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HYDROGEN EMISSION IN THE DIRECTION OF h AND χ PERSEI

L. V. MIRZOYAN, M. MARSELAN, A. T. GARIBJANIAN, J. BOULESTEIX, A. L. MIRZOYAN, Y. M. GEORGELIN

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The results of the Fabry-Perot observations in h and χ Persei region are presented. The intrinsic H_α emission is detected apparently comming from the OB-association situated on the distance of about 1200 pc. The intensity of the detected H_α-emission is estimated to be around 8 Rayleighs which gives in more usual units an intrinsic monochromatic brightness about $2 \cdot 10^{-6}$ $erg \cdot cm^{-2} \cdot s^{-1} sr^{-1}$.

1. *Introduction*. It is well known that the Perseus OB1 association observed in the h and χ Persei region is the only one which is not connected with some diffuse nebula. While, a high abundance of OB-stars in this association shows that the star formation process in it is still going on. Therefore, the absence of diffuse matter in this young system where star formation is not finished yet seems to be a mystery.

Recently a joint study of the distributions of OB—stars and absorbing matter in the direction of h and χ Persei region has allowed us to find out that the Perseus OB1 association is in fact a superposition of two OB—associations, projected one upon the other [1, 2]. The distance between them is about 1000 pc which excludes any physical connection of these associations. It is important for us that the absorbing matter in the direction of h and χ Persei is concentrated completely in associations [1].

The presence of absorbing matter (dust) in the considered OB—associations gives us some grounds to hope that a gaseous matter also exists in them.

In this paper we present the results of a search of the gaseous matter in the direction of the h and χ Persei region.

2. *Observations*. For the detection of the ionized hydrogen emmision in the direction of the h and χ Persei clusters, supposed to be nuclei of the Perseus OB1 association, interferometric observations were carried out. The scanning Fabry-Perot interferometer "Cigale" of the Marseille

Observatory [3, 4] mounted on the 2.6m telescope of the Byurakan Astrophysical Observatory was used.

We have made attempts to detect an emission of the ionized hydrogen in the direction of h and χ Persei. The coordinates of the field center which we observed are: $\alpha(1985) = 2h$ 19 min 08 s; $\delta(1985) = =57°06'10''$. Its orientation is given in Fig. 1.

The first attempt was made at H_β wavelength (August 25, 1985). The result of this observation was negative. During 3200 seconds no appreciable signal was obtained. This result showed that if there really exists some emission of the ionized hydrogen in the direction of h and χ Persei it must be very faint.

The next attempt to detect the expected emission was made at H_α wavelength (September 14, 1985). Because of the faintness of the emission we wanted to detect, this observation was carried out with fixed spacing of the Fabry-Perot interferometer plates, that is without scanning. The interference filter used for this observation was centered at the wavelength 6564A with a FWHM=10A. The exposure time of the H_α observation was longer than of the H_β observation—6000 seconds. For this reason the images of stars on this plate are somewhat trailed. This attempt was quite successful. The H_α emission we tried to detect is observed clearly, at least, on the central ring of the obtained interferogram.

3. *Results.* The detected H_α emission registrated clearly on the central ring contains the following three components (Fig. 1):

1. The brightest ring is also the innermost one. It is due to the geocoronal emission at H_α (6562.78A) to which was added the H_α emission of the local arm of the Milky way, brought to the same wavelength because of the earth motion.

2. The second ring, corresponds exactly to the expected H_α emission. This emission of the ionized hydrogen is due to the matter situated in the direction of the h and χ Persei. Its mean radial velocity is equal to approximately —30 $km \cdot s^{-1}$ (heliocentric).

3. The third, outermost ring is the faintest. This ring is due to a night sky line of OH at 6568.7A The free spectral range of the interferometer, that is the wavelength difference from one to the following ring of the same spectral line, is equal to 8.2A. This makes our assumption quite probable. Indeed in this case one of the interference patterns can appear at 6560.5A, just one quarter of spectral range outside H_α.

For the determination of the radial velocities of the detected H_α emission, the emission lines of the H_α geocoronal emission and the OH night sky emission were used as comparison ones.

