Abstract

Auroral forms observed at Syowa Station, Antarctica, are compiled in the form of an atlas. A revised system of classification is used which relates auroral displays to physical mechanisms. Classification is conducted under the following headings ; 1) *Horizontal Extension*, 2) *Form of the Lower Border*, 3) *Homogeneity*, 4) *Vertical Profile*, 5) *Brightness*, 6) *Colour*, 7) *Activity* and 8) *Aspect*.

1. INTRODUCTION

Auroral observation was begun at Syowa Station in 1957 under the Japanese Antarctic Research Expedition. Since that time the observation has been continued except for a period of the closure between 1962 – 1965. Based on the aurorae observed over a period more than six years, results are compiled and auroral forms classified.

Syowa Station (69°00′ S, 39°35′ E) is located at −66.7° lat. and 72.5° long. in corrected geomagnetic coordinates (HAKURA, 1965). This position is slightly on the equatorial side of the average auroral belt in the nighttime (FELDSTEIN, 1966), if the auroral belt in the northern hemisphere is assumed applicable to the antarctic area. Depending on the degree of aeronomical disturbances, various auroral forms typical of the auroral zone can be observed at Syowa Station. Aurorae proper to the polar-cap region (LASSEN, 1967) do not appear at Syowa Station.

The physical significance of auroral displays is increasing in importance with the investigation of upper atmospheric disturbance phenomena in high-latitude regions, which originate in plasma-dynamic processes in the earth's environment.

Classification of aurorae is quite difficult in practice, because of the complicated in form and movement of the auroral display. It is desirable to have a classification of auroral forms based on the physical properties of the auroral display. In the atlas a revised classification based upon the physical characteristics of the auroral forms is proposed so as to aid future research of aurora.

2. CLASSIFICATION

As written in the introduction, it is necessary that physical characteristics of auroral display are defined exactly and uniquely. We have chosen as classification headings the following eight characteristics ; *Horizontal Extension*, *Form of the Lower Border*, *Homogeneity*, *Vertical Profile*, *Brightness*, *Colour*, *Activity* and *Aspect*.

The grouping under *Horizontal Extension* is to indicate the pattern of the precipitating particles causing the aurora. Differences in the precipitating pattern will be revealed further in *Form of the Lower Border*. The internal constitution of an auroral form is delineated by *Homogeneity*, and *Vertical Profile*. *The Vertical Profile* gives a measure of the energy spectrum of the impinging corpuscular flux.

Table 1. Relations between classification items and physical characteristics manifested in auroral display.

Physical characteristics \ Classification headings		Horizontal Extension	Form of the Lower Border	Homogeneity	Vertical Profile	Brightness	Colour	Activity	Aspect
Plasma source	Area	◎	○						○
	Shape	○	◎						○
	Small Scale Irregularity			◎					
	Motion							◎	○
Incoming particle	Energy Spectrum				◎		◎		
	Flux					◎			
	Variation							◎	○

The incoming flux and energy spectrum of auroral particles are also related to both *Brightness* and *Colour*. We give *Activity* indices for motion and brightness variation of auroral forms. Observers of aurorae may be dazzled by the change in aspect of their display and make mistakes in identifying some essential features of aurorae. Various aspects originate mainly from the scale of display and depend upon the position of an observer. Therefore, these factors are also taken into consideration in our classification.

Relations between the headings of classification and physical characteristics manifested in auroral display are illustrated in Table 1. The details of each heading are described in the following.

2. 1. Horizontal Extension

In this atlas we first classify auroral forms according to the dimensions of their lower border or the envelope of the lower border. The lower border of an auroral form can be clearly defined, and so its dimension is an appropriate indicator of the precipitation pattern of auroral particles from the magnetosphere. Therefore, the horizontal extension is an essential factor in classification of auroral forms, implicitly done in many previous classifications. We classify auroral forms into five types ; 1) one having a planar (two-dimensional) lower border, 2) one having a line (one-dimensional) lower border, 3) one with a point-like lower border, 4) one with surface-like lower border, and 5) unidentifiable one.

2. 1. 1. Veil (notation V), A form with a planar (two-dimensional) lower border

Aurorae of this type cover the whole or a large portion of the sky like a luminous veil, uniformly or without a sharp intensity gradient. Aurorae of this type alone usually appear in the stage of low auroral activity. But it is not rare that aurorae of this type are seen simultaneously with those of other types, especially so-called quiet arcs.

Since veil aurorae are usually quite low in brightness, only an experienced observer can detect their appearance from the poor contrast with star-background on a moonless clear night.

On rare occasions, one can observe a crimson veil during severe magnetic storm, as shown in Fig. 1, due to the emission of neutral atomic oxygen forbidden lines [OI] λ6300, 6364A. Spectral features of this red veil are naturally different from those of ordinary ones.

2. 1. 2. Band, A form with a line (one-dimensional) lower border

In this type, the lower border of the aurorae is continuous or continual. The apparent discontinuity is attributed to a spaced alignment of rays or ray-bundles. Though these are grouped under the name *Ray* in "Photographic Atlas of Auroral Forms" (1930), we assign fundamental importance to linear alignment rather than to a single ray or a ray-bundle structure.

Auroral forms of this type are named *Band* in the present classification.

These are divided into two sub-types according to the presence or absence of smal-lscale irregularities such as kinks and folds along the form.

a) Band-A (notation A), A line (one-dimensional) form without horizontal irregularities

Aurorae of this type correspond to those customarily referred to as an *Arc*. It is generally homogeneous in structure and quiet, but a rayed-structure form is not so unusual. It is observed predominantly before geomagnetic midnight. It shifts gradually to lower latitudes with increasing brightness. In many cases it tends to become an aurora of a Band-B type, a more active form, but sometimes retreats poleward again without changing form, and eventually fades out. An ordinary shape of this type is a luminous arch in the sky. Aurorae of this type sometimes extend even from horizon to horizon over the zenith almost parallel to the geomagnetic E–W direction. In such a case, we occasionally observe an irregular fibre-like structure in the aurora, as illustrated in Fig. 6.

Spectral characteristics of this Band-A type aurora are noticeable enhancement of red atomic oxygen lines [OI] λ6300, 6364A against green line [OI] λ5577A and 1 NG of N_2^+-bands.

Examples are illustrated in Figs. 2, 3, 5 and 6.

b) Band-B (notation B), one-dimensional form with horizontal irregularities

Aurorae of this type are ordinarily active and complex. It is, therefore, difficult to give a precise description of the display features of this kind of aurora. Band-B is generally observed as a developed form of Band-A, from a pre-breakup stage to a decay stage of auroral display. Its general trend is for the initial homogeneous form to turn into that with a ray-structure in the course of breakup, and in the post-breakup stage the form becomes meandering and further fragmentary, until it is diffused and changed to a form of the next stage.

The brightness of Band-B ranges widely from I to IV of the International Brightness Coefficient (SEATON, 1954). The colour of Band-B also varies, from time to time. Various forms of this type are shown in Figs. 4 and 7 to 45.

2. 1. 3. Ray (notation R), A form with a point-like lower border

Aurorae of this type correspond to a ray or bundle of rays. Their shapes resemble a luminous column or a wisp of light along the geomagnetic line of force. Their typical appearances are dispersed rays accompanied by active bands, and isolated rays remain in the decay phase of display. The altitude range of rays is greatly variable and accordingly the colour of the ray has various tints. Figs. 46 to 51 illustrate several forms of rays.

2. 1. 4. Patch (notation P), A form with a surface-like lower border

As features of this type, we can mention that the form is diffuse and not so large. Those forms occurring in region of the zenith have generally about a 10° field of view. Usually patches are observed in the decaying stage of display and cover a large part of the sky with many forms appearing and disappearing

alternatively. These pulsating patches seem to have a close relation to VLF auroral chorus emissions. Examples of patches are shown in Figs. 52 to 55.

2. 1. 5. Unidentifiable form (notation M)

There are occasions on which we are unable to identify the auroral form for several reasons, such as bad weather conditions, obstacles on the ground, and distant displays which exhibit only their upper portions above the horizon. For these cases, we set this type of classification.

2. 2. Form of the Lower Border

A description of the whole form of the lower border would be useful for investigating the auroral particle source in the magnetosphere. Hence, we set several qualifying measures for a more precise description of auroral forms. Their notations are put before those of horizontal extension (*e. g.*, sB, iR, etc.).

2. 2. 1. Form of the Lower Border of a Veil

a) Uniform (notation u): Brightness is uniform.

b) Gradated (notation g): Brightness changes gradually.

2. 2. 2. Form of the Lower Border of a Band

a) Straight (notation s): Lower border stretches linearly or with a slight bend.

b) Hooked (notation h): Lower border has a U- or J-shaped form.

c) Meandering (notation m): Lower border is meandering.

d) Fragmentary (notation f): Band displays a fragmentary form.

e) Vague (notation v): Lower border has a diffuse horizontal margin in short form.

2. 2. 3. Form of the Lower Border for Rays and Patches

a) Isolated (notation i): Ray or patch appears solely or apart from other forms of identical shape.

b) Dispersed (notation d) : A number of rays or patches appear simultaneously scattered in the sky.

2. 3. Homogeneity

The internal constitution of auroral forms has recently become the object of television cinematography of aurorae. It has been observed that some of ray structure originate from small scale foldings in the form, and homogeneous Band-A, a so-called homogeneous arc, is quite a rare phenomenon in television cinematographic observation (DAVIS, 1965 and 1967). But at the present stage, observational facts of this kind are not sufficient to classify structure, combining features of their internal constitution with their generation mechanisms.

In this category, auroral forms are discriminated through their degree of homogeneity. The homogeneity notation is put in front of those for the lower

border forms and horizontal extensions. Sometimes, more than two different degrees of homogeneity exist simultaneously in one form. Denoting these cases, we write corresponding notations under bar, *e. g.*, $\overline{\text{HR}}$.

2. 3. 1. Homogeneous structure (notation H)

Auroral form is horizontally homogeneous, or at least without discernible inhomogeneity, thus showing a continuous lower border.

2. 3. 2. Rayed structure (notation ℍ)

The auroral form has a rayed structure with a homogeneous background. Its lower border is continuous, like that of the auroral forms belonging to the preceding class.

2. 3. 3. Ray structure (notation R)

Only a ray structure is visible in this aurora, or at least the ray structure is far predominant in contrast to the homogeneous background. Consequently, the lower border is discontinuous.

In highly elevated bands, or sometimes patches, fibre-like striations or forms can occasionally be observed along the lower border, as seen in Figs. 6 and 16. We denote the existence of this phenomenon by the subscript $_{''}$ to notation of homogeneity, *e. g.*, $\text{H}_{''}$.

2. 4. Vertical Profile

Vertical structure is one of the most important factors for the internal constitution of an auroral form, since it indicates the energy spectrum of the impinging auroral particles. Referring to various energy spectra of incoming flux, we designate five different vertical luminosity profiles. These designations are described by numerical superscripts on the right shoulder of homogeneity notations.

2. 4. 1. Unidentifiable (notation 0)

The vertical profile is not identifiable. This case corresponds to an extended two-dimensional form and some forms whose inclination is coincident with the observer's line of sight.

2. 4. 2. Lower border concentration (notation 1)

Emission concentrates in the neighbourhood of the lower border.

2. 4. 3. Short tail (notation 2)

The vertical profile exhibits a similar concentration of emission to that of the preceding class, but a short tail extends upward for several tens of kilometers.

2. 4. 4. Long tail (notation 3)

Though considerable emission originates from the lower border and its neighbourhood, the vertical profile has a typical long tail for a few hundred kilometers.

2. 4. 5. No-concentration (notation 4)

Emission gradually decreases with increasing distance from the lower border, and its concentration is not remarkable at the bottom. The height exceeds a few hundred kilometers.

2. 5. Brightness

We use International Brightness Coefficients (IBC) (HUNTEN, 1955) as the measure of brightness. The brightness in the maximum intensity region is taken as that of the form, and is written in IBC before the notation of homogeneity. In the case of a complex structure form, this procedure is carried out for each part of having a different structure, *e. g.*, $\overline{\text{IIH}^2\ \text{IIIR}^3\text{hB}}$.

2. 5. 1. IBC 0, oxygen green line [OI] λ5577A intensity <1 KR
Extreme lower limit, night sky brightness.

2. 5. 2 IBC I, oxygen green line [OI] λ5577A intensity 1 KR
Brightness of the Milky Way.

2. 5. 3. IBC II, oxygen green line [OI] λ5577A intensity 10 KR
Brightness of thin moonlit cirrus.

2. 5. 4. IBC III, oxygen green line [OI] λ5577A intensity 100 KR
Brightness of moonlit cumulus.

2. 5. 5. IBC IV, oxygen green line [OI] λ5577A intensity 1000 KR

2. 6. Colour

Classification of colour is based on the "International Auroral Atlas" (1963) because of its extensiveness. Identification of colour is made by a procedure the same as that of brightness. The notation is written after IBC, *e. g.*, IIcH²hB.

2. 6. 1. Red upper region (notation a)
Red (6300A, 6364A) upper regions with green (5577A) dominant in the lower regions is often observed in bands and some of rays.

2. 6. 2. Red lower border (notation b)
Red colour due to the first positive bands of molecular nitrogen occurs especially at very low heights. This colour may be observed as a fringe along the lower border of bands which are dominantly green above and is frequently a conspicuous feature of these forms in the aroral regions.

2. 6. 3. White, green or yellow (notation c)
The appearance of white is generally associated with very low levels of luminance, the appearance of white or yellow may arise from appropriate proportion of green (5577A from atomic oxygen), red (6300A, 6364A from atomic oxygen), and blue (3914A, 4278A, etc., from ionized molecular nitrogen).

2. 6. 4. Red (notation d)

The appearance of red aurorae from dominance of the red atomic oxygen lines.

2. 6. 5. Red and green (notation e)

Red and green (due to atomic oxygen), irregularly distributed or alternating along the horizontal extent of an aurora, is common.

2. 6. 6. Blue or purple dominant (notation f)

Blue colour arises mainly from the ionized nitrogen bands and is commonly dominant during or after very active display. Mixture with the red atomic oxygen lines gives the appearance of purple.

2. 7. Activity

We adopt the definition of "International Auroral Atlas" for its extensiveness. We put index of activity before IBC.

2. 7. 1. Notation q

A quiet aurora in one which undergoes only very slow changes in position and shape.

2. 7. 2. Notation a_1

This symbol refers to the movement of folds or irregularities along the boundary of bands at speeds up to about 500 m/sec.

2. 7. 3. Notation a_2

This sub-classification covers individual forms in which the shape of the lower border changes rapidly; a rapid movement across the sky may accompany the change.

2. 7. 4. Notation a_3

This condition is the appearance of rapid movement of rays horizontally along the form. Speeds of the order of 10 km/sec are common.

2. 7. 5 Notation p_1

This sub-class covers those conditions in which the phase of the variation of brightness is uniform throughout the form.

2. 7. 6. Notation p_2

This sub-classification refers to a large area of the sky rather than to an individaul form. The sky appears lit by surges of luminosity sweeping upwards towards the magnetic zenith.

2. 7. 7. Notation p_3

This is a condition of a large part of a display which undergoes rapid, more or less irregular changes in brightness as if lit by flickering flames.

Table. 2. Classification table.

Horizontal Extension	Form of the Lower Border	Homogeneity	Vertical Profile	Brightness	Colour	Activity	Aspect
Planar (two-dimensional) Veil(V)	uniform(u)	Homogeneous (H)	unidentifiable (0)	[OI] λ5577A <IKR IBC(0)	red upper region (a)	quiet (q)	Arch(A)
	gradated(g)					movements of fold or irregularities (a_1)	Horse-shoe(H)
Line (one-dimensional) Band Band-A(A) Band-B(B)	straight(s)		lower border concentration (1)	[OI] λ5577A IKR IBC(I)	red lower border (b)	lower border change (a_2)	Drapery(D)
	hooked(h)						
	meandering (m)	Rayed-structure (R)			white, green or yellow (c)	horizontal movement of rays (a_3)	Flame(F)
	fragmentary (f)		short tail (2)	[OI] λ5577A 10 KR IBC(II)			
	vague(v)					uniform variation of brightness(p_1)	Corona(C)
Point-like Ray(R)	isolated(i)				red (d)		
	dispersed(d)		long tail (3)	[OI] λ5577A 100 KR IBC(III)		whole flaming up (p_2)	Will-o'-the-wisp (W)
Surface-like Patch(P)	isolated(i)	Ray-structure (R)			red and green (e)		
	dispersed(d)					rapid irregular change in brightness(p_3)	Pencil(P)
Unidentifiable Miscellaneous (M)			no-concentration (4)	[OI] λ5577A 1000 KR IBC(IV)	blue or purple dominant(f)	irregular variation in horizontal extent(p_4)	Surface(S)

2. 7. 8. Notation p_4

In this sub-class there is an irregular variation of brightness which progresses rapidly along the horizontal extent of homogeneous forms.

2. 8. Aspect

Recently, from the viewpoint of plasma dynamics in the magnetosphere, the problem of proton precipitation has become one of the most interesting problems in auroral physics again. The atomic hydrogen line, H_β, is detected mainly in a region somewhat apart from visual auroral forms (EATHER and JACKA, 1966). It is important to make clear the relative position between precipitating regions of electrons and protons. Aspect, the general measure of auroral display, would be useful for this purpose, too.

We typify the aspect of auroral display of one group by the following. This notation is put at the top of notation array.

2. 8. 1. Arch (notation A)

Arch is an ordinary aspect in the display of bands; an example is shown in Fig. 42.

2. 8. 2. Horse-shoe (notation H)

Horse-shoe is an aspect in the display of curved form bands; Fig. 33 illustrates an example.

2. 8. 3. Drapery (notation D)

Drapery corresponds to the display of bands with the long tail of rays, as in Fig. 41.

2. 8. 4. Flame (notation F)

For the active display of bright bands, the aspcet is identified as Flame; an example is shown in Fig. 36.

2. 8. 5. Corona (notation C)

Corona is the aspect in the display of rayed- or ray-structure form around the magnetic zenith.

2. 8. 6. Will-o'-the-wisp (notation W)

This name of aspect is attached to the display of dispersed patches and rays; an example is illustrated in Fig. 54.

2. 8. 7. Pencil-Beam (notation P)

Pencil-Beam is an aspect in the display of isolated long rays; Fig. 49 shows an example.

2. 8. 8. Surface (notation S)

Surface is an aspect in the display of diffused forms; an example is shown in Fig. 53.

We compile all the headings in the classification table (Table 2).

2.9. Description

Notations of classification headings are aligned in the following order; *Aspect*, *Activity*, *Brightness*, *Colour*, *Homogeneity*, *Vertical Profile*, *Form of the Lower Border* and *Horizontal Extension*, *e. g.*, AqIIcH¹sA. When auroral display in one group contains several forms, description is made about each form with seven headings except *Aspect*, and the notation of *Aspect* is put at the top with a parenthesis denoting one group display, as in the caption of Fig. 31, etc. In caption of figures, we put only notations necessary for the illustration of the classification for convenience.

