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An attempt of identification of barium hydride molecular lines in sunspot umbral spectra(Article)

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Abstract

A high-resolution sunspot umbra spectrum recorded in National Solar Observatory, Kitt Peak in the visible and infrared wave number range 13, 600 – 25, 000cm^{-1} was taken in the present study for identifying the rotational lines of barium hydride (BaH) molecule. Number of chance coincidences was evaluated for the A $^2\Pi_{1/2}$ – X $^2\Sigma$ ((0,0), (1,1), (2,2), (1,0), (2,1)), A $^2\Pi_{3/2}$ – X $^2\Sigma$ ((0,0), (1,1), (2,2)), B $^2\Pi_{1/2}$ – X $^2\Sigma$ (0,0), B $^2\Pi_{3/2}$ – X $^2\Sigma$ (0,0), C $^2\Sigma$ – X $^2\Sigma$ ((1,1), (1,0), (2,2), (2,1), (3,2)) and D $^2\Sigma$ – X $^2\Sigma$ ((1,0), (2,0), (3,0), (4,0), (5,0), (8,0), (9,0)) band systems of BaH using line identification procedure. The obtained number of chance of coincidences was compared with I- parameter values. The highly resolved rotational lines were chosen to evaluate equivalent widths using triangle approximation method. The effective rotational temperatures were calculated for the bands (0,0), (1,1), (2,2) and (2,1) of A $^2\Pi_{1/2}$ – X $^2\Sigma$, (0,0) (1,1) and (2,2) of A $^2\Pi_{3/2}$ – X $^2\Sigma$, B $^2\Pi_{1/2}$ – X $^2\Sigma$ (0,0) and B $^2\Pi_{3/2}$ – X $^2\Sigma$ (0,0) of BaH molecule. The rotational temperature values calculated for these bands were found to be in the range 1185 – 3514 K. They were also compared with the already reported sunspot temperatures. © 2020

Author keywords

BaH molecule | Line width | Rotational temperature | Sunspot spectrum

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