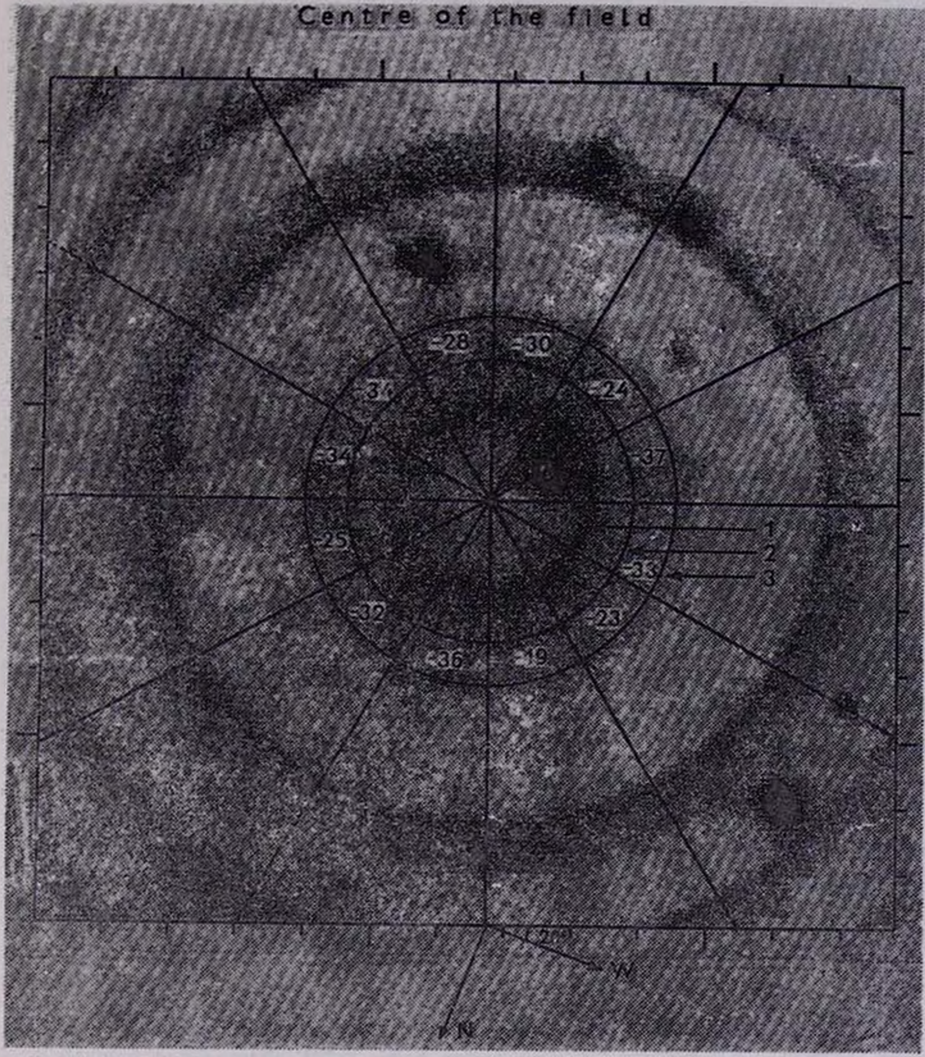

Fig. 1. Heliocentric radial velocities of the H_α emission in the direction of the h and χ Persei region, measured in sectors of 30°. Orientation of the observed field (Image inverted) and sizes of it are given in Fig. 1. The components of the observed emission are: 1. H_α emission of geocoronal nature to which was added the emission of the local arm of the Milky Way. 2. H_α emission we wanted to detect, and 3. OH emission due to the night sky line at 6568.7A.

The radial velocities of the ionized hydrogen emission in the direction of h and χ Persei have been measured in sectors of 30°, averaging the obtained signal for them. The precision of the measurements of these radial velocities is equal to $+10$ km·s^{-1}. The obtained mean radial velocities of the H_α emission are presented in Fig. 1.

The measurements of radial velocities were possible only for the first central interference ring where the different lines are separated enough. They were almost impossible for other rings.

The average value for the heliocentric radial velocity of the detected H_α emission is found to be -30 ± 6 km·s^{-1}.