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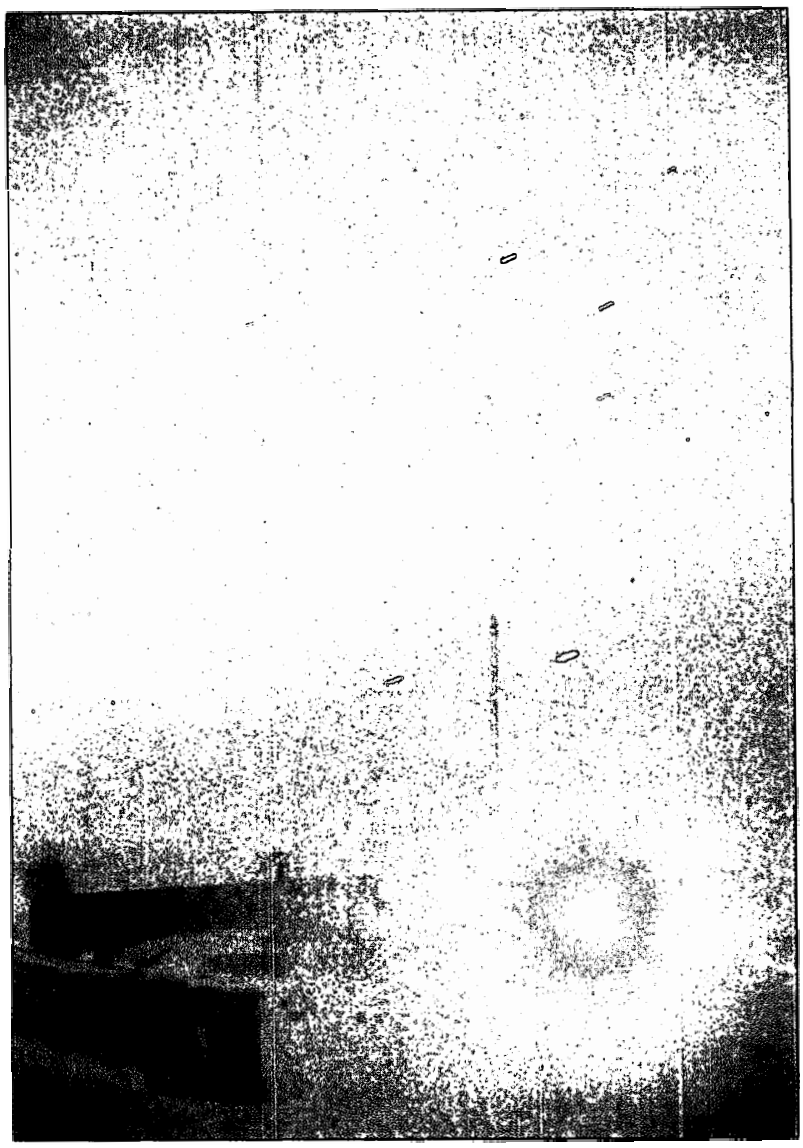

Fig. 1. ***Red veil during severe magnetic storm, discrete green forms appear.*** IIdH⁰uV

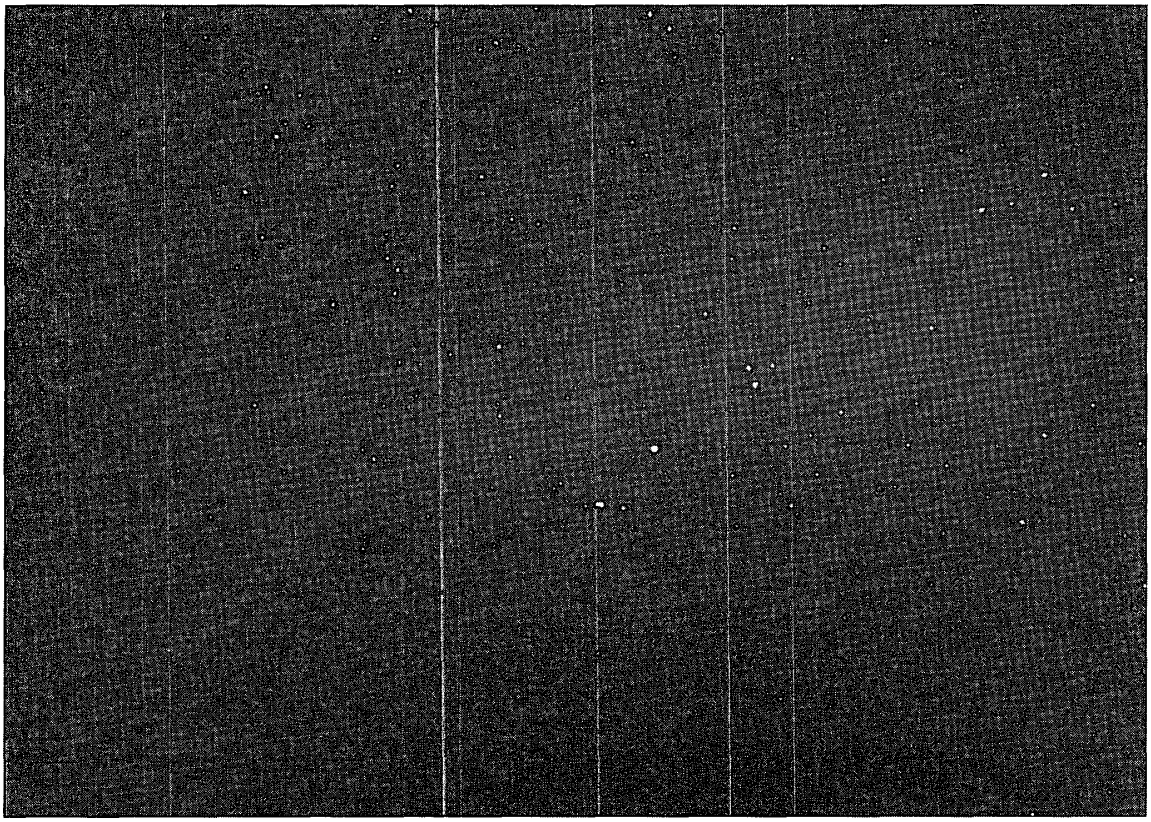

Fig. 2. Homogeneous straight band (Band-A). IH²sA

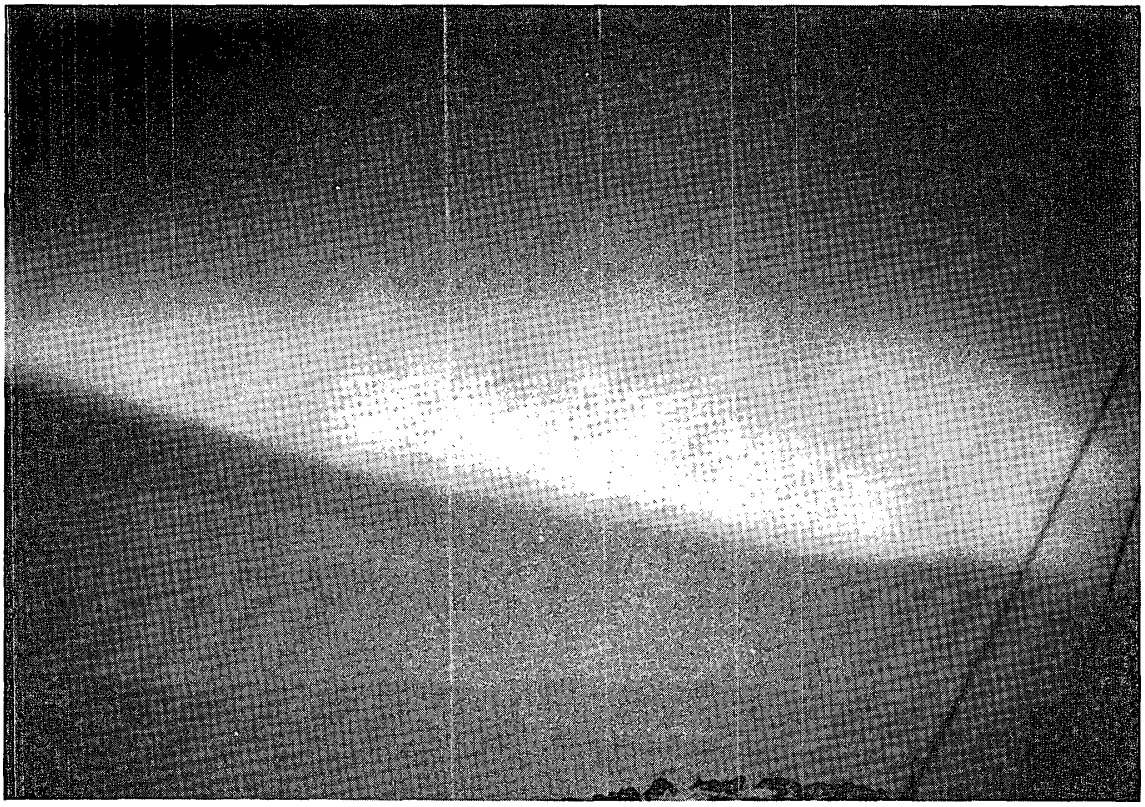

Fig. 3. Homogeneous straight band (Band-A). IIH²sA

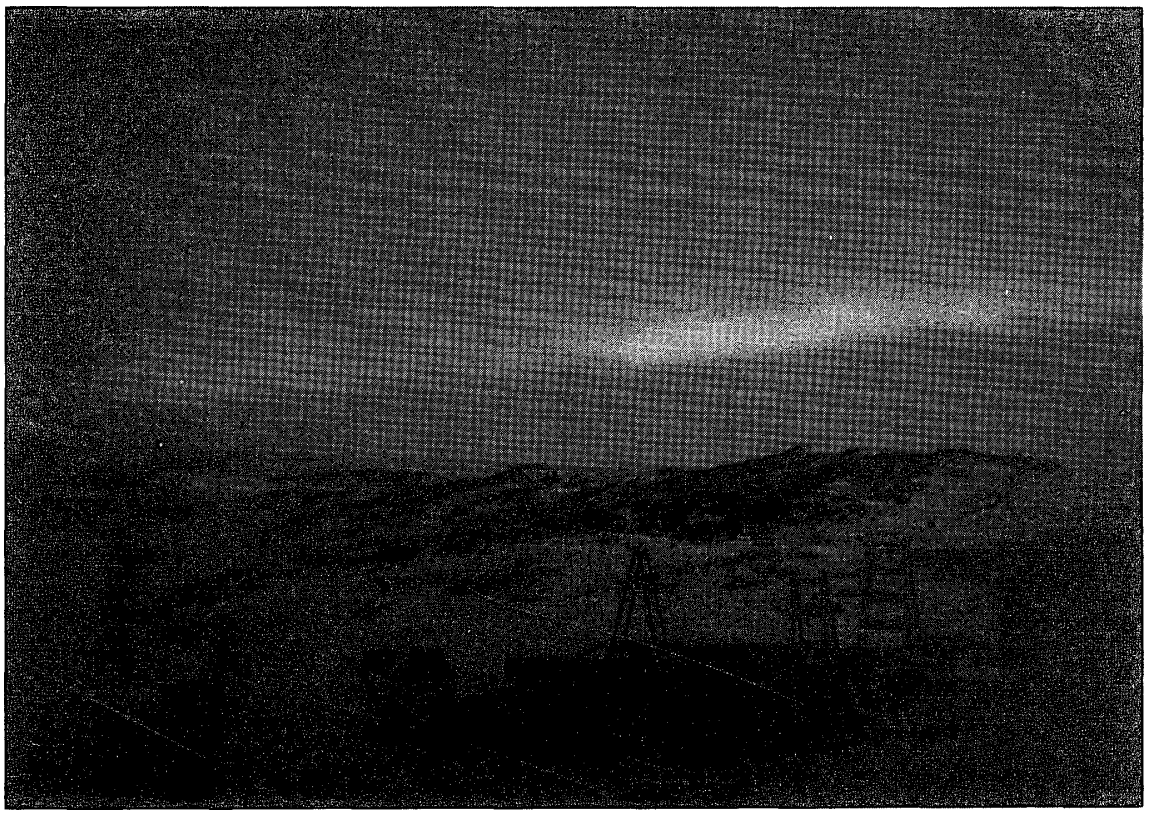

Fig. 4. Homogeneous straight band (Band–B). IIH²sB

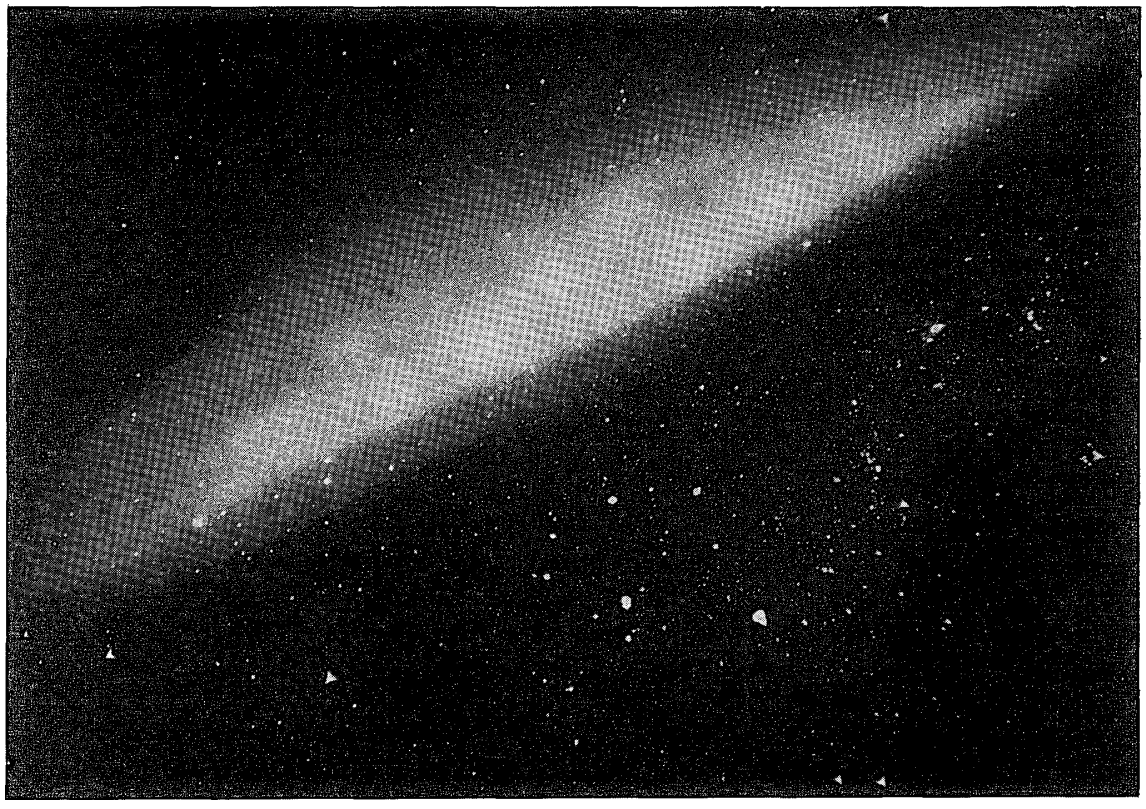

Fig. 5. Homogeneous straight band (Band–A), near the zenith. IIH⁰sA

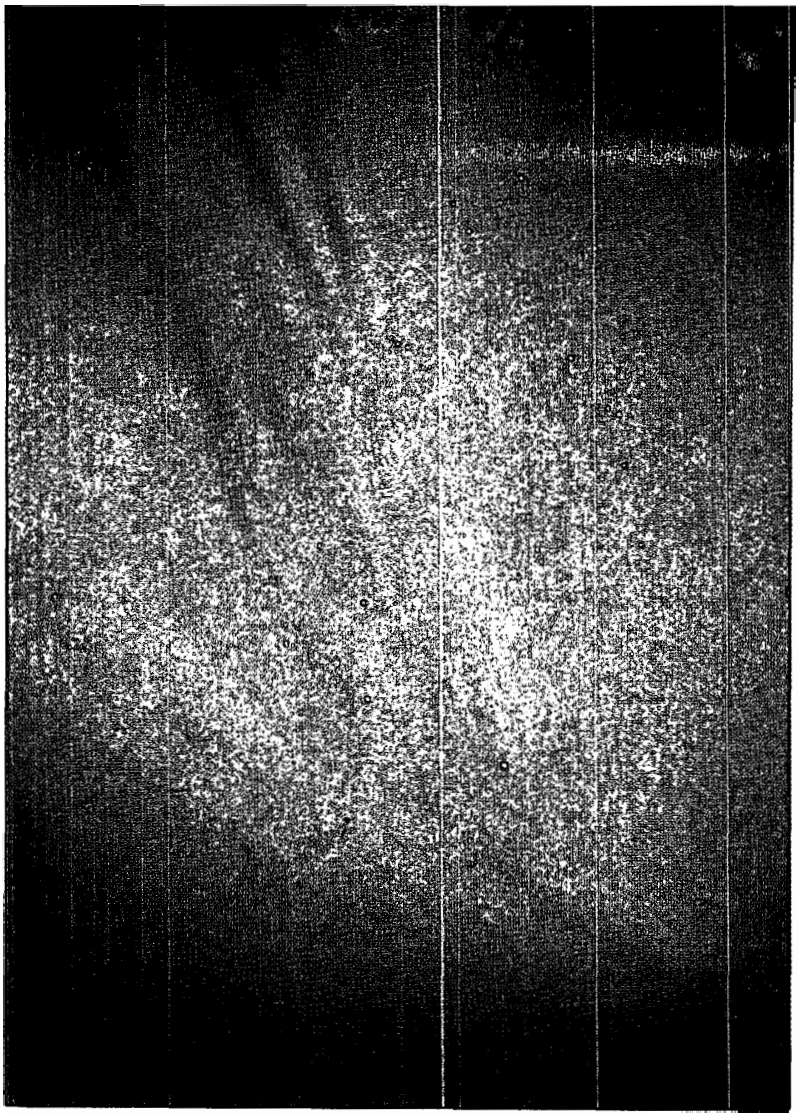

Fig. 6. Homogeneous hooked bands (Band–A) with striation. IIcH$_{II}$^{2}hA

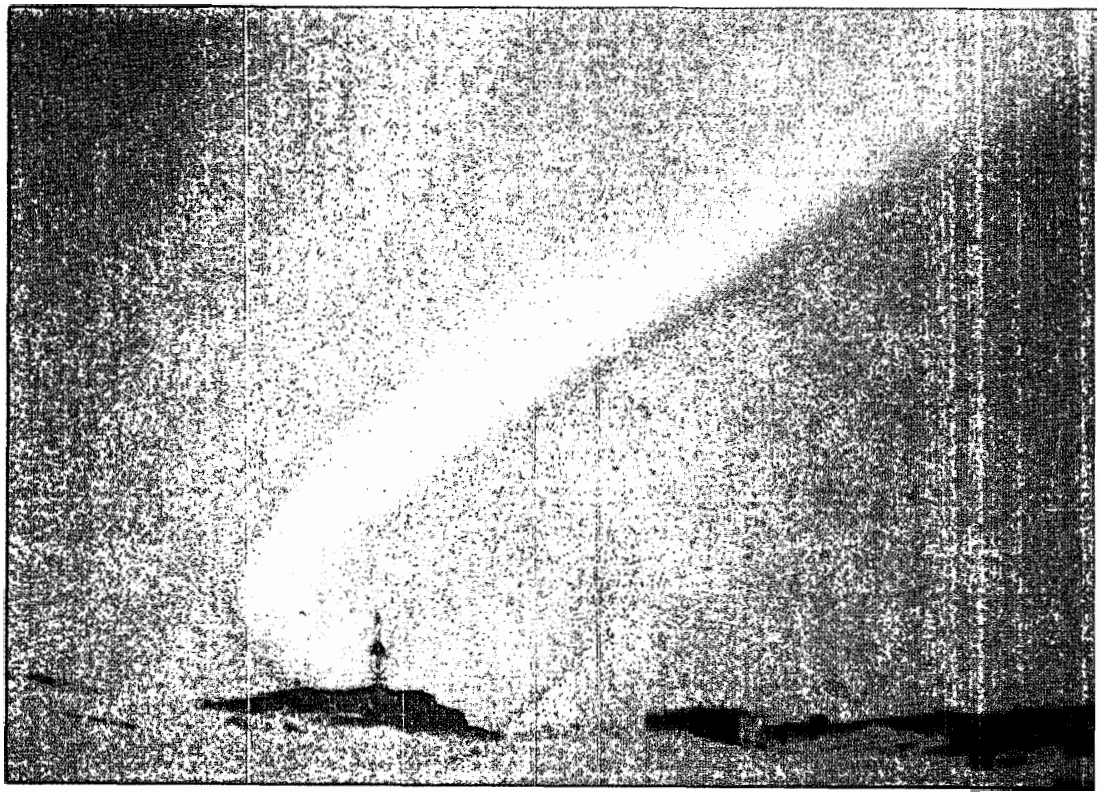

Fig. 7. Homogeneous hooked bands (Band–B). (IIIbH^{3}hB, IIcH^{3}hB)

