EQUIVALENT WIDTHS OF MOLECULAR LINES IN ETA AQUILAE

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Using Dawe's model atmospheres the equivalent widths of R_1 line belonging to the 0—0 band of the electronic transition $B^2\Sigma^+ - X^2\Sigma^+$ of the CN molecule were calculated for various phases of light variation in ηAql. The equivalent width variation shows a good correspondence with the model effective temperatures. A comparison with our earlier results shows that the sensitivity of the strength of molecular lines to the variations with phase of the run of temperature with depth in ηAql atmosphere decreases in the order CO, CN, C_2 and CH.

Эквивалентные ширины молекулярных линий в спектре η Aql

С использованием модели атмосферы Dawe вычислена для разных фаз кривой блеска η Aql эквивалентная ширина линии R_1, относящейся к полосе 0—0 электронного перехода $B^2\Sigma^+ - X^2\Sigma^+$ молекули CN. Изменения эквивалентной ширины находятся в хорошем соответствии с моделью эффективных температур. Сравнение с нашими более ранними результатами показывает, что чувствительность интенсивности молекулярных линий к вариациям с фазой изменения температур с глубиной в атмосфере η Aql уменьшается в последовательности CO, CN, C_2 и CH.

Introduction

Our earlier investigations (Pande and Joshi, 1973; Bondal et. al., 1973; Joshi et. al., 1973) were aimed at understanding the role which the molecular lines can play in refining the theoretical model atmospheres for ηAql. In the present analysis we consider the case of CN and combine the results of the present and earlier investigations with a view to discuss the sensitivity of the strength of molecular lines to the phase variation of the run of temperature with depth in ηAql atmosphere and the extent to which the observations of molecular lines can refine the Dawe's (1968) preliminary model atmospheres. The significance of such investigations has already been discussed by Pande et. al. (1972).

Calculations and Results

For the present equivalent width calculations for various phases of light variation in ηAql, we selected the violet system λ3825.307 A line of CN molecule, belonging to the R_1 branch of the 0—0 band. Dawe's (1968) model atmospheres have been used.

The procedure for the above calculations is the same as outlined by Pande and Joshi (1973). The results of all the previous investigations and the present one are summarised in Table 1 and Figs. 1 and 2. In Table 1, the wavelengths of the lines of CO, CN, C_2 and CH are respectively 23023.9 A, 3825.307 A, 5136.256 A and 4313.662 A and the dissociation potentials D_0 in electron volts, of these molecules are from Tatum (1966).

Table 1

Phase (Φ)	Effective temperature from Dawe's models in degrees Kelvin	CO $D_0 = 11{\cdot}09$	CN 7·5	C_2 6·25	CH 3·47
		Equivalent width W in mA			
·68	5330	4	175	27	20
·556; ·75	5470	—	108	—	16
·35; ·85	5820	—	23	—	7
·15; ·90	6040	—	14	—	4
0·0	6500	·02	4	·94	1

An inspection of Fig. 1 shows that for various molecules the ratio (W_{min}/W_{max}) of the equivalent widths of the selected lines at minimum and maximum phases decreases with the decrease in the dissociation energy. Though CO shows largest (W_{min}/W_{max}) value but its predicted equivalent widths are so small that it cannot be considered a suitable molecule for investigating the changes with phase in the physical conditions in ηAql atmosphere. The lines belonging to CN have appreciably large equivalent widths at all phases (cf., Fig. 2) and are fairly sensitive to the temperature changes in the star's atmosphere in the region of formation of CN lines. In this sense, C_2 lines are less sensitive and CH lines still less so. However, we should bear in mind that the depth of formation of these molecular lines will increase in the order CO, CN, C_2 and CH and the information derived from these lines will refer to the corresponding depths of formation.

