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Isotope shift studies in the spectrum of boron monosulphide

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Abstract. The spectrum of boron monosulphide has been excited in microwave discharge and photographed at moderate dispersion. The $C^2\Pi_r$–$X^2\Sigma^+$, $B^2\Sigma^+$–$A^2\Pi_i$ and $A^2\Pi_i$–$X^2\Sigma^+$ band systems extending from 2100–9000 Å have been obtained for $B^{32}S$ and $B^{34}S$ species. Isotope shifts for all these band systems have been measured. Comparison of the observed isotope shifts with the theoretically calculated isotope shifts confirms the emitter as well as the vibrational assignments of all these band systems.

Keywords. Emission band spectrum; boron monosulphide; isotope shifts.

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1. Introduction

Boron monosulphide molecule has an extensive electronic band spectrum in the 2200–9000 Å region in which several band systems have been identified:

$A^2\Pi_i$–$X^2\Sigma^+$ (4300–9000 Å), $B^2\Sigma^+$–$A^2\Pi_i$ (4900–5050 Å),

$C^2\Pi_r$–$X^2\Sigma^+$ (2400–2900 Å), $D^2\Delta_i$–$A^2\Pi_i$ (3100 Å),

$F^2\Delta_r$–$A^2\Pi_i$ (4100 Å) and $E^2\Sigma^+$–$X^2\Sigma^+$ (2100–2300 Å).

Although vibrational and rotational structure analyses of several of these band systems have been carried out, (Zeeman 1951; McDonald and Innes 1969; Singh *et al* 1971; Bell and McClean Megan 1976; Jenouvrier and Pascat 1981), extensive isotope shift studies of this spectrum have not so far been carried out. The isotope shift studies help identify the emitter of the spectrum as well as provide a check on the correctness of the vibrational assignments in various electronic band systems. We have taken up the isotope shift studies of this molecule by exciting the spectra of $B^{32}S$ and $B^{34}S$ in microwave discharge and by recording the spectrum under moderate dispersion (5·6 Å/mm). We have obtained experimental isotope shifts and compared them with the corresponding theoretical shifts for various band systems. The details of these studies are presented in this paper.

2. Experimental details

The spectra of $B^{32}S$ and $B^{34}S$ molecules have been excited by microwave discharge (200 Watt, 2450 MHz) through a sealed quartz discharge tube containing small