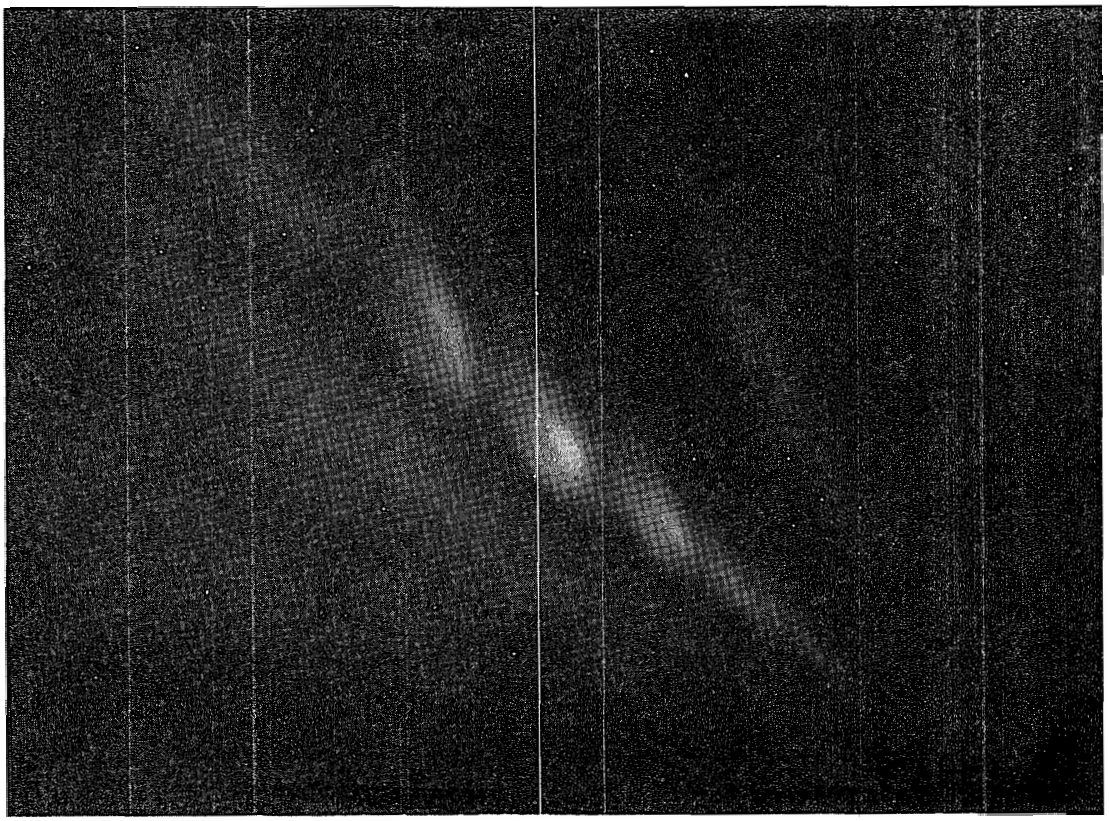

Fig. 8. Ray-structure straight band (Band–B) with other parallel homogeneous bands. IIR²sB

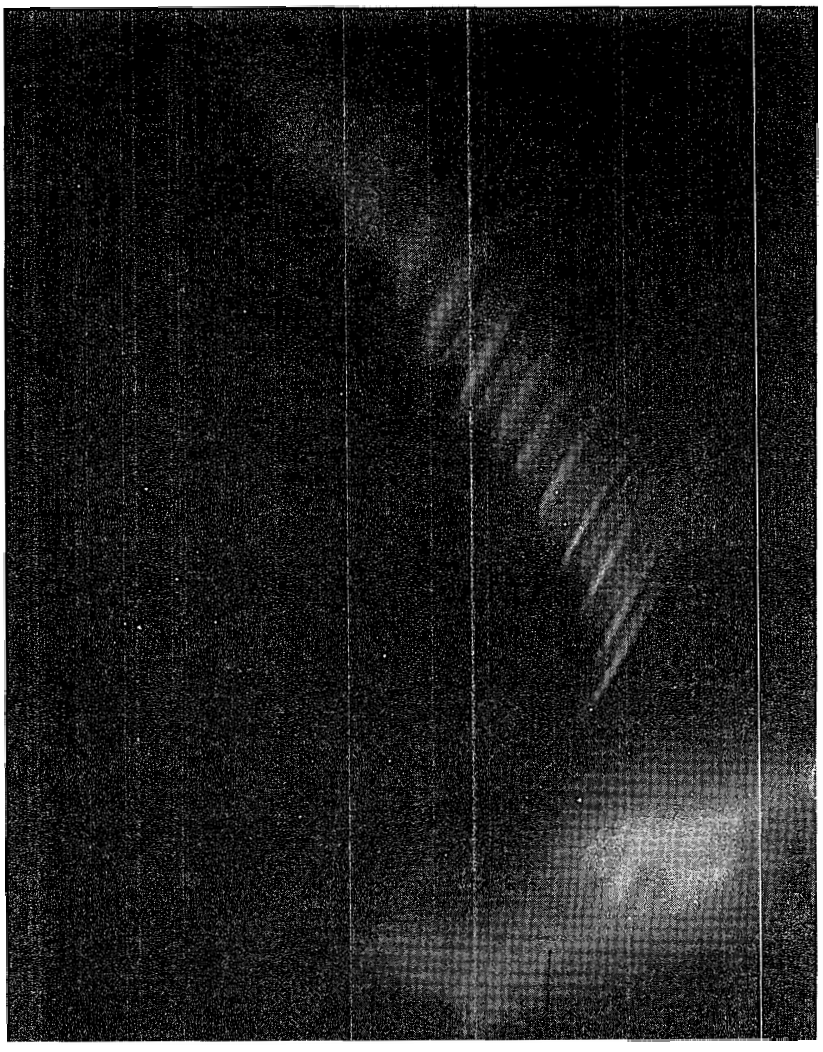

Fig. 9. Ray-structure hooked band (Band–B). IIR²hB

Fig. 10. Parallel bands (Band–B) with complex homogeneity. $\overline{\text{IIH}^1\ \text{IIR}^2\text{sB}}$, $\overline{\text{IIH}^2\ \text{IIR}^2\text{hB}}$

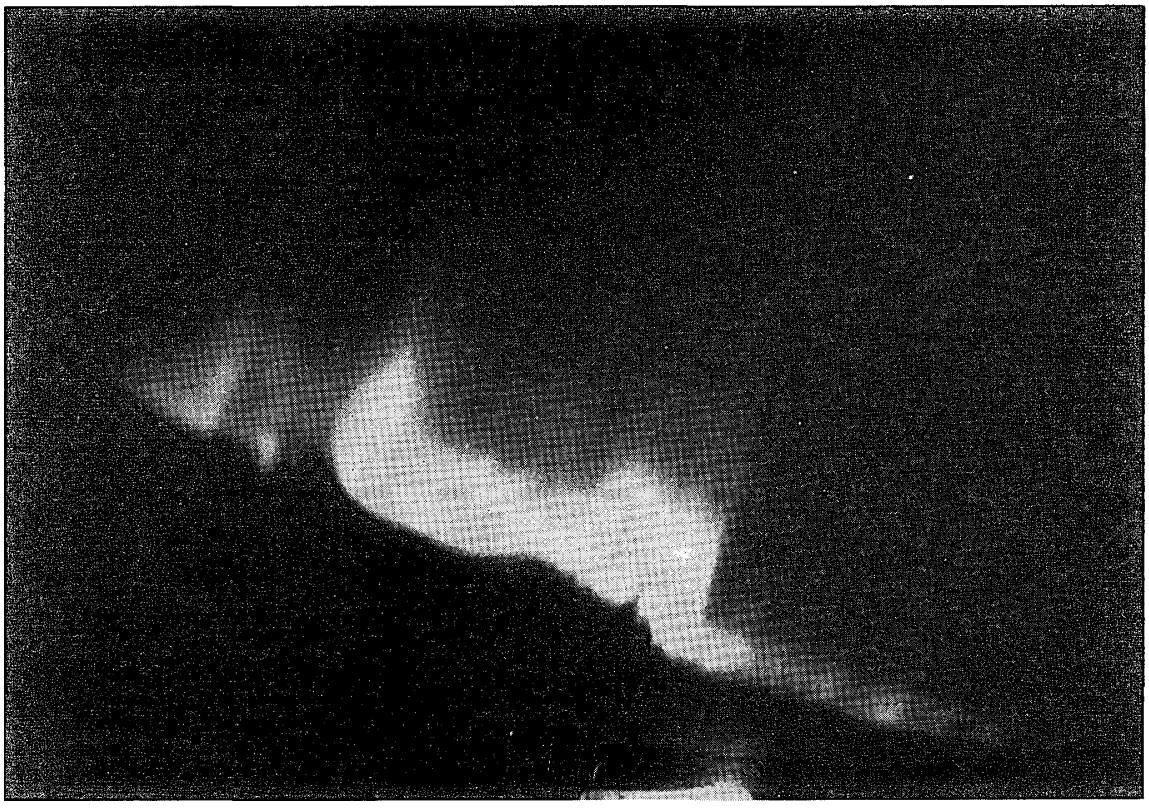

Fig. 11. Ray-structure band (Band–B) with different vertical profiles along the form. $\overline{\text{IIH}^3\ \text{IIR}^2\text{sB}}$

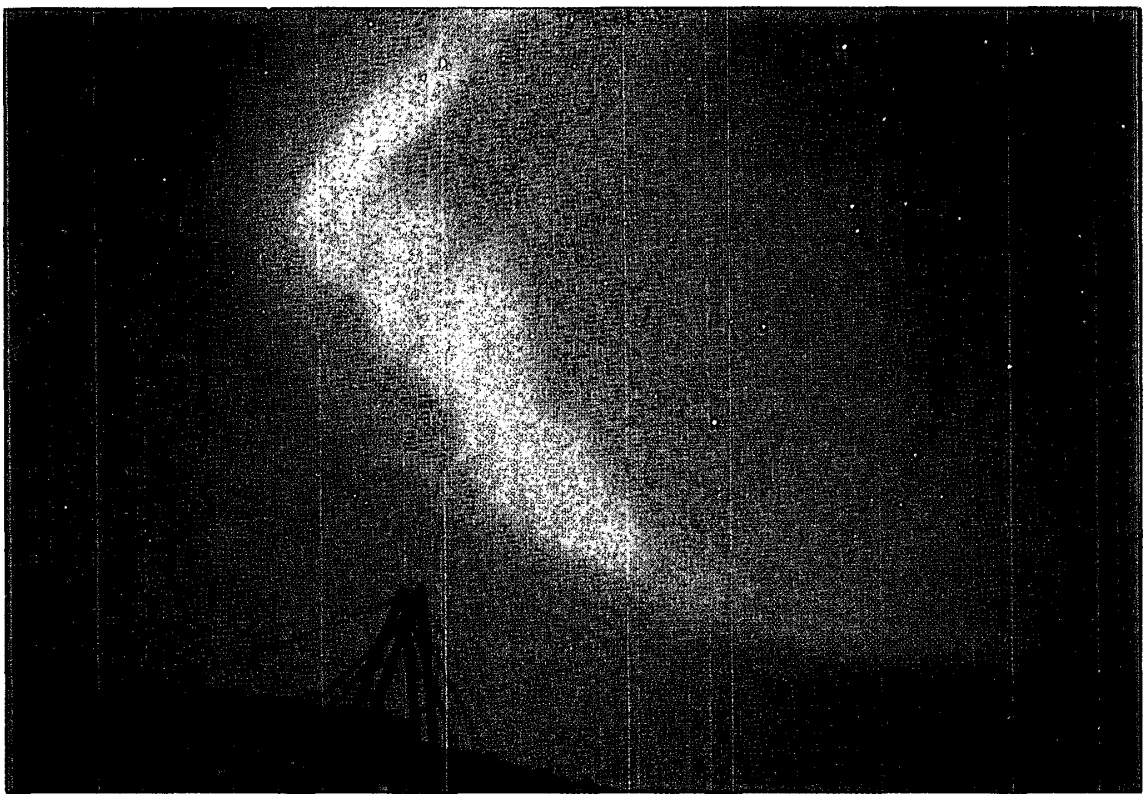

Fig. 12. Hooked band (Band–B) with complex homogeneity, colour c-type. $\overline{\text{IIIcR}^3\ \text{IIcR}^2\text{hB}}$

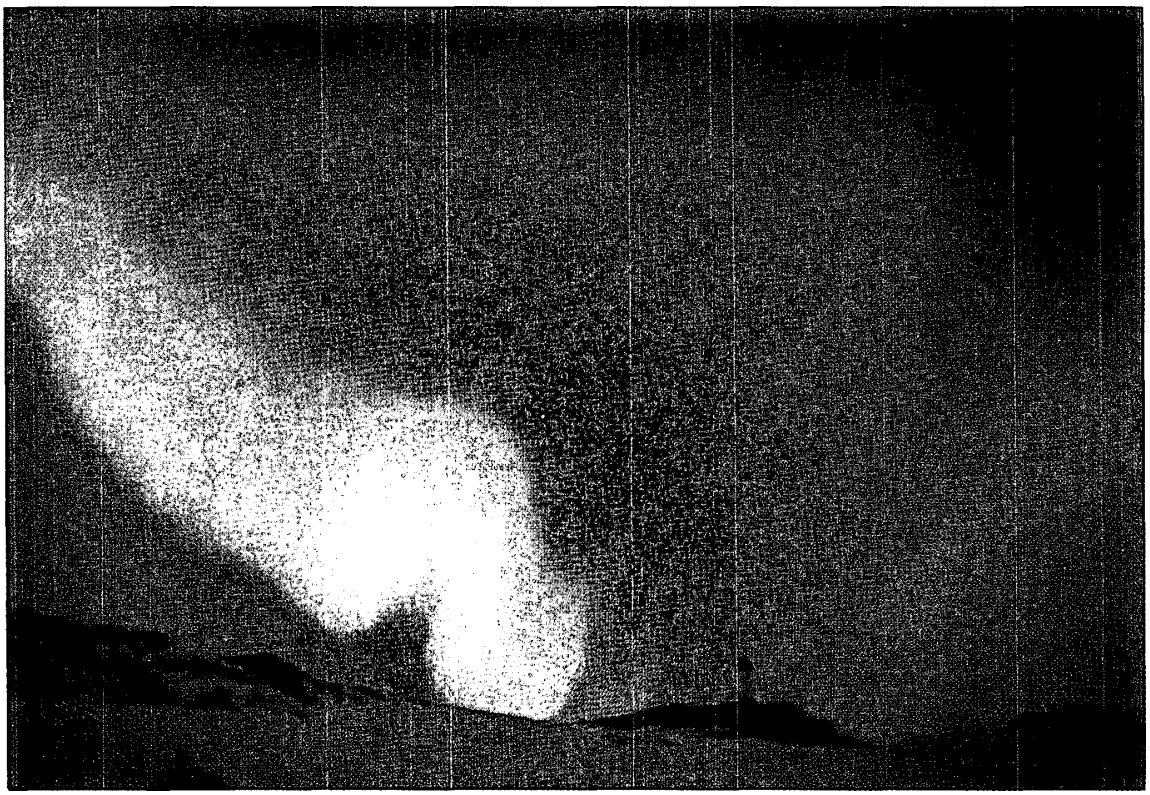

Fig. 13. Rayed-structure band (Band–B), colour b-type. IIIbR^{3}sB

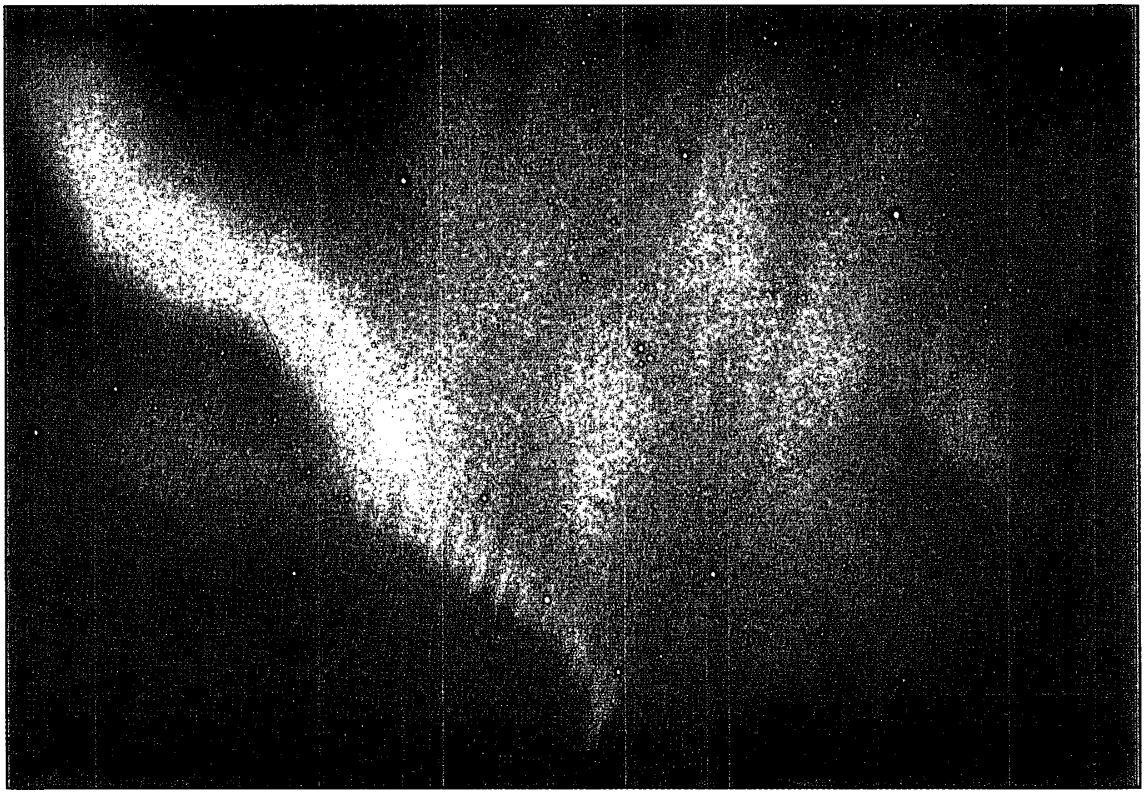

Fig. 14. Ray-structure band (Band–B), colour b-type. IIIbIR² IIIbR²sB

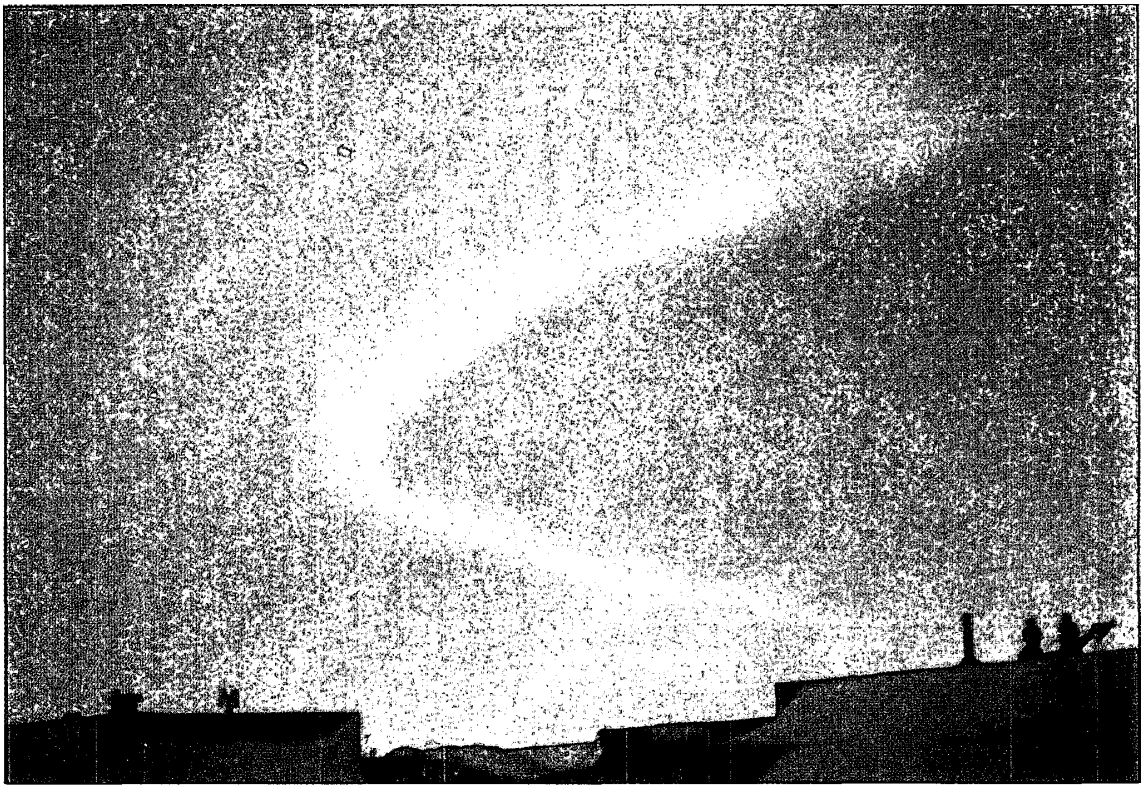

Fig. 15. Rayed-structure band (Band–B), colour c-type. IIIcIR² IIIcR³hB

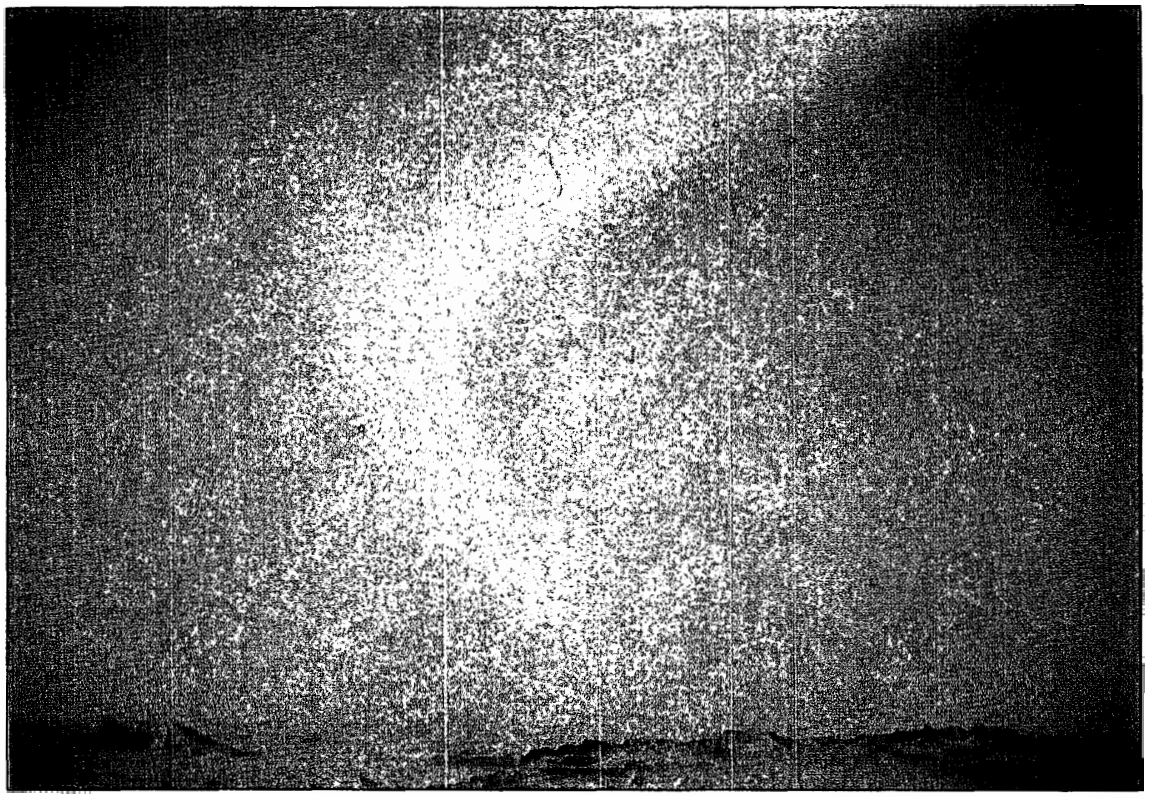

Fig. 16. Rayed-structure band (Band–B) with striations, colour c-type and dispersed rays. IIIcHR$_{11}$^{2}hB, IIcR^{3}dR