In brief, it would be worthwhile to carry out

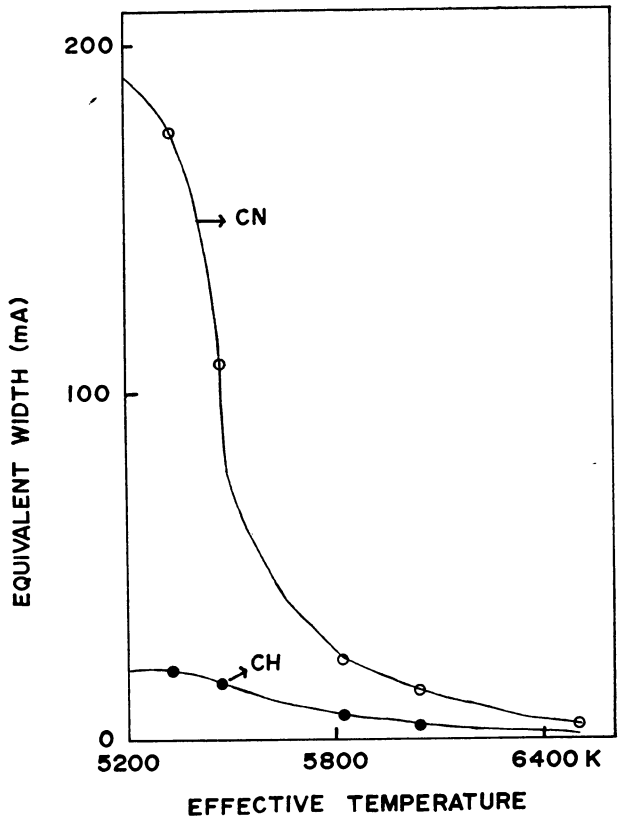

Fig. 1. The dependence of log (W_{min}/W_{max}) on the dissociation potential.

spectroscopic observations of these molecular lines at fairly good dispersion (preferably at less than 10 A/mm) so that an actual comparison of the predictions with the observations may lead to a refinement of Dawe's (1968) model atmospheres.

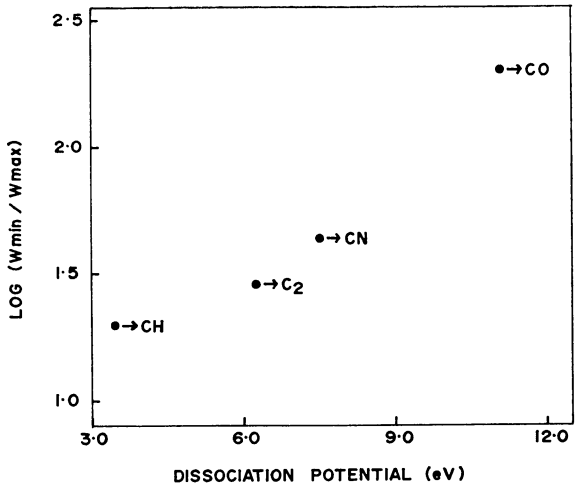

Fig. 2. Variation of equivalent width of the CN and CH lines with the phase variation of the effective temperature of η Aql.

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BOOK REVIEWS

VISTAS IN ASTRONOMY, Vol. 15.

Edited by Arthur Beer, published by Pergamon Press, Oxford—New York—Toronto—Sydney—Braunschweig; 192 pp.; price £ 9·00.

As usually, this further volume of Vistas in Astronomy consists of several articles by famous authors. Each of which presents a compendium of contemporary knowledges and problems of some branch of astronomy.

Nine authors contributed to this book. The first chapter (Astronomy, the people and the governments) by J. - C. Pecker is devoted to serious problem of contacts with governmental bodies. The next article (Computer simulations of star cluster dynamics) by S. J. Aarseth is intended as an introduction to numerical studies of small self-gravitating stellar systems. The author discuss the computations of evolution of cluster models containing 250 and 500 members. The contribution of G. Worrall and A. M. Wilson (Velocity fields in stellar atmospheres and the concept of mictoturbulence) concerns the problem of existence of small scale velocity fields and microturbulence in stellar atmospheres. J. D. McGee (Image tubes in astronomy) summarizes the principles of electronography and the application of image tubes in astronomy. Three representative instruments are discussed: Lallemand's electronic camera, Kron's, U.S. Navy, electronographic tube and the spectracon. R. E. Nather (High — speed photometry) presents the principles of the photometry of astronomical objects with a time resolution between 10 μ sec and 10 sec and describes the computer-based system of McDonald Observatory. He summarizes the results of the observations of nova remnants, U Gem stars, lunar occultations, planeraty occultations,