It can be added that we succeeded to obtain a rough estimate of the detected H_α emission intensity by its comparison with the emission of the neighbouring nightskylines. Such an estimate had been already made in the case of the bridge connecting Small and Large Magellanic Clouds (SMC and LMC) [5].

Assuming that for the H_α geocoronal emission the typical intensity is 10 Rayleighs [6] the authors of the paper [5] have found for the intensity of the OH 6568.7A line about 8 Rayleighs in the SMC-LMC bridge.

The geocoronal H_α emission observed in the case of the h and χ Persei is however 2—3 times brighter than OH—emission in this line. In fact the observed H_α coronal emission is reinforced by superposition of the H_α emission originated in the local arm of the Milky Way (probably with the same order of intensity). Normally found about -15 km·s^{-1} (heliocentric) it was brought almost in coincidence with the geocoronal H_α emission at the data of the observation since the solar reduction was $+20$ km·s^{-1}. At the same time the intensity of the H_α —emission in h and χ Persei is almost equal to the intensity of the OH – emission.

Thus we can conclude that the following components are observed on Fig. 1:

1. The central ring produced by superposition of two H_α emissions: geocoronal (~ 10 Rayleighs) and from local arm of the Milky Way (~ 10 Rayleighs). Thus total intensity of these emissions is equal to $\sim$ $\sim$20 Reyleighs.

2. The second ring produced by H_α emission from h and χ Persei with intensity equal to ~ 8 Reyleighs.

3. The third ring produced by the nightskyline OH 6568.7A with the same intensity (~ 8 Rayleighs).

Consequently, the intensity of the H_α emission detected in h and χ Persei must be around 8 Rayleighs, which is in more usual units an intrinsic monochromatic brightness about $2 \cdot 10^{-6}$ erg. $cm^{-2} \cdot s^{-1} \cdot sr^{-1}$ or $2 \cdot 10^{-9}$ $J \cdot cm^{-2}$. s^{-1}. sr^{-1}.

4. *Discussion*. From the point of view of the obtained result it is very important to clear up the question whether the detected H_α emission is originated in the considered OB—associations or in the interstellar medium.

The only possibility to solve this problem is the comparison of the radial velocities of these OB—associations and of the interstellar medium with that of the detected H_α emission.

According to the paper [2] the radial velocities of the OB—associations in the direction of the h and χ Persei region are equal to -35.90 ± 12.63 and -44.59 ± 8.35 $km.s^{-1}$, respectively.

On the other hand, the radial velocity of the ionized hydrogen assumed to be more or less distributed in interstellar space due to galactic rotation can be estimated by Oort's formula [7]. For the distance $r = 1600$ pc of the middle between the censidered OB—associations it is equal to about -25 $km \cdot s^{-1}$.

All these radial velocities are close to the mean radial velocity of the detected H_α emission obtained by us -30 $km.s^{-1}$. Therefore, comparison of radial velocities do not allow us to solve the above-mentioned question.

Nevertheless, taking into account that the intensity of radiation of the farther OB—association must be about four times fainter than that of the nearer one and the fact that absorbing matter is concentrated in those associations [1] it seems to us that the detected H_α emission comes mainly from the nearer OB—association.

Byurakan Astrophysical Observatory
Marseille Observatory, France

ВОДОРОДНОЕ ИЗЛУЧЕНИЕ В НАПРАВЛЕНИИ h И χ ПЕРСЕЯ

Л. В. МИРЗОЯН, М. МАРСЕЛАН, А. Т. ГАРИБДЖАНЯН, Ж. БУЛЕСТЕКС, А. Л. МИРЗОЯН, И. М. ЖОРЖЕЛАН

Представлены результаты Фабри-Перо наблюдений в области h и χ Персея. Обнаружено внутреннее H_α излучение, идущее, по-видимому, из OB-ассоциации, расположенной на расстоянии около 1200 пк. Оценена интенсивность обнаруженного H_α излучения—около 8 Релея, что соответствует монохроматической яркости, равной $2 \cdot 10^{-2}$ эрг. $см^{-2}$. $с^{-1}$. $ср^{-1}$.

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