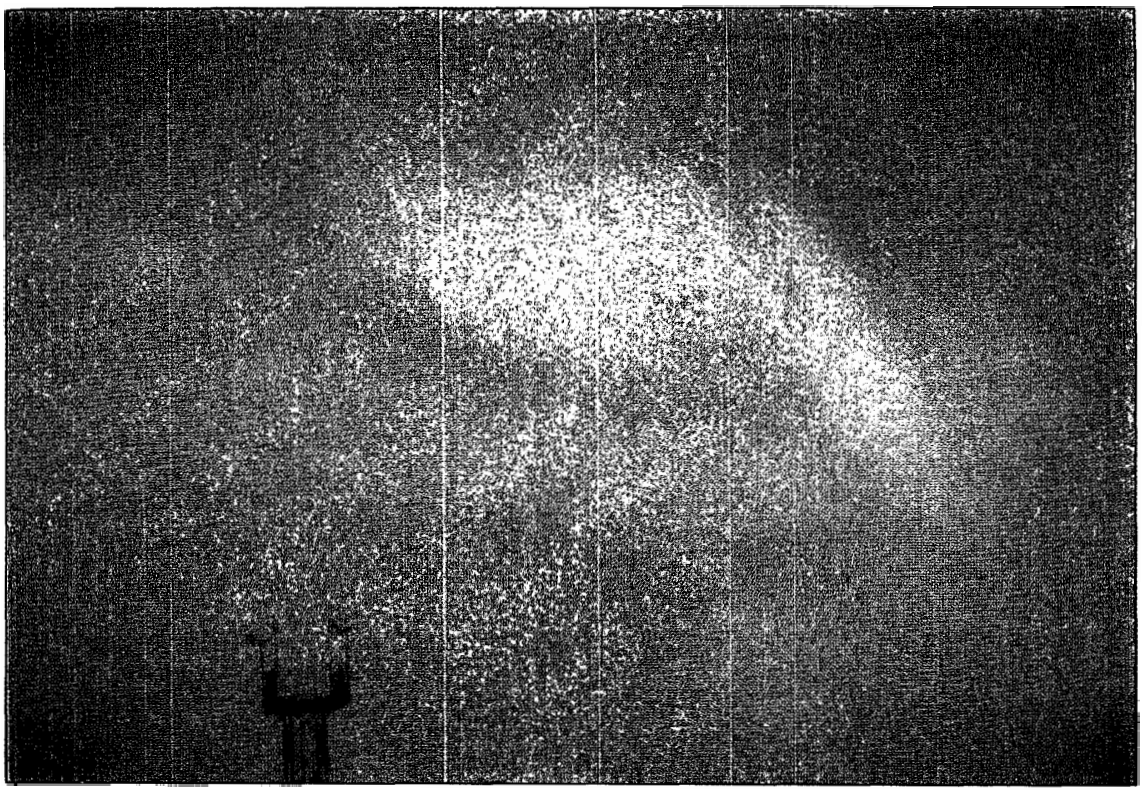

Fig. 17. Ray-structure band (Band–B), colour a-type. (IIIaR^{3}hB, $\overline{\text{IIcH}^{2}\ \text{IIcR}^{2}}$hB)

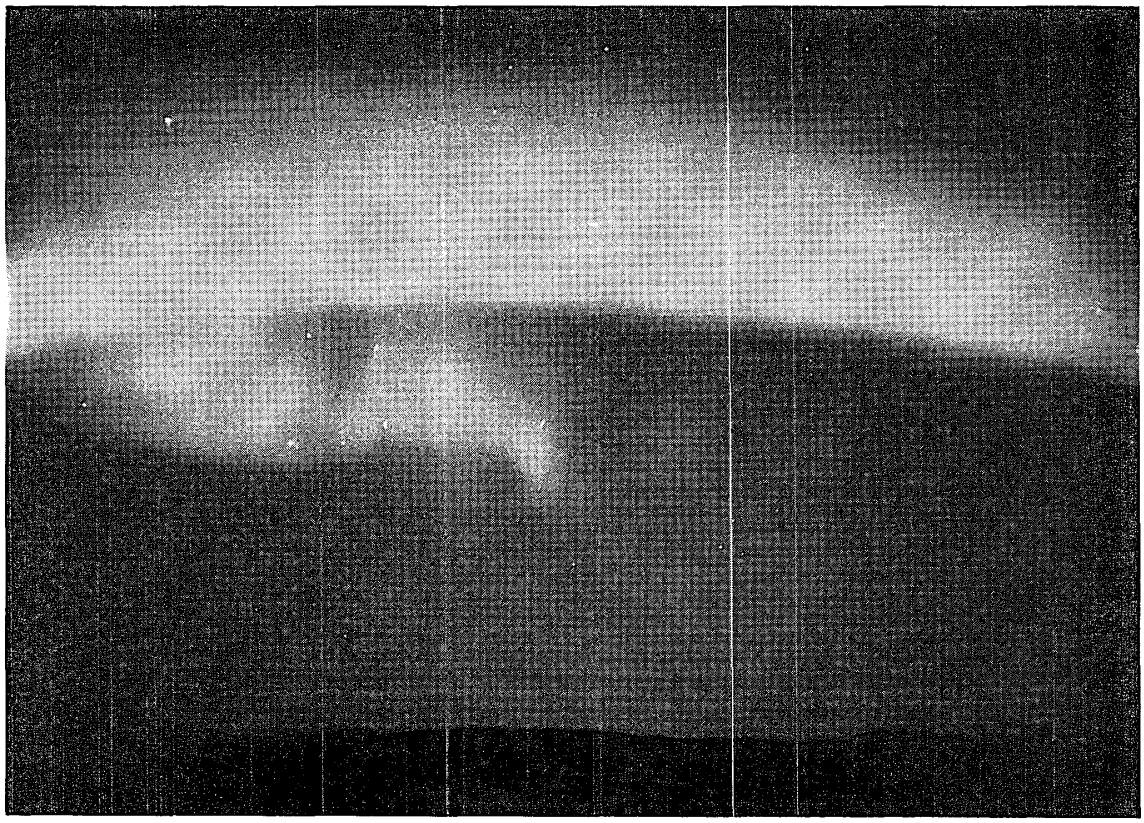

Fig. 18. Hooked band (Band–B) with complex homogeneity. IIIH² IIIR²hB

Fig. 19. Hooked band (Band–B) near the horizon. IIIH²hB

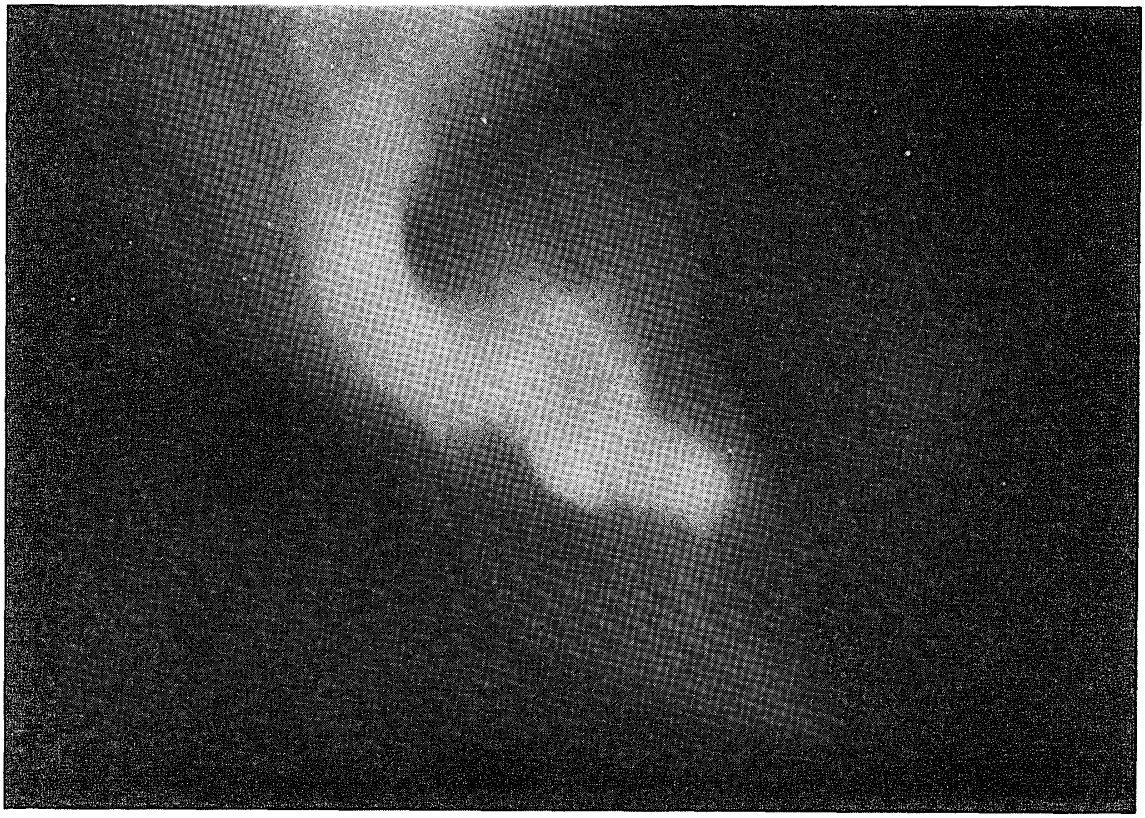

Fig. 20. Rayed-structure meandering band (Band–B). IIIR²mB

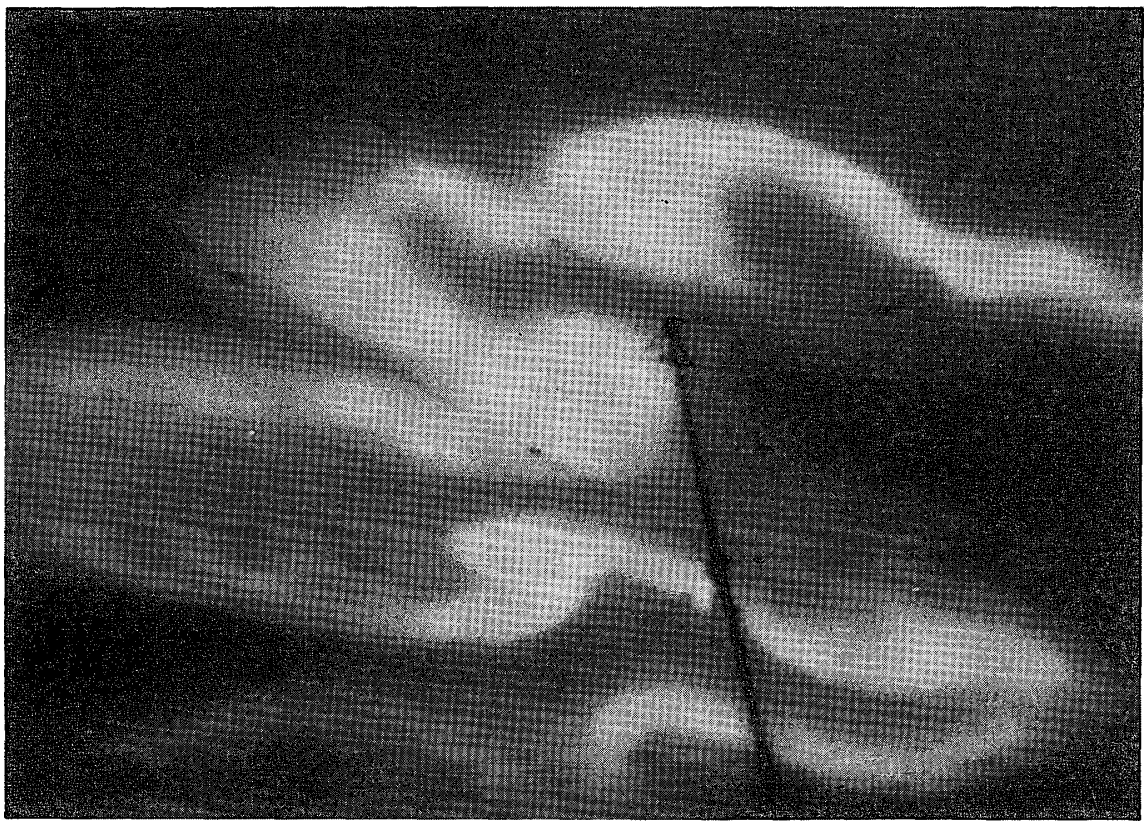

Fig. 21. Homogeneous meandering band (Band–B) near the magnetic zenith, aspect Corona. IIIH²mB

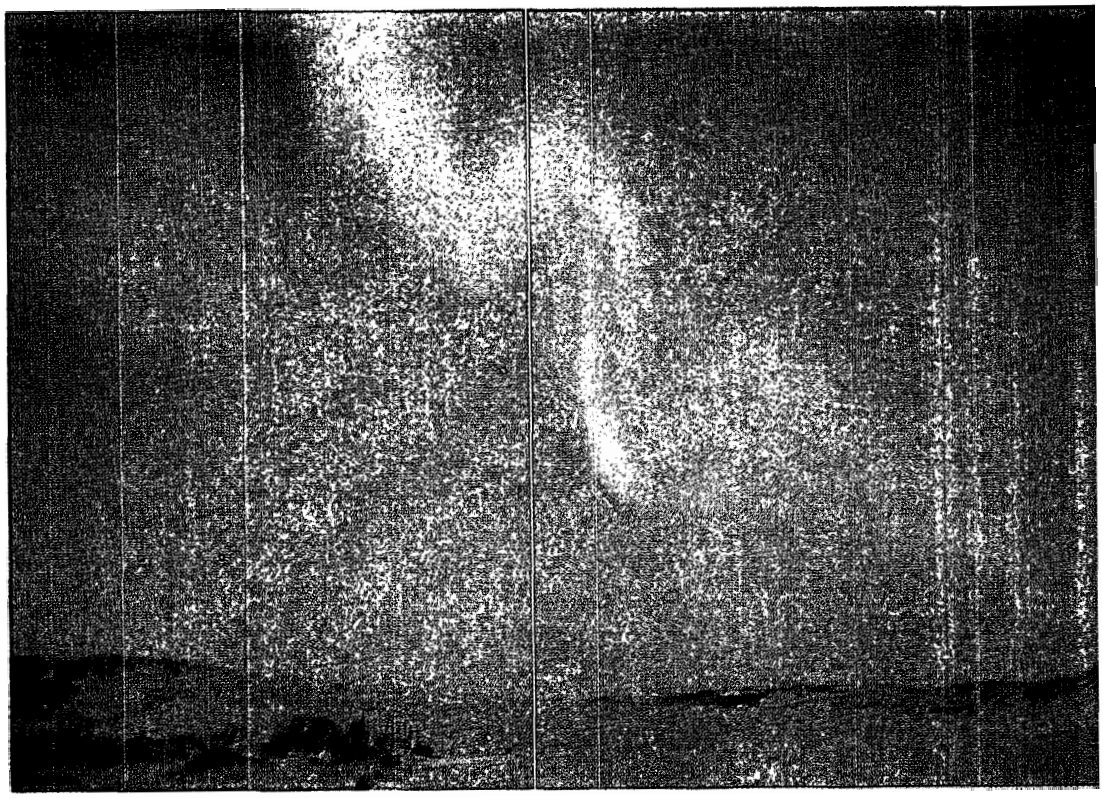

Fig. 22. Rayed-structure meandering band (Band–B), colour b-type. IIIbIR²mB

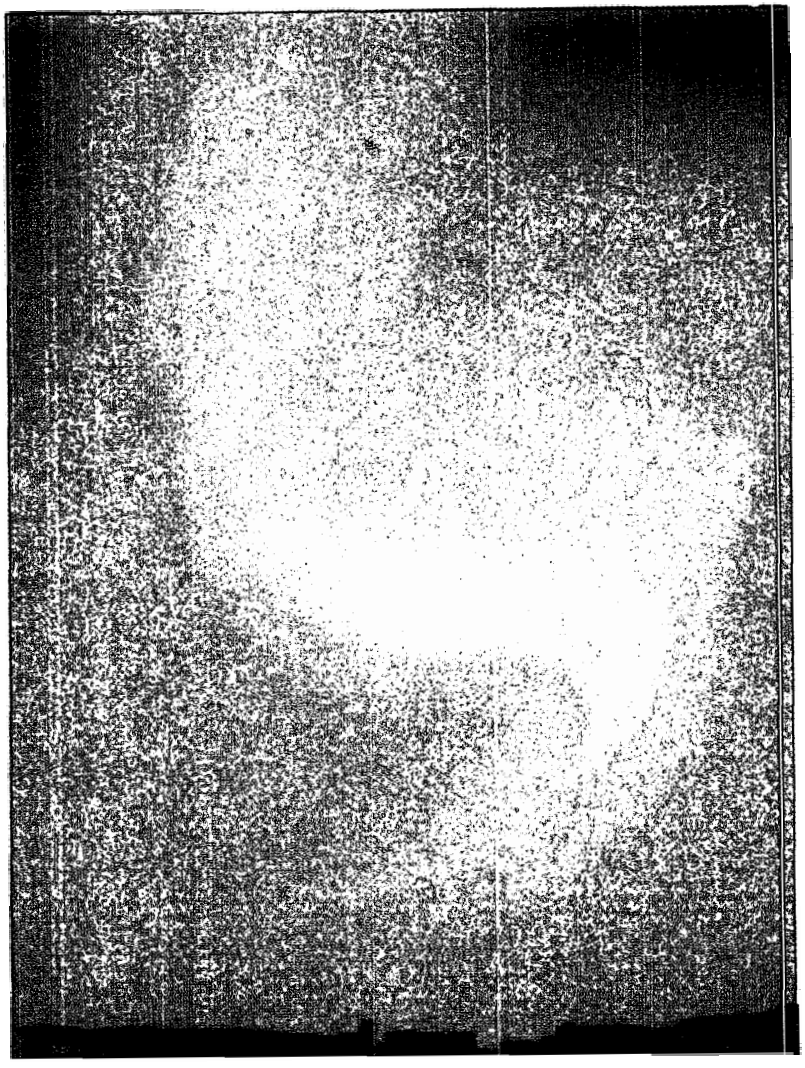

Fig. 23. Meandering band (Band–B) accompanied by fragmentary band, colour c-type. (IIIcH³ IIH¹mB, IIcR¹fB)

