi_{3/2}$ transitions have been analysed and their respective vibrational levels are given in an energy-level diagram in Fig. 2. It is found that all the bands arise from different initial vibrational levels to the $v'' = 0$ level of the final $^2\Pi$ state. The band system belongs to a $^2\Pi$ (a)–$^2\Pi$ (a) transition with large spin-splitting in both the states. A comparison of the $\Delta_2F''_1$ $(J + 1/2)$ and $\Delta_2F''_2$ $(J + 1/2)$ values, that is, $R(J - 1) - P(J + 1)$, of the $^2\Pi_{1/2}$ and $^2\Pi_{3/2}$ sub-states of the final $^2\Pi$ level with those obtained for the $v'' = 0$ of final levels of the β- and γ-systems[1,2] shows good agreement, thereby indicating that all the three band systems have the $^2\Pi$ ground state as the common final level.

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[1] Barrow, R. F., Drummond, G., and Zeeman, P. B., *Proc. Phys. Soc.*, **67**. A, 365 (1954).
[2] Zeeman, P. B., *Canad. J. Phys.*, **29**, 174 (1951).