INTERSTELLAR LINES OF CH^+ IN THE SPECTRUM OF EPSILON AURIGAE

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Two of the three sharp interstellar lines[1,2] of CH^+, λ4232.54 and λ3957.70, have been identified on coudé spectrograms of ε Aurigae obtained by O. Struve at the 100-inch telescope of the Mount Wilson Observatory (dispersion 2.8 A/mm). The third line[3] at λ3745.31 falls very close to a strong *Fe* I line and thus cannot be observed (Plate XVIII).

These two lines are very sharp and faint, in marked contrast to the broad, sometimes quite diffuse, character of the normal stellar lines of the F5 star. The visibility of such lines depends greatly upon the contrast of the photographic plate. However, they were definitely present or suspected on twelve out of seventeen plates of ε Aurigae taken by Struve since 1950. The contrast of the five plates upon which the lines were not seen was either too weak or too strong to show such fine features.

Radial velocities of the two sharp CH^+ lines, corrected to the sun, were measured on six plates. The results are given in Table I. The intensities shown are arbitrary, 2 indicating a line very easily visible, 1 indicating the faintest line which is well visible, and 0 indicating a line on the limit of visibility. The radial velocity of the star, corrected to the sun, is included for reference, although it is only provisionally determined from a few stellar lines near the two CH^+ lines. The measures strongly indi-

TABLE I

Plate	Date	*CH*+4232.54 Rad. Vel.	*CH*+4232.54 Int.	*CH*+3957.70 Rad. Vel.	*CH*+3957.70 Int.	Star Rad. Vel.
Cd 7610	1951, Oct. 22	+2.2 km/sec	2	−1.8 km/sec	1	+10.0 km/sec
Cd 8534	1952, Dec. 7	+2.3	2	−1.9	1	+19.7
Cd 8619	1953, Jan. 30	+0.4	1	+0.6	1	+12.2
Cd 8837	1953, Aug. 20	+1.6	1	+1.4	0	+13.0
Cd 9132	1954, Mar. 13	+0.2	2	+3.3	0	+10.5
Cd 9151	1954, Mar. 16	+2.0	2	+0.0	1	+13.1
	Average	+1.4		+0.3		

cate a stationary velocity for CH^+ of $+0.9 \pm 1.0$ km/sec, the average for both lines, which is very different from the large positive velocity of the stellar lines at this phase of the 27.1-year cycle.

The fundamental question of whether these lines are really interstellar or circumstellar can probably not be answered at this stage, although a few remarks relative to this problem might be made. From the interstellar lines in the spectra of O and B stars in the same region of the sky and at about the same distance (250 parsecs) as ε Aurigae, Adams[4] finds velocities of +8 to +13 km/sec for the interstellar clouds, which does not agree with the velocity of +1 km/sec found for the CH^+ lines in ε Aurigae. However, one star, χ Aurigae, shows the following velocities for the interstellar material:

Ca II	0.0, +10.6 km/sec
CH	+9.6 "
CH^+	+5.3 "

The position of this star compared to that of ε Aurigae is:

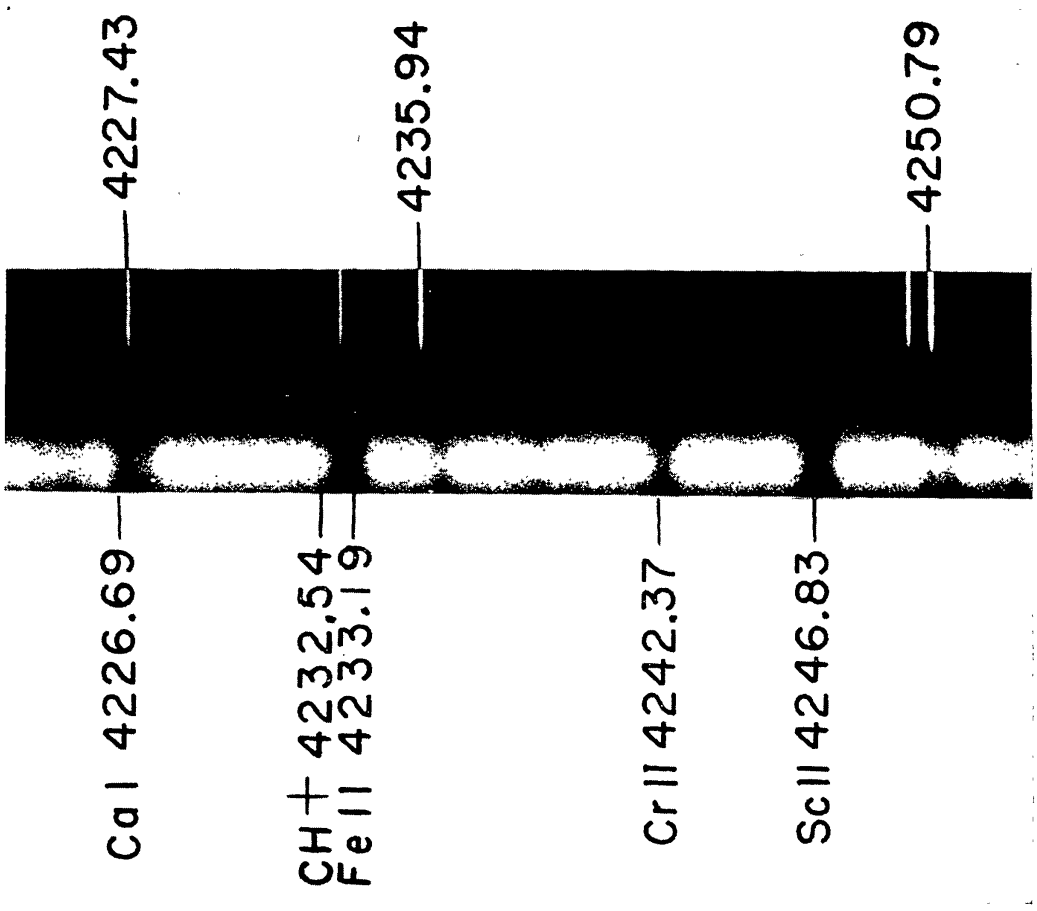
	α 1900	δ 1900
ε Aurigae	$4^h\ 54^m.8$	43° 41′
χ Aurigae	5 26.2	32 7

Other stars closer to ε Aurigae than χ Aurigae do not show the low velocity clouds. From measures of Yerkes Observatory plates Kuiper, Struve, and Strömgren[5] find the γ velocity of ε Aurigae to be −2.5 km/sec, which agrees a little better with the stationary velocity of the CH^+ lines. Finally, Struve[6] has observed circumstellar lines of *Ca* II in the spectrum of ε Aurigae. The average velocity for the H and K lines was −27.6 km/sec. Therefore, if the CH^+ does originate in a circumstellar cloud, the velocity characteristics of this cloud must be very different from those of the circumstellar *Ca* II cloud.

Most of the other sharp interstellar absorption lines in McKellar's list[7] fall too near strong stellar features to make any further identifications of this kind easily possible.

I wish to express my appreciation to Dr. Otto Struve for making these high dispersion Mount Wilson plates available to me.

PLATE XVIII



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