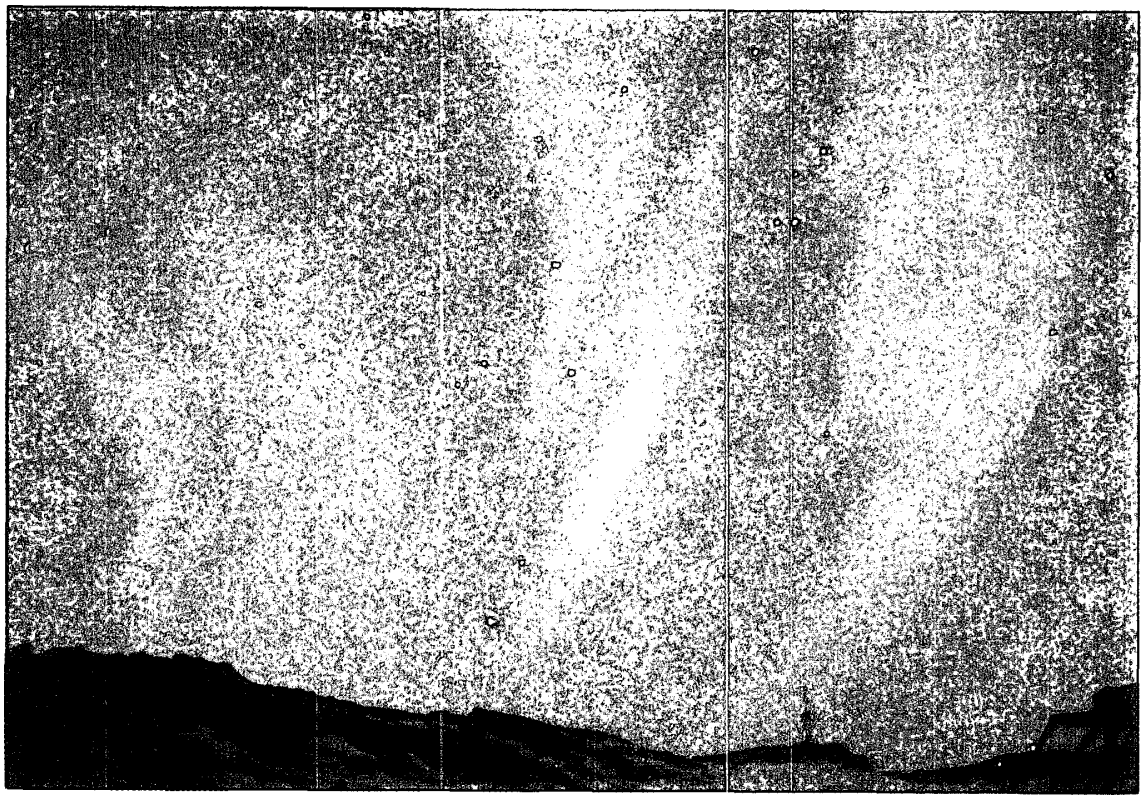

Fig. 24. Multiple bands of same constitution.
(IIIcIR³mB, IIcIR³mB, IIcH²hB, IIIcIR³mB, IIIcIR³mB)

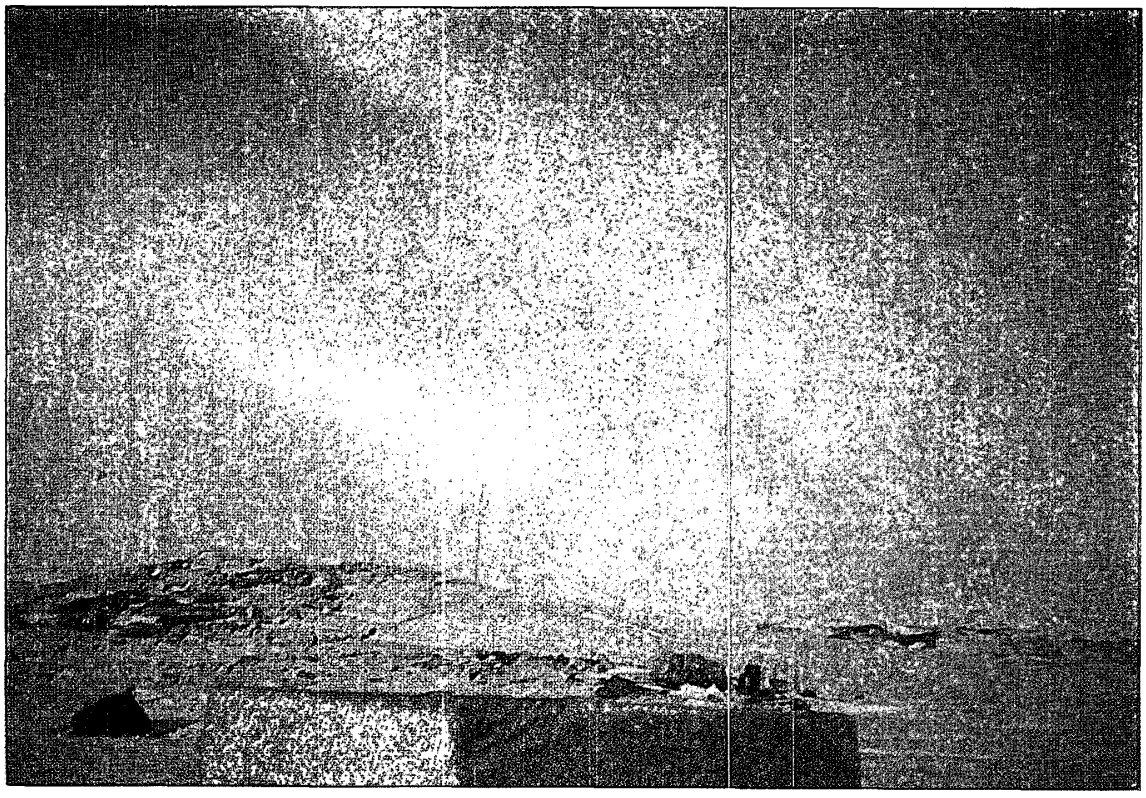

Fig. 25. Multiple bands of different constitution. (IIIcR²mB, IIIcH²fB)

Fig. 26. Multiple bands of similar constitution. (IIR² IIIR²mB, IIIR²fB)

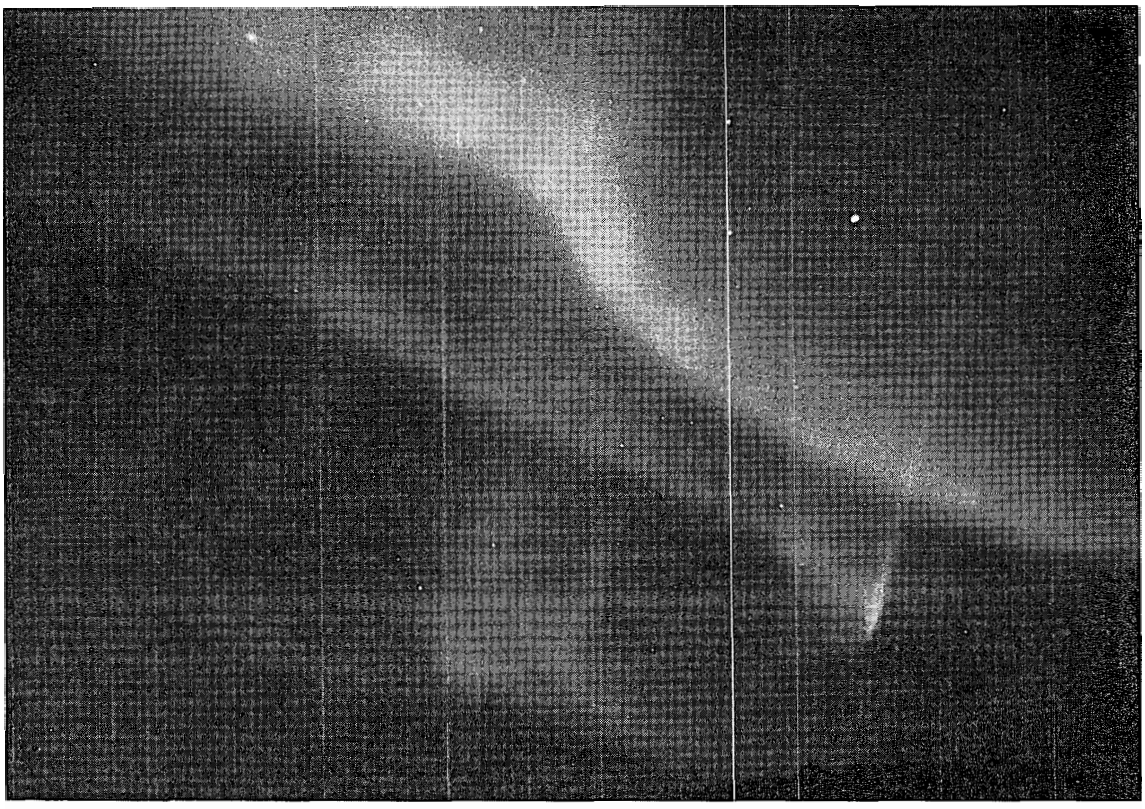

Fig. 27. Multiple bands of different constitution. (IIH² IIH¹mB, IIH¹ IIR³sB, IIR³mB)

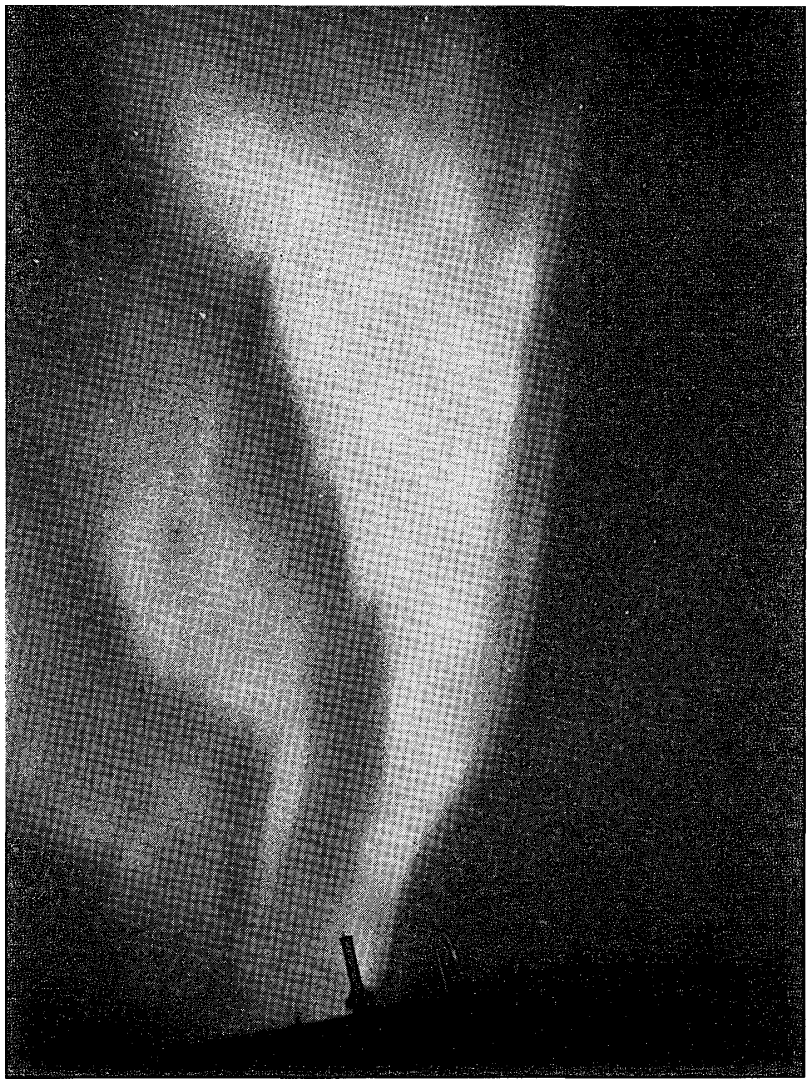

Fig. 28. Multiple bands of same constitution, aspect Drapery. (IIIHR³fB, IIIHR³fB, IIIHR³fB)

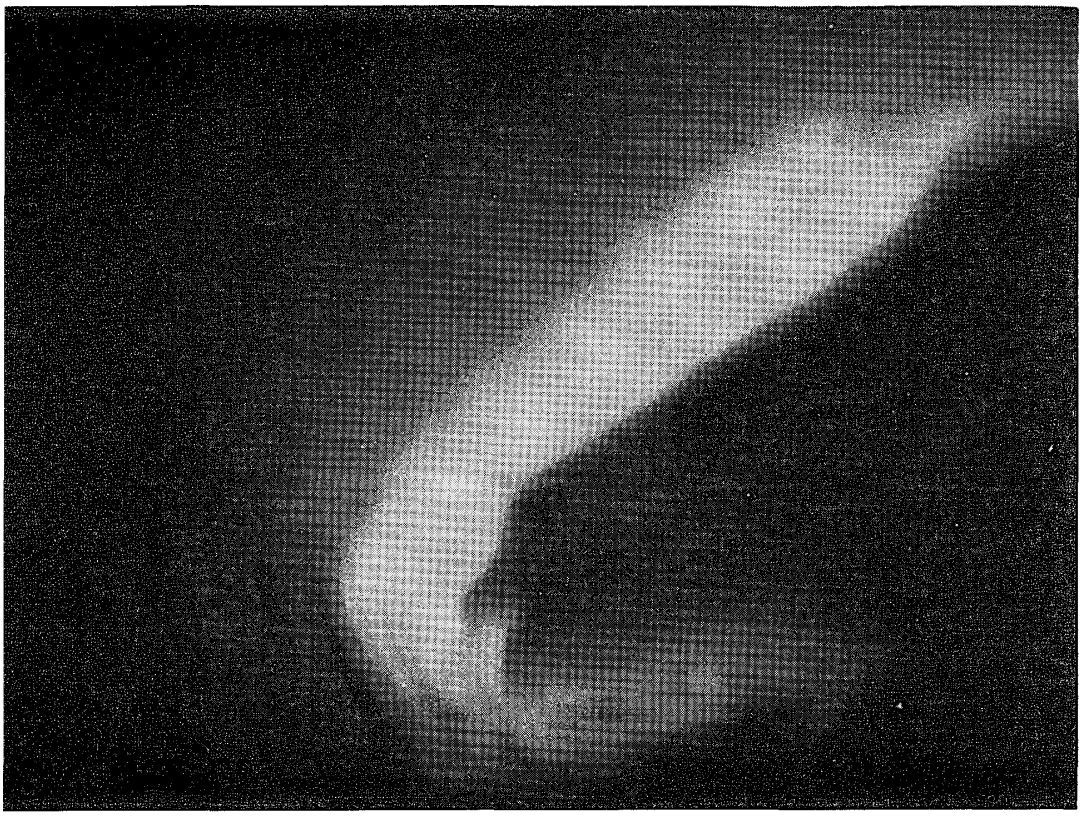

Fig. 29. Multiple bands of similar constitution. (IIIR² IIIH²mB, IIIH$_{n}$²hB, IH$_{n}$¹hB, IH¹hB, IH¹fB)

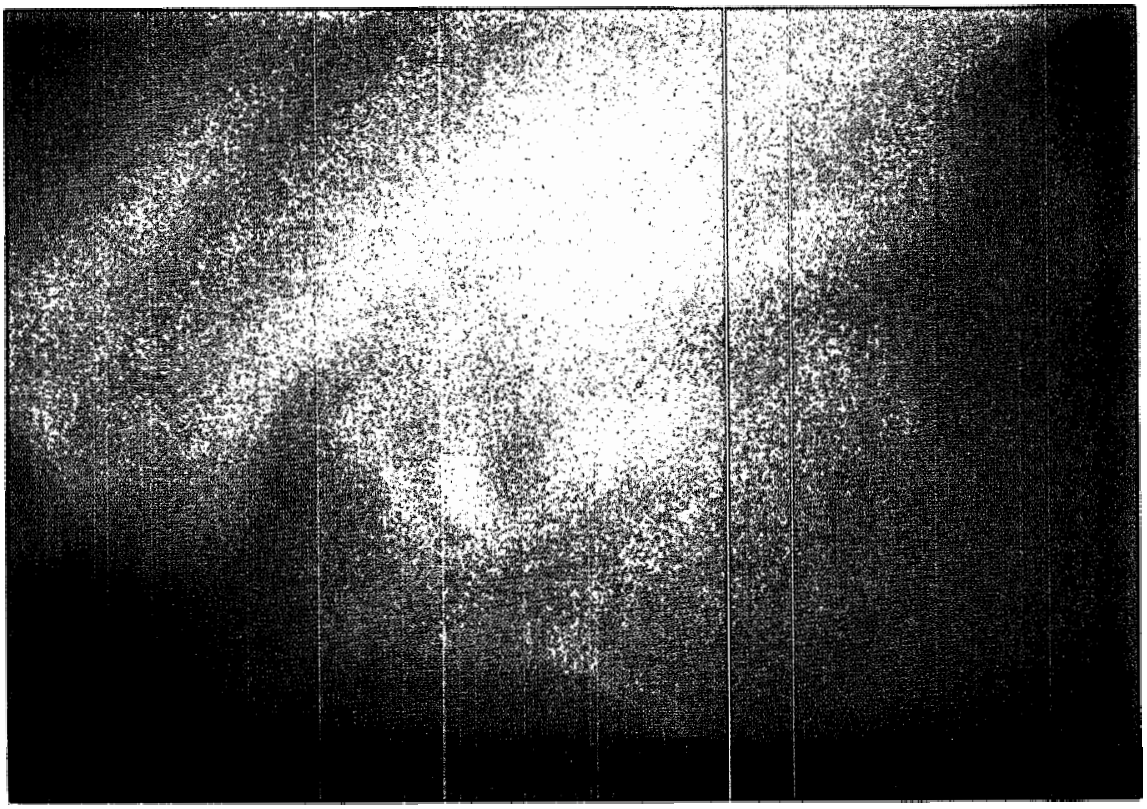

Fig. 30. Multiple bands of different constitution. (IIIbR²mB, IIIcR²mB)

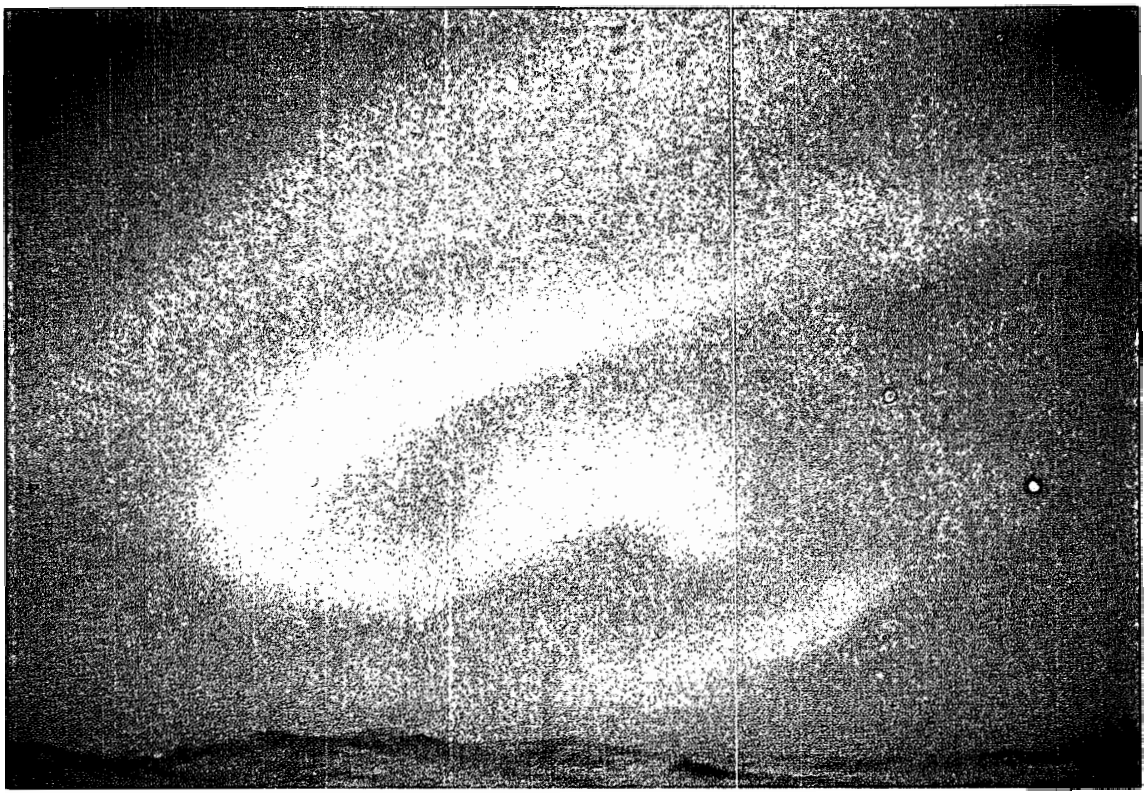

Fig. 31. Multiple bands of similar constitution, aspect Horse-shoe. H(IIIcH²mB, IIIcH²hB)

