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INTENSITY VARIATIONS OF H_α AND [N II] 6 583 A LINES IN THE NIGHT SKY SPECTRUM

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SUMMARY

The strong intensity variations of the lines H_α and [N II] 6 583 A in the spectrum of the night sky are often the result of passage of galactic regions H II in the field of spectrographs. The line H_α , emitted in the interplanetary space or, more probably, in the upper atmosphere, can be isolated only outside the Milky Way.

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1. The study of intensity variations of the line H_α in the night sky spectrum was pursued at the Haute-Provence Observatory (53°56'N.lat., 23 E long.) with the aid of the grating spectrograph described in a preceding Note [1], the dispersion being 48 A/mm). A preliminary slight fogging of films Eastman 103aE allowed us to abridge the exposures and to obtain a spectrum in a single night. We thus obtained 28 spectrograms during the moonless nights from 12 January to 17 July 1961, by aiming at 15° of the North horizon.

All show the fine H_α line between the rotation lines $P_1(3)$ and $P_2(4)$ of the band (6.1) of OH (Fig.1). Its intensity increased rather reglarly from January to March and passed through a maximum around the April newmoon (between 9 and 18 April). It then decreased more rapidly, seemingly having stabilized in June-July. On 16 and 18 April the photographic intensity of the line H_α had almost reached that of the line [O,I] 6 364 A (Fig.1b).

Basing ourselves upon the absolute average intensities of the lines of the band (6.1) given by G. Kvifte [3], one may consider that at 15° of the horizon North the intensity of H_α roughly varied from 5 to nearly 20 Rayleighs. This is exactly the amplitude found under analogous conditions by V. S. Prokudina at Zvenigorod (51°03' Lat.N) [4]. R. X. Haynoullina and Z. V. Kariahina [5] have measured at Alma-Ata in December 1957 and January 1958 for H_α at 20° from the horizon intensities comprised between 4.1 and 6.4 Rayleighs.

(*) Sur les variations d'intensité des raies H_α and [N II] 6 583 A dans le spectre du ciel nocturne.

The line [N II] 6 583 A, visible on 15 of our negatives (January to May), is found to be enhanced simultaneously with the line H_α, as already noted by Kvifte [3] when he mentioned for the first time the presence of [N II] lines in the night sky spectrum. It is the sole radiation between 5 500 and 6 700 A of which the intensity seems to be related to that of the line H_α.

The covariance of the lines H_α and 6 583 A naturally leads one to suspect the intervention of galactic regions H II, where the emission of forbidden lines of ionized nitrogen generally accompanies that of hydrogen lines [6]. Their role may be important by virtue of the rather limited field of our spectrograph. Taking account of the angular aperture of the collimator, directly aimed at the sky, and of the length of the horizontal slot, the useful region of the sky corresponds to an area of slightly more than 30 degrees-square (4.5° in height and about 7° in azimuth) and the regions H II of declinations between 58°45' and 63°15' may cross the field in a little more than one hour.

Had they been uniformly distributed, as an average, between two small circles parallel to the galactic plane, the intensity of H_α would be proportional to the duration of the passage of the zone considered in the field. The curves plotted by calculating for various epochs the duration of passage of the galactic zone comprised between the latitudes +10° and −10° (for example) resemble effectively to the curve representing the variations of H_α as a function of time: same gradual increase from January to April, same more rapid decrease afterward. The duration of the passage is maximum during the second fortnight of April.

The brillant and extended regions of H II likely to pass in the field are restricted in number. Reference is principally made to the group of nebulosities near N.G.C. 7635 ($\alpha \simeq 23\,h\,18\,m$, $\delta \simeq +60°\,49'$, 1961,), near I.C. 1805 ($\alpha = 2\,h\,31\,m$, $\delta = +61°\,20'$) and near I.C. 1848 ($\alpha = 2\,h\,54\,m$, $\delta = +61°\,18'$). The first group intervenes from January to the end of April, I.C. 1805 from February to the beginning of June, and I.C. 1848 from March till about 15 June. The duration of the passage is maximum for these regions in March-April.

We thus believe that the intensity variation of the line H_α, observed in the Haute-Provence in the spring of 1961, stems at least in greater part from the !assage of galactic regions H II. However, since the Milky Way no longer passes in the field in July, the line H_α observed during that time and of which the intensity is weak and little variable, must indeed be of atmospheric. geocoronal or interpanetary origin.

3. Our measurements of radial velocity on the line H_α seem to corroborate these conclusions despite their being of little precision. They seem significant when the line is strong. On 16 and 18 April we find −23 and −18 km/sec. Taking into account the orbital velocity of the Earth at the epoch, the radial velocities measured by G. Courtès [7] by observing the interference rings of the line H_α lead to geocentric velocities −37.2 km/sec for I.C. 1805 and −19.5 km/sec for i.c. 1848. In view of the degree of our measurement precision (of the order of ±10 km/sec), the agreement is rather satisfactory.

The less reliable measurements of February and July negatives give nearly zero radial velocities, as if the "terrestrial" phenomenon were then prevalent.