Fig. 32. Multiple bands of different constitution, aspect Arch. A(IIH^{1}hB, IIH^{2}mB, IIH$_{n}$^{2}mB, IIIH^{2}hB)

Fig. 33. Multiple bands of similar constitution, aspect Horse-shoe. H(IIIH^{2}hB, IIIH^{2}hB, III^{2}hB, IIIH^{2}mB)

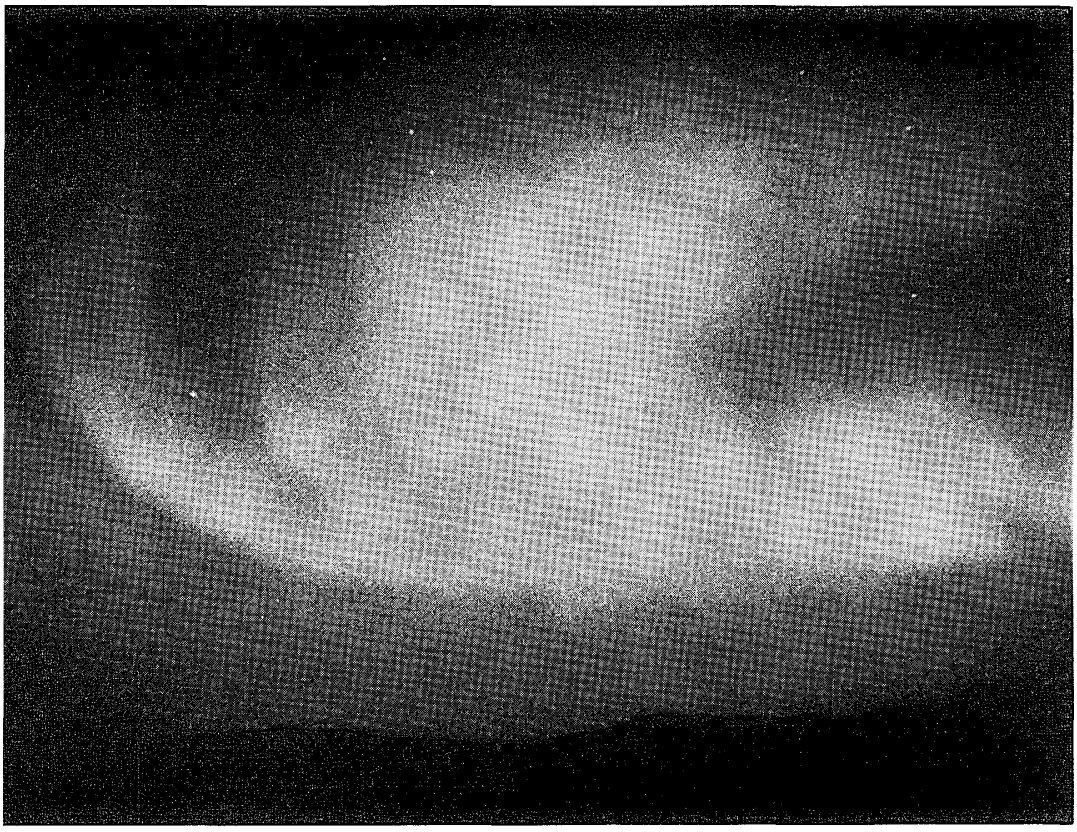

Fig. 34. Multiple bands of similar constitution, aspect Horse shoe. H(IIIH[1]fB, IIIR[2]hB, IIIH[2]hB, IIIH[2]mB)

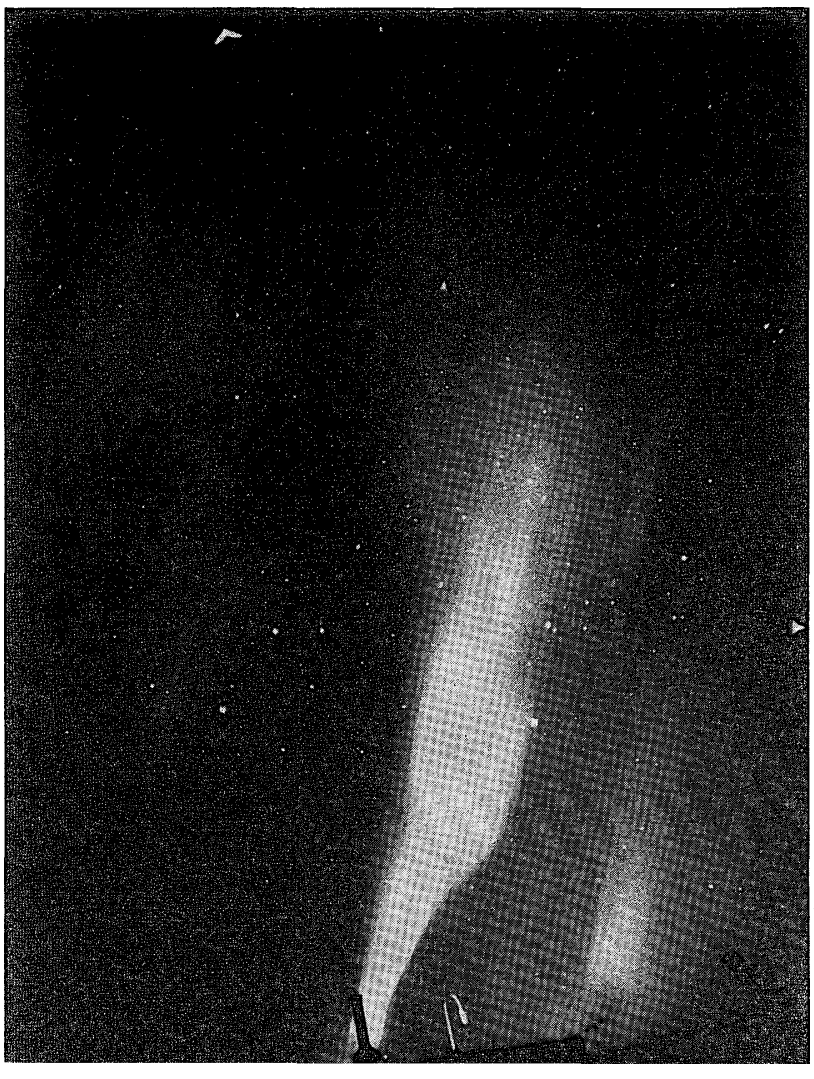

Fig. 35. Fragmentary band with dispersed rays, aspect Drapery. D(IIIHR[3]fB)

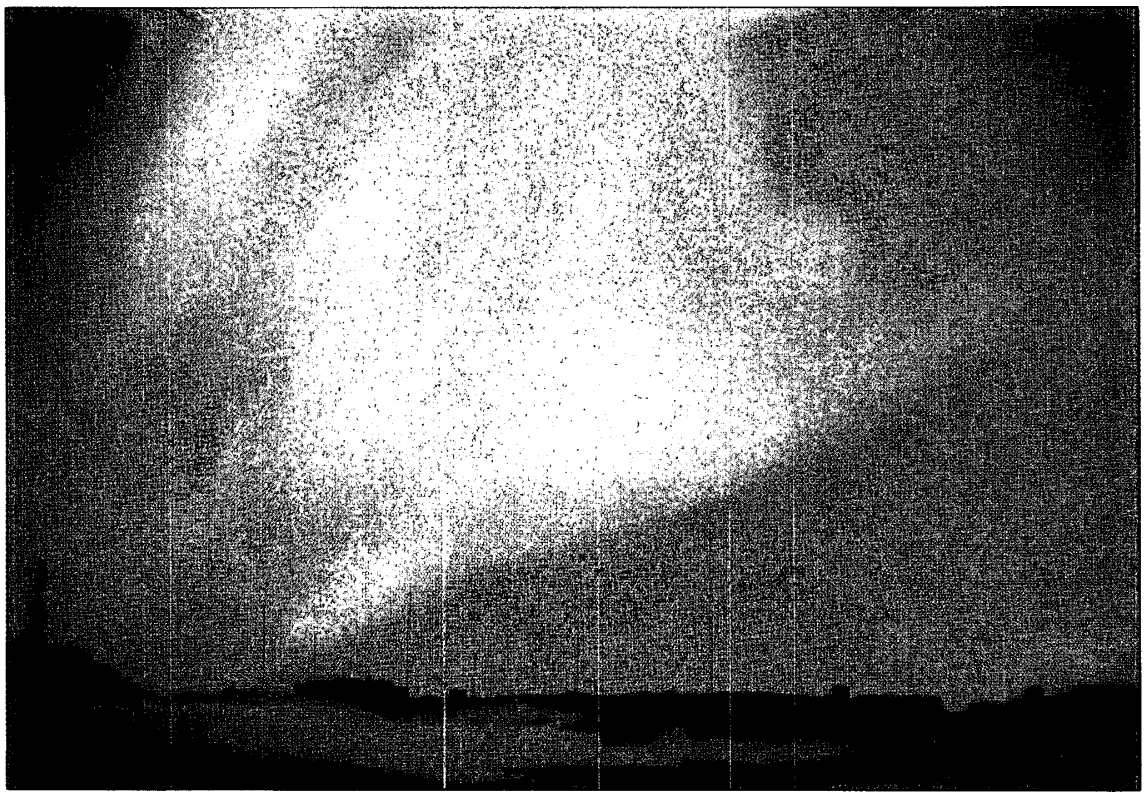

Fig. 36. Fragmentary band, aspect Flame, diffuse profile due to rapid motion. FIVbIR³fB

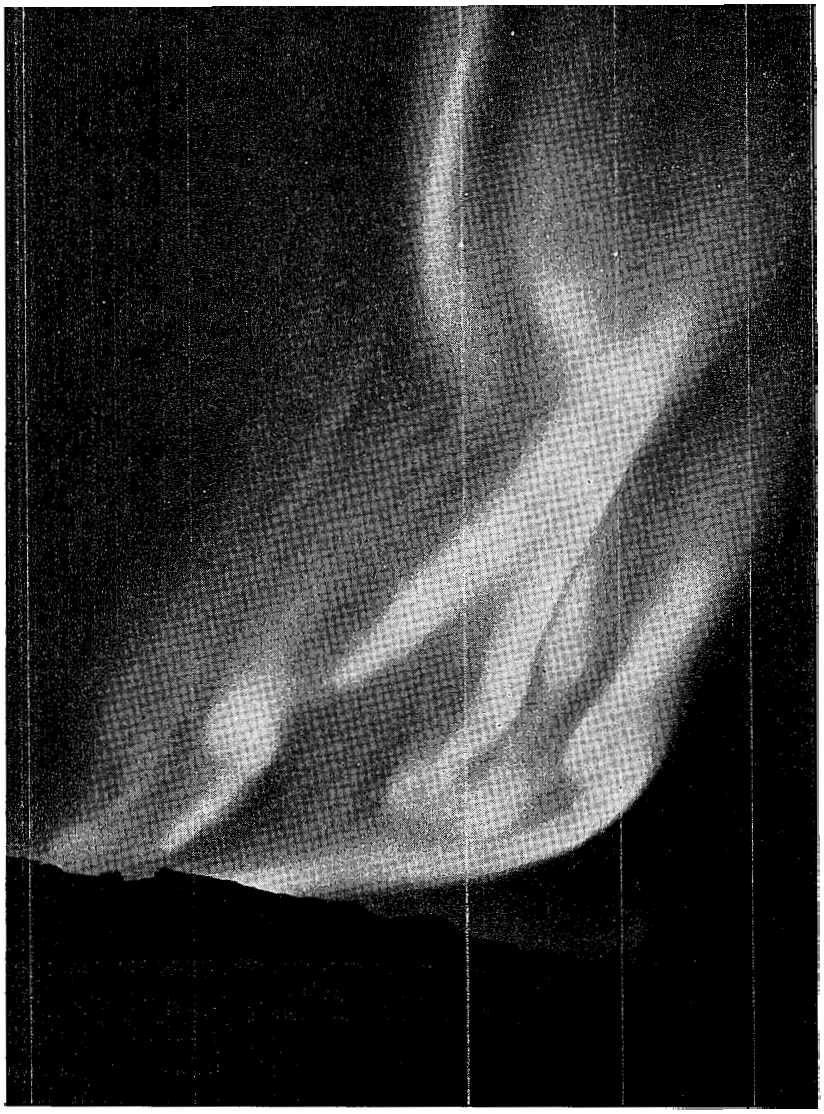

Fig. 37. Fragmentary band, aspect Flame. F(IIIHR³fB, IIIHR³fB)

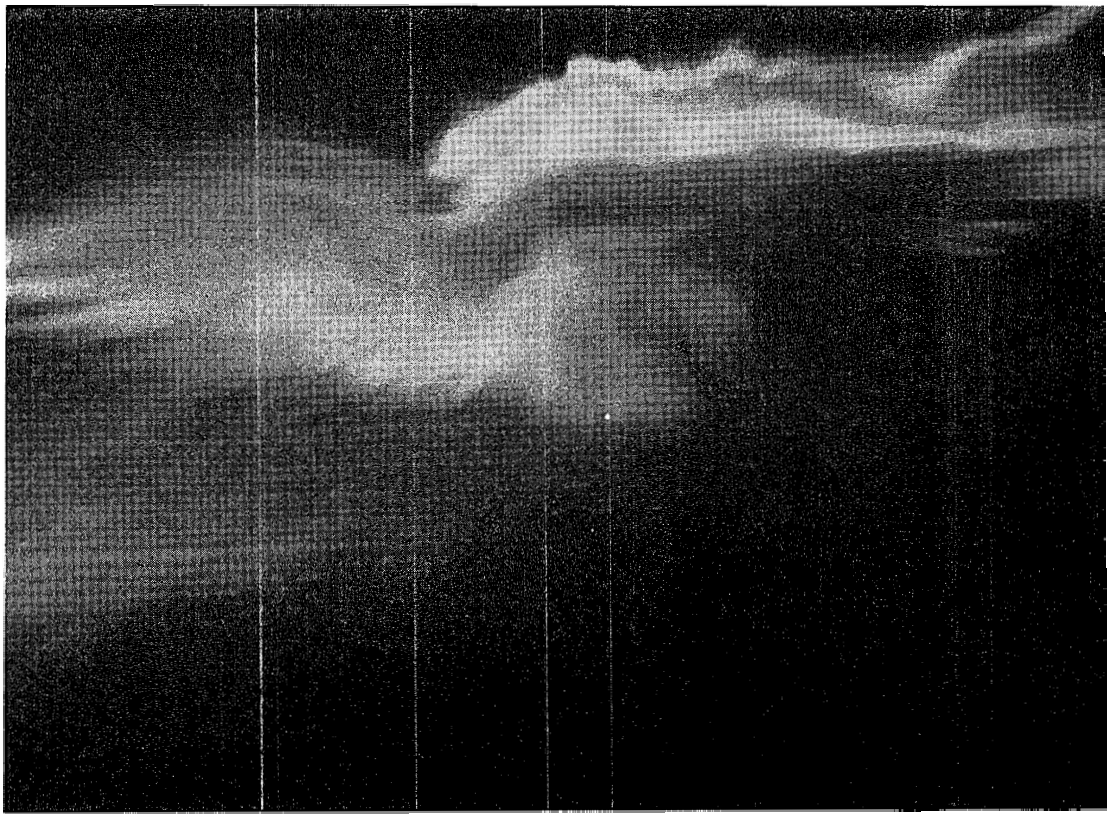

Fig. 38. Fragmentary band, aspect Corona. C(IIIR³fB, IIIR³fB, IIR³fB, IIR³fB)

Fig. 39. Fragmentary bands with different homogeneities. (IIIH²fB, IIIH²fB, IIIR²fB IIIR²fB, IIR²fB)

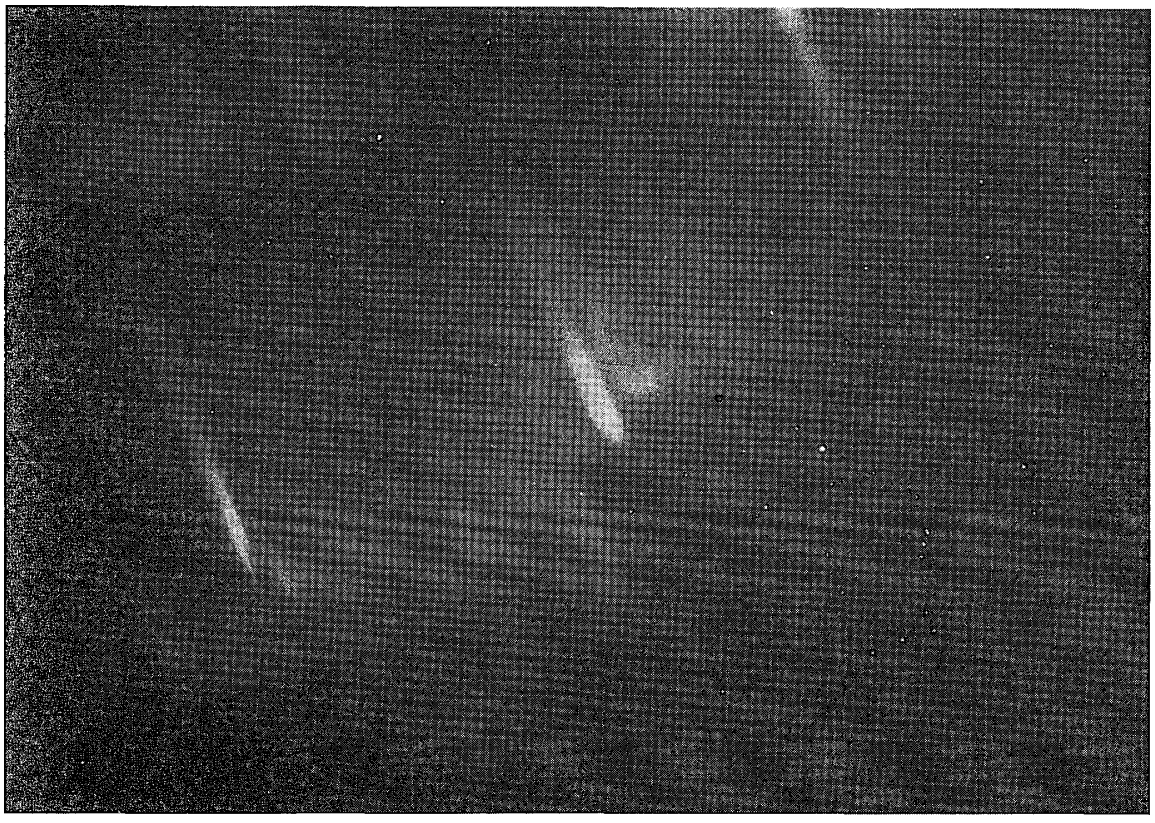

Fig. 40. Fragmentary band (Upper) with dispersed rays and ray-bundles, aspect Drapery. IIIR⁴fB

Fig. 41. Fragmentary bands, colour f-type, aspect Drapery with dispersed rays. D(IIIfR⁴fB, IIIfR⁴fB, IIR⁴dR)

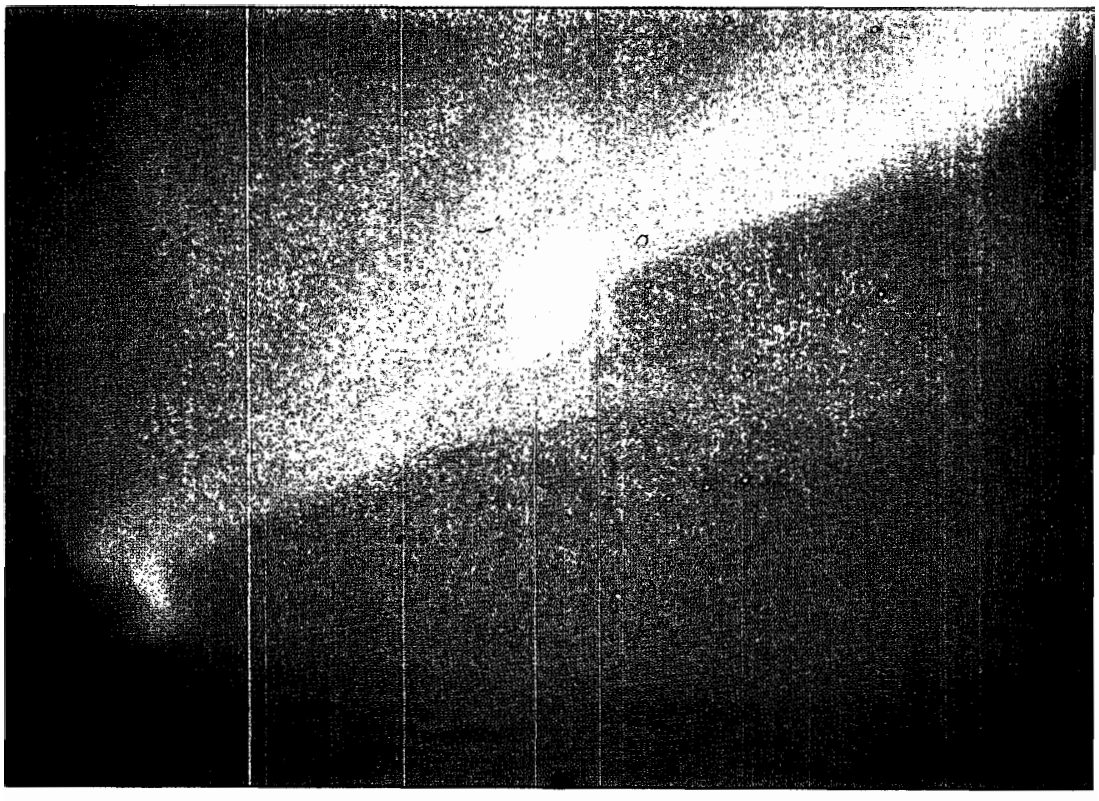

Fig. 42. Bands and dispersed rays, aspect Arch. A(IIIcHR³mB, IIcHR²fB, IIcR²dR)

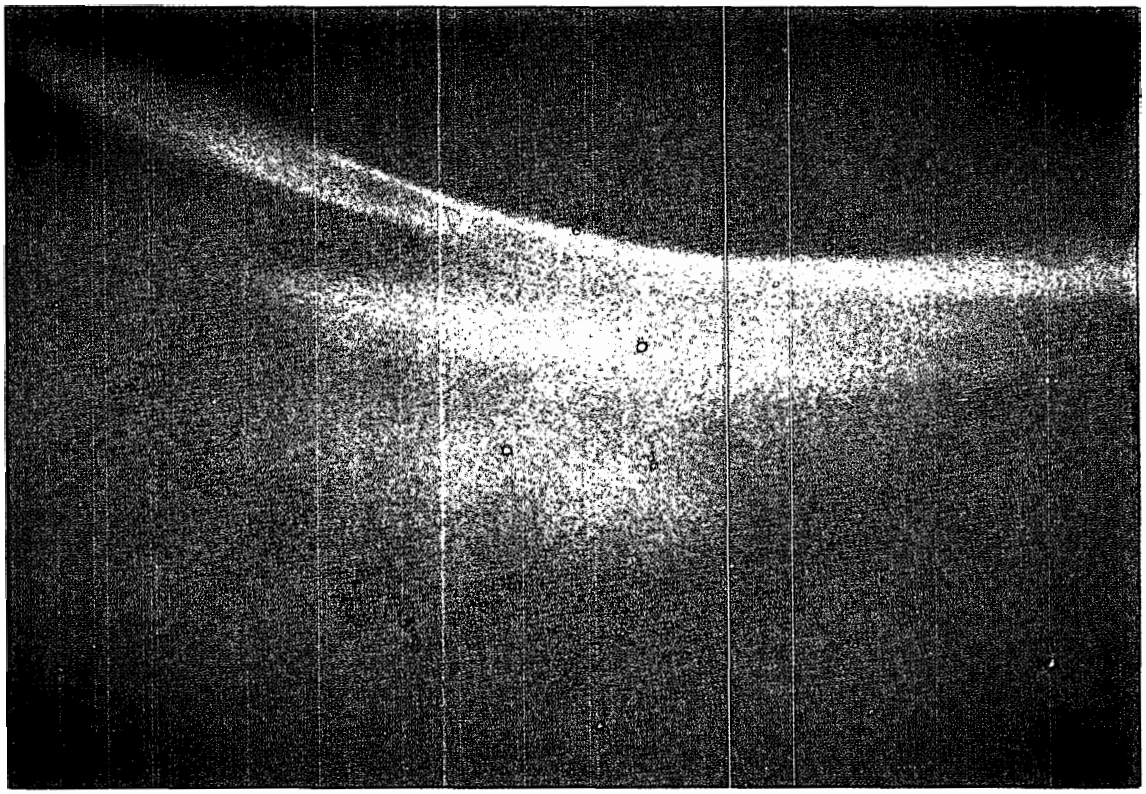

Fig. 43. Fragmentary bands in magnetic zenith, aspect Corona. C(IIfH^{0}fB, IIfH^{0}fB, IIfH^{0}fB, IIfR^{1}fB)

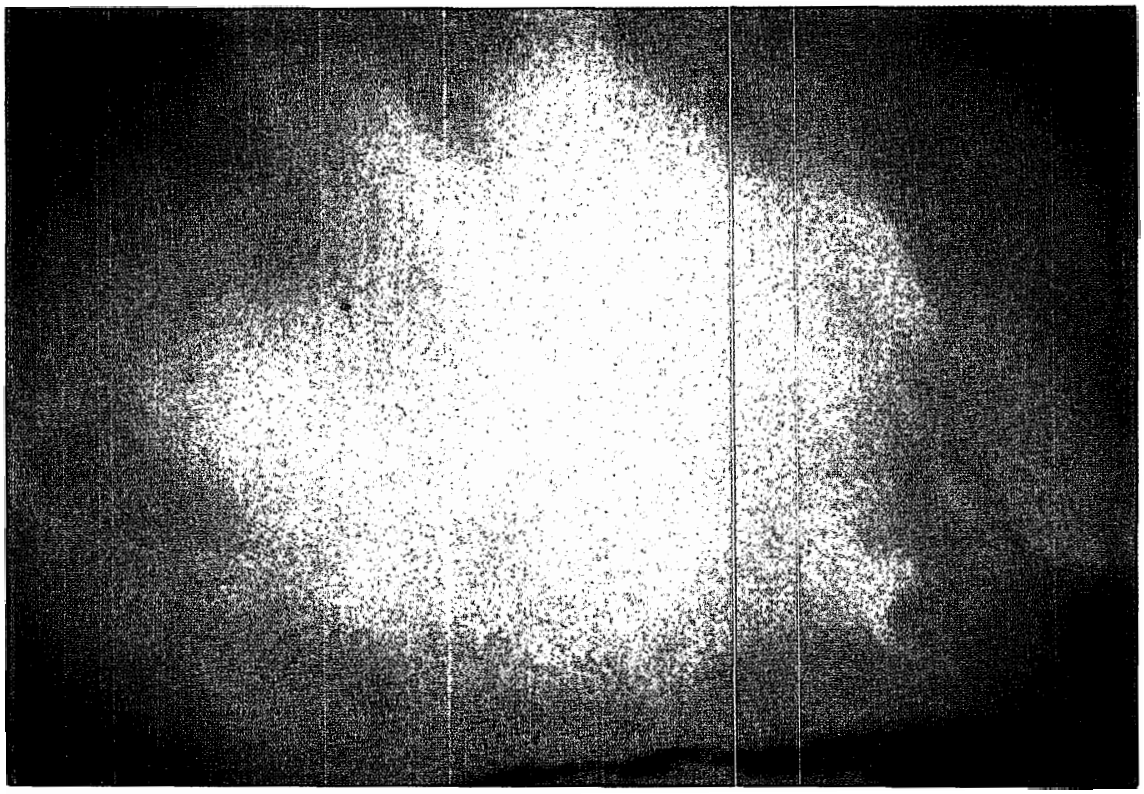

Fig. 44. Many fragmentary bands, aspect Drapery. DIIcR^{4}fB

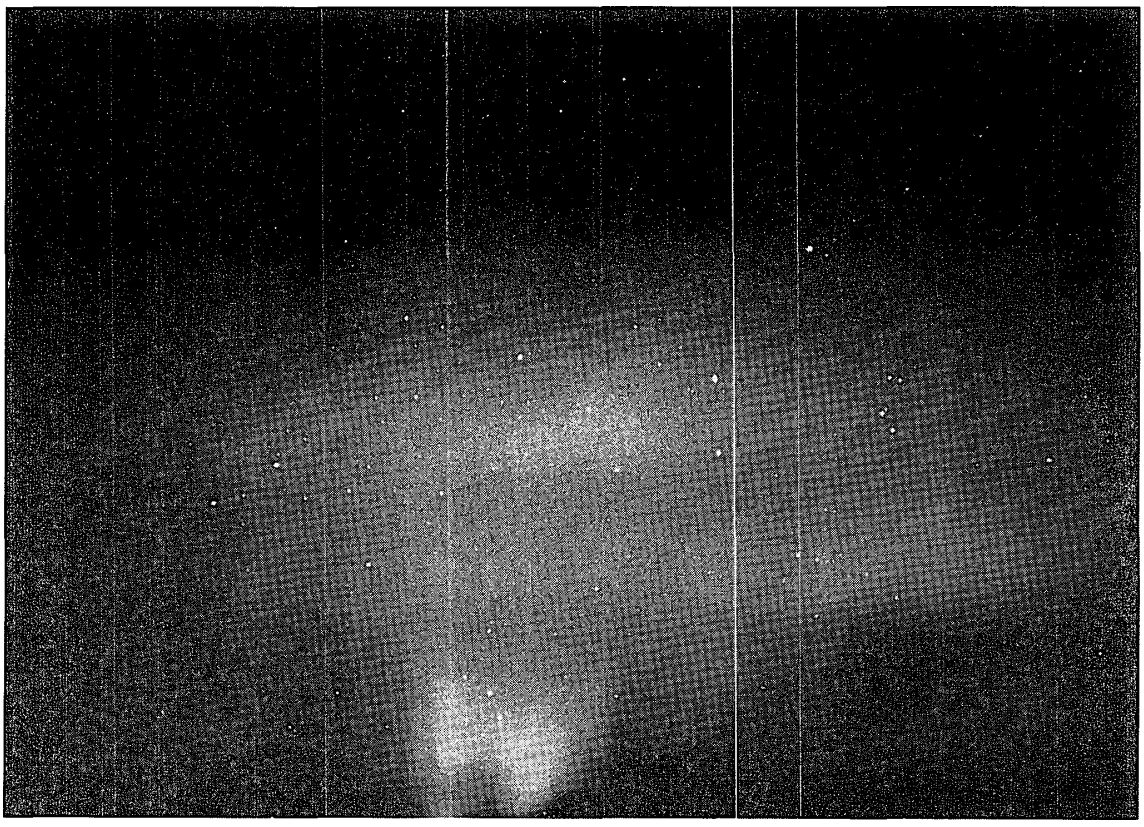

Fig. 45. Vague bands and fragmentary band with dispersed rays. (IIH¹vB, IIH¹vB, IIR²fB, IIR²dR)

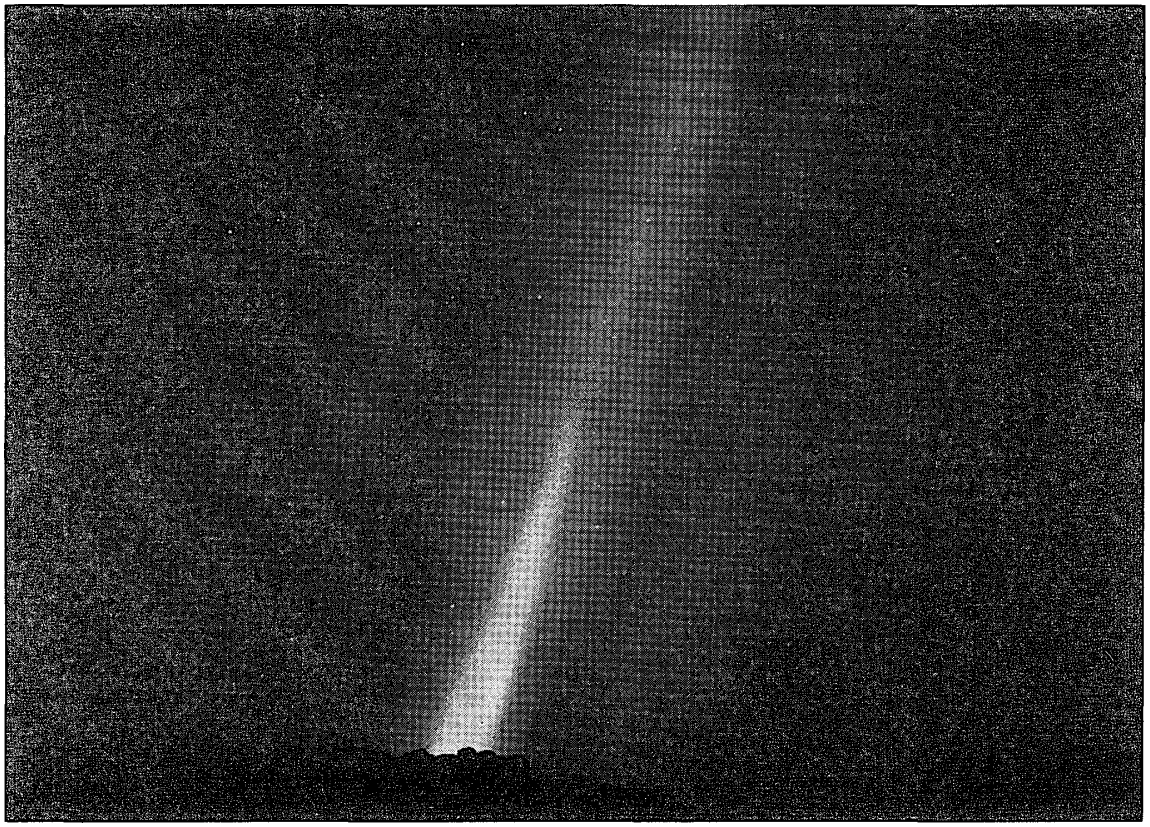

Fig. 46. Isolated ray-bundle and dispersed rays, aspect Pencil. P(IIR⁴iR, IIR⁴dR)

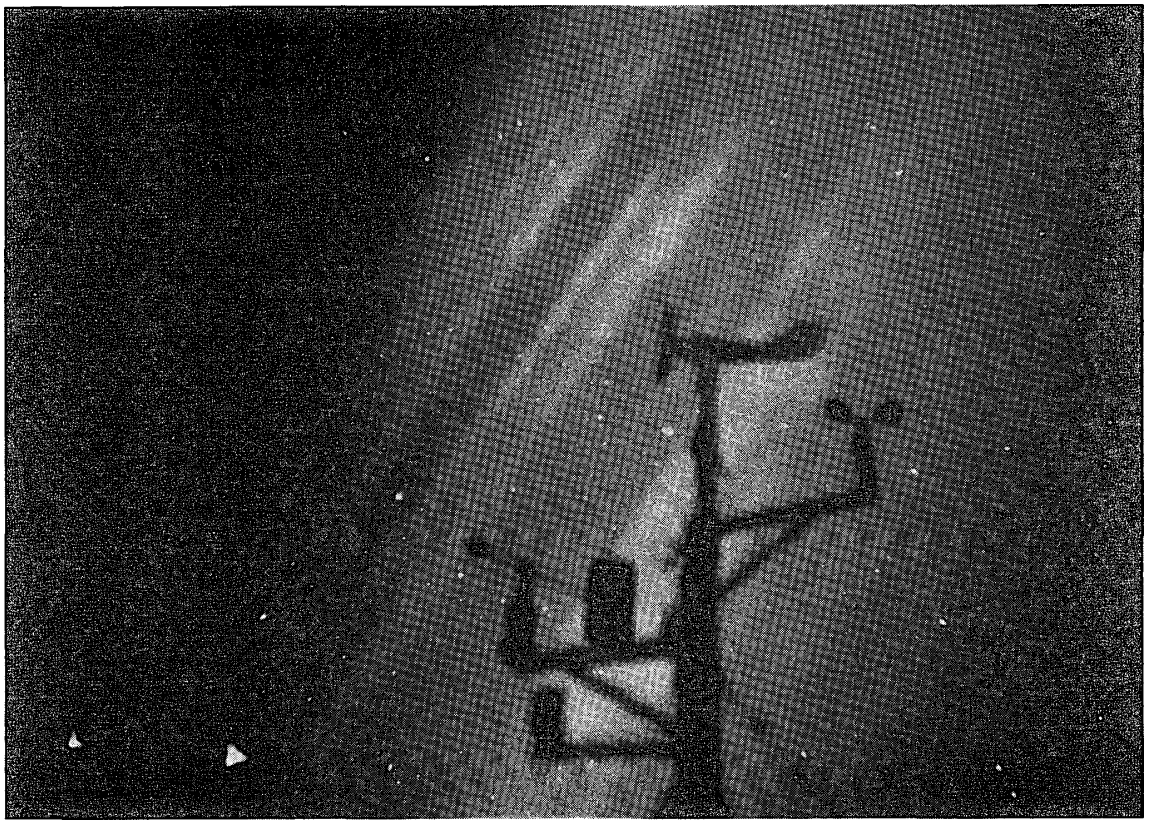

Fig. 47. Dispersed rays, aspect Pencil. PIIR⁴dR

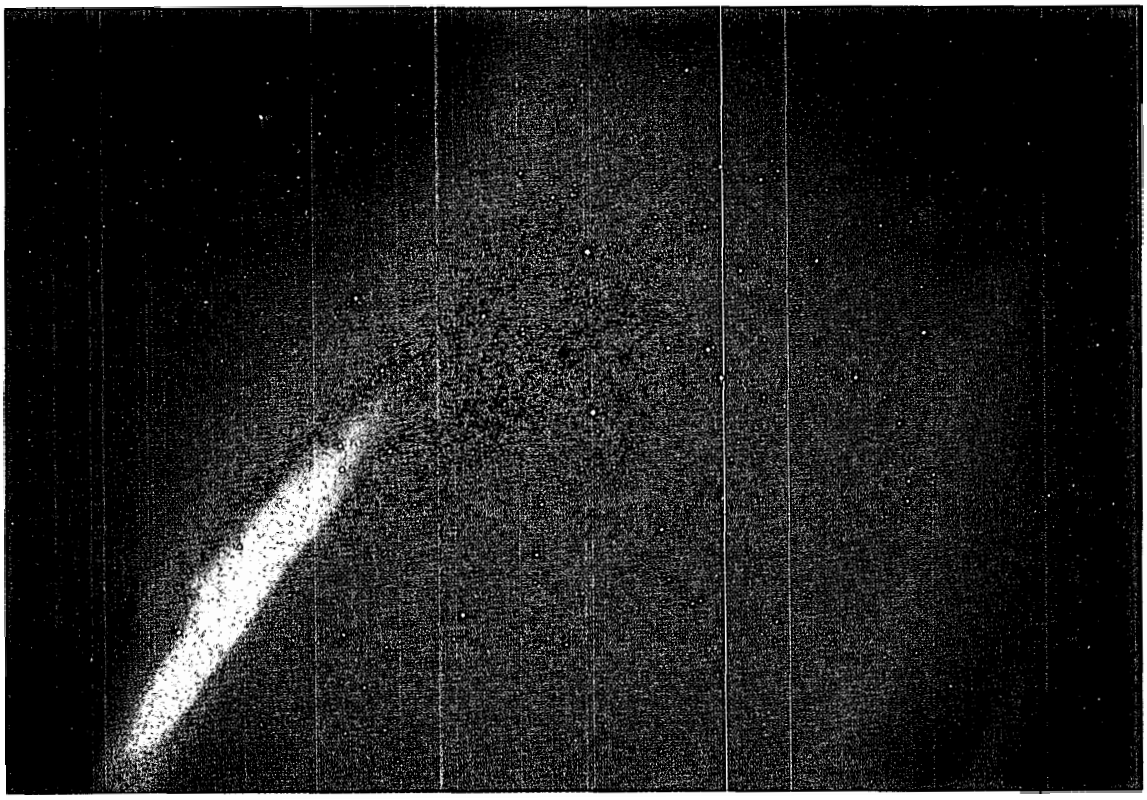

Fig. 48. Dispersed rays. (IIIdR^{3}iR, IIcR^{3}dR)