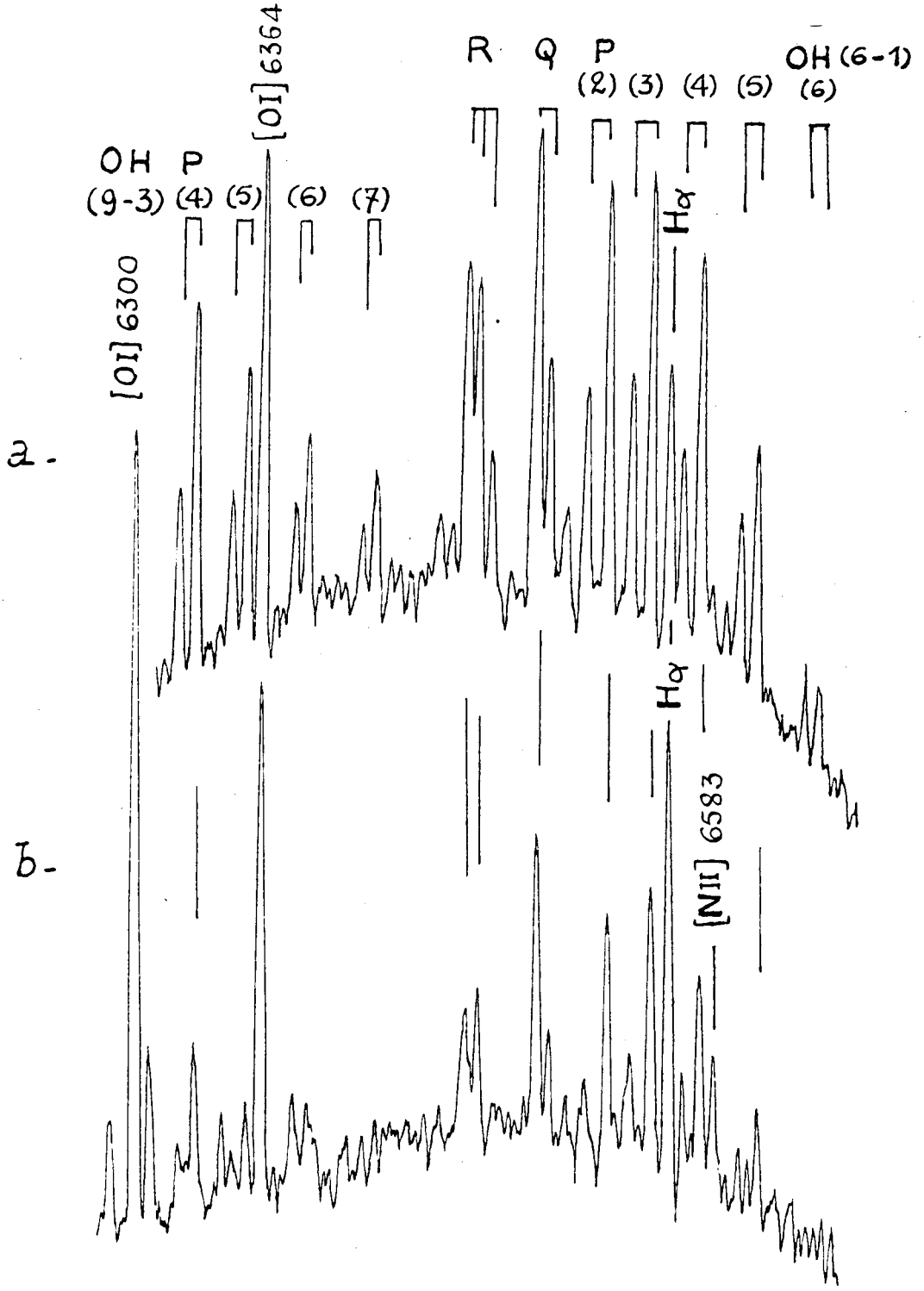

Fig.1.

a) Spectrum of 12 Januaty 1961, exp.of 09h.55 m.
b) Spectrum of 18 April 1961, exp.of 06h.45m.

4. The discussion of Kvifte observations [3] makes still more clearly apparent the contribution of regions H II. Their exposures were made at As (Norway, latitude 59°40' N), at various azimuths and heights, by projecting with the aid of a lens with short focal length the image of the sky on the vertical slot of the fixed spectrograph. The indications given by the author generally allow the identification of the galactic regions observed.

Brillant H II regions have passed in the field during all the exposures where the lines H_α and [N II] 6 583 A are intense and, contrary to author's opinion, the important enhancements of the two lines localized at certain points of the image of the slot, correspond well to the nebulosities of Orion and Cygnus.

We undertook analogous observations by projecting the image of the sky on the slot of our spectrograph mounted on an equatorial table that follows the diurnal motion, with a lens having a very short focus. The first two spectra obtained by aiming near α Cygni (6 and 7 August 1961) show the lines $H\alpha$ and 6 583 A localized near Nebula America. $H\alpha$ is much stronger than the lines [0 I] 5 577 and 6 300 A, that extend uniformly over the entire length of the slot. The duration of exposures (4h.45') was not sufficient to make appear the line H_α outside the nebulosities, not anymore than the bands OH. The weakening of the "terrestrial" line near the zenith seems to be in favor of an atmospheric origin rather than interplanetary or even geocoronal of the line H_α observed near horizon, beyond the Milky Way. It is not known yet whether the lines of [N II] are present in the spectrum of night glow, outside the regions H II.

**** T H E E N D ****

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