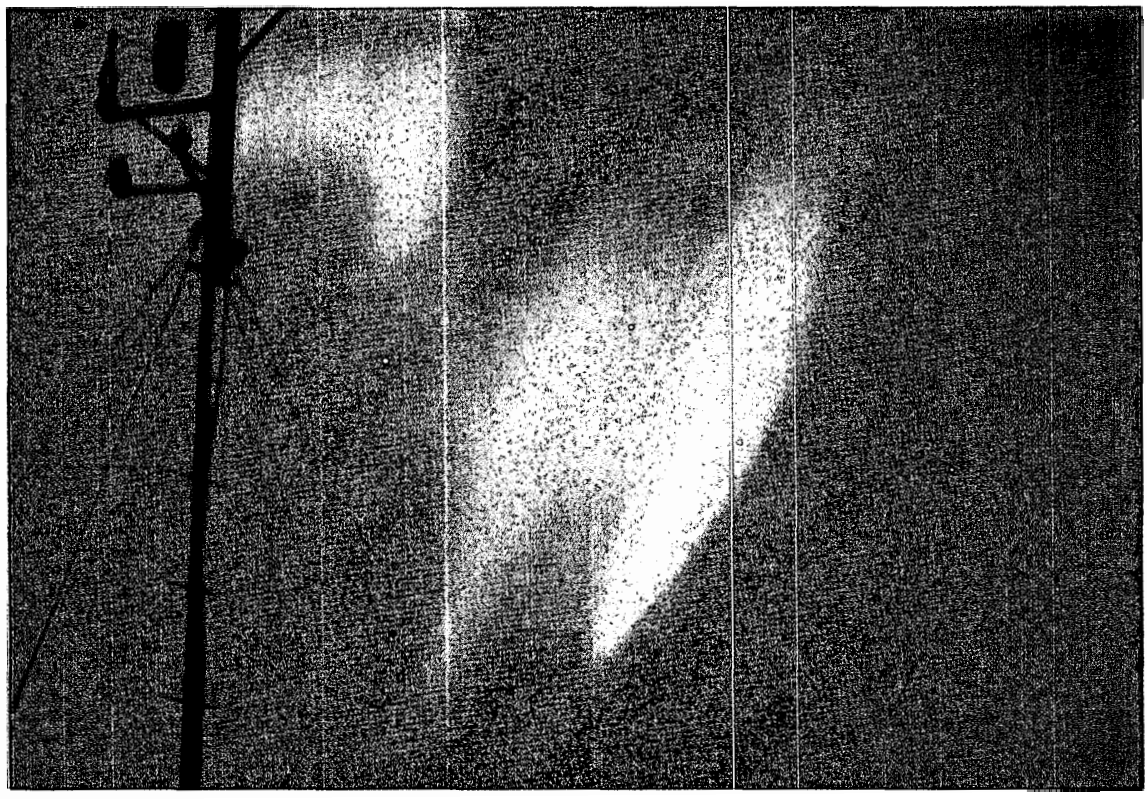

Fig. 49. Isolated ray-bundles, aspect Pencil. P(IIIdR^{4}iR, IIcR^{4}iR)

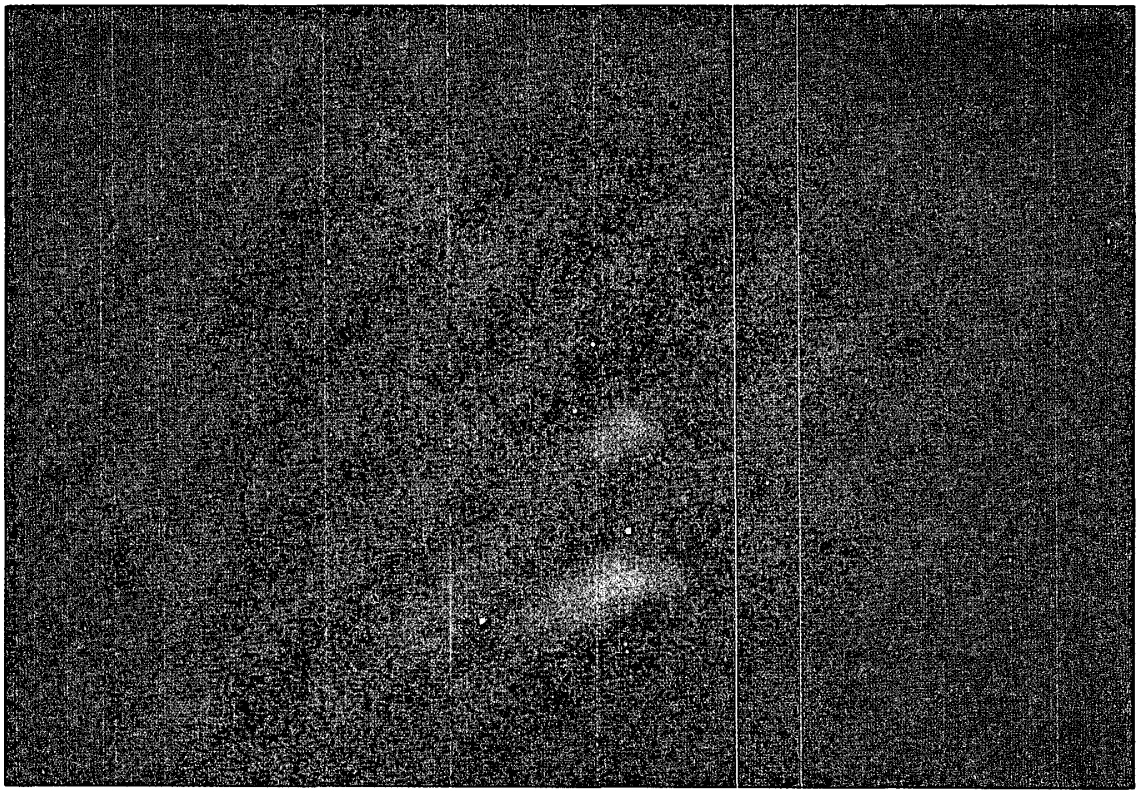

Fig. 50. Dispersed rays, aspect Corona. CHcR²dR

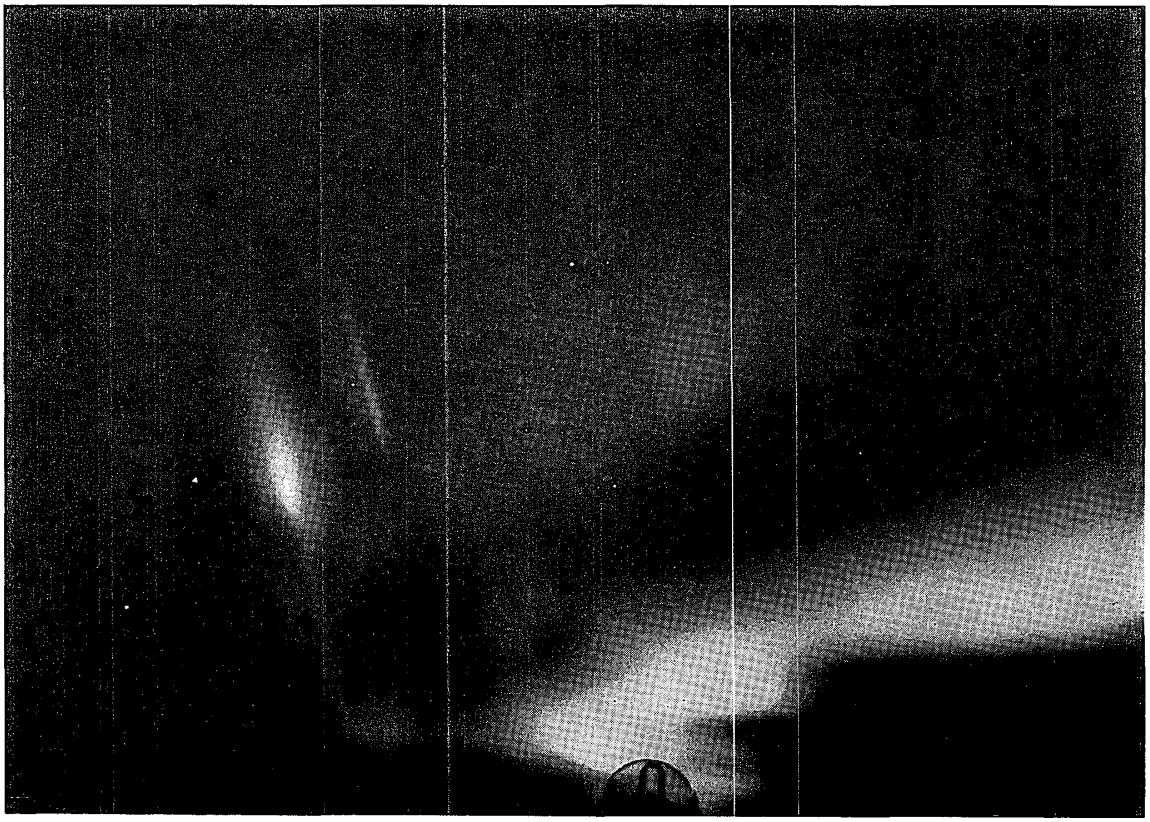

Fig. 51. Isolated ray-bundles (Upper) associated with meandering band. (IIR²iR, IIR²iR, IIR²iR, IIH¹iP, IIIH¹mB)

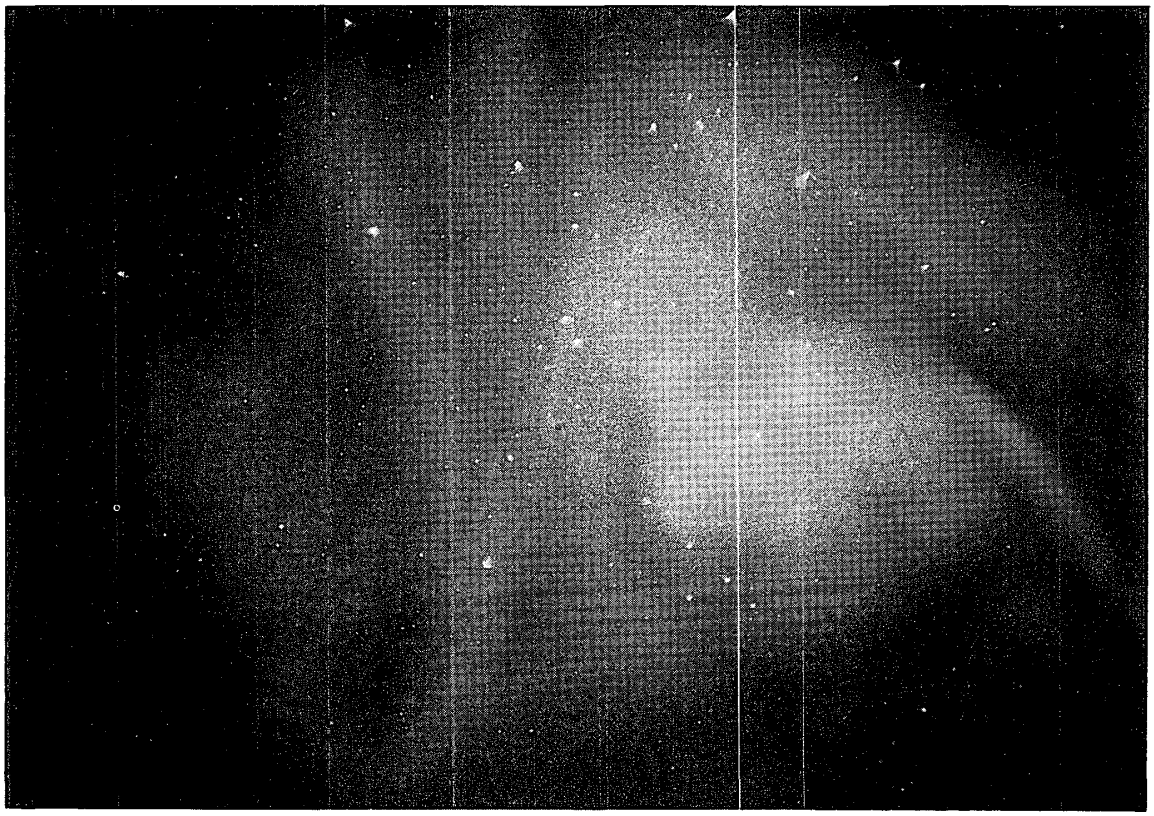

Fig. 52. Dispersed patches in the magnetic zenith, aspect Corona. C(IIIR²dP)

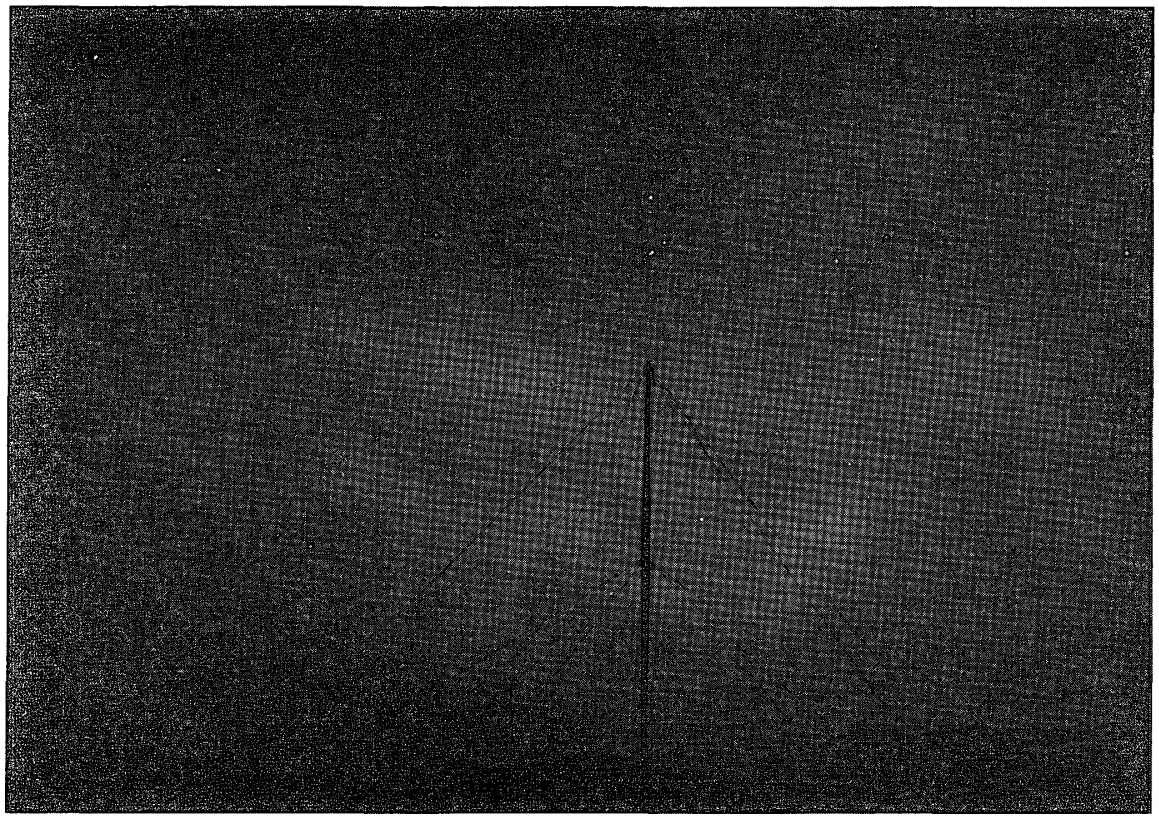

Fig. 53. Dispersed patches and vague bands, aspect Surface. S(IIH¹dP, IIH¹vB, IIH¹vB)

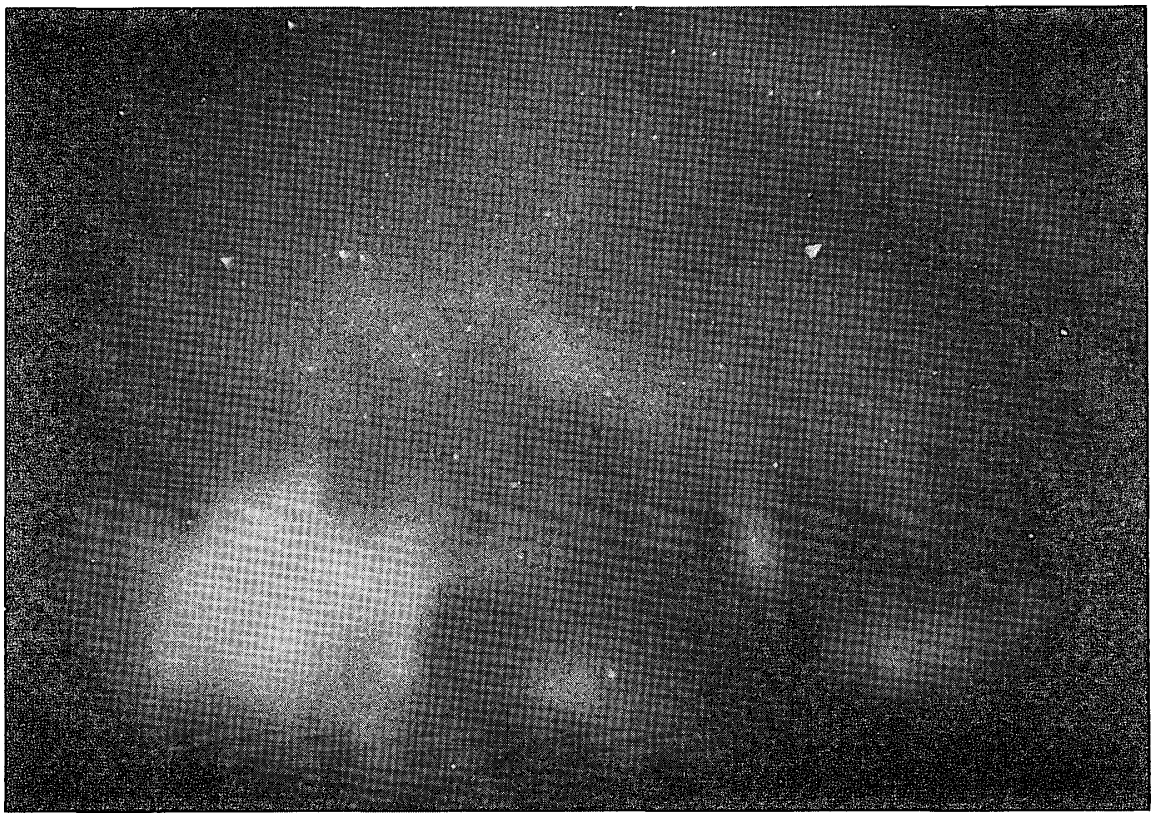

Fig. 54. Dispersed patches, aspect Will-o'-the-wisp. W(IIH¹dP, IIR²dP)

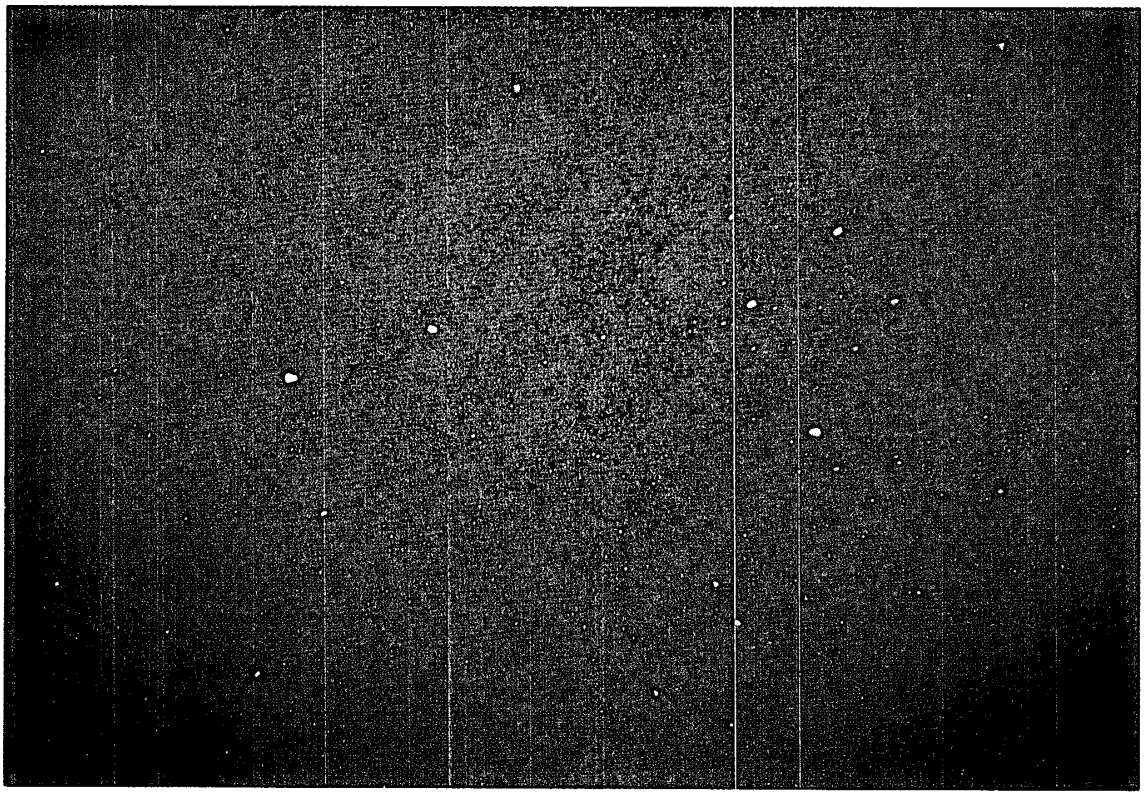

Fig. 55. Homogeneous patch near the zenith. IIcH⁰iP