THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS

Solar Bulletin

HARRY L. BONDY, EDITOR — 61-30 157 ST., FLUSHING 67, N. Y.

SPRING 1962 — Number: 158

ACTIVE MEMBERS OF THE AAVSO - SOLAR DIVISION

Note: SSO = Standard Sunspot Observer whose observations are used in the reduction of the American Sunspot Number - R_A - for the National Bureau of Standards
SA = participating in the Gleissberg-Hotinly study of Sunspot Assymetry /i.e. distribution/;
SEA = participating in an international patrol recording ionospheric effects of solar flares, socalled Sudden Enhancements of Atmospherics, on 27 kHz using the Warshaw-Receiver (see S.D. Bulletin Sep.-Oct. 1956; Jan.-Feb. 1957; Mar.-Apr.,May-Jun.,Sep.-Oct.,Nov.-Dec.1957; Oct.-Dec.'58;

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ROBERT M. ADAMS, Neosho, Mo., SSO

HANS ARBER, Manila, Philippines, SSO SEA (Station A-11); special solar photography in cooperation with Dr. Waldmeier,Zürich

JAMES C. BARTLETT, Jr., Baltimore, Md., special sunspot obs.(col.,conf.)

DOROTHY E. BEETLE, Laramie, Wyo., SSO

HARRY L. BONDY, Flushing, N.Y., SSO SEA-coordinator

RALPH N. BUCKSTAFF, Oshkosh, Wisc. SSO SEA spec. sunspot obs. (A-6)

THOMAS A. CRAGG, Mt. Wilson Obs. Cal. SSO solar research SA

FRANK J. DEKINDER, Montreal, Canada, SSO

DEMETRIUS P. ELIAS, Nat. Obs. Athens, Greece SSO solar research

VICTOR A. ESTREMADOYRO, Lima, Peru SSO spec. solar obs.

WALTER A. FEIBELMAN, Pittsburgh, Pa. SEA spec. sol. studies (A-2)

CYRUS F. FERNALD, Wilton, Maine SSO SA

HARVEY HEPWORTH, Blauvelt, N.Y. SEA (A-10) sunspot photography spec.ob.

SARAH J. HILL, Whitin Obs.,Mass. computer of Amer. Sunspot Number R_A

Active AAVSO-Solar Division members (continued)

C. H. HOSSFIELD, Ramsey, N.J. SEA (A-5) records also Sudden Enhancement of Signals (SES) with receiver of own design (signals from NBA-Panama; NPM-Hawaii(!) and others)

FRANK J. KELLY, St.Petersburg, Fla. SSO

HERMAN W. LANG, St. Louis, Mo. SSO

ERNEST O. LORENZ, Lakewood, Calif. SSO spec. sunspot obs.

WALTER L. MOORE, Univ.of Louisville, Ky. SSO

JEAN NICOLINI, Sao Paulo, Brazil, SSO

BEN C. PARMENTER, Spokane, Wash. spec. solar obs., spectroheliograph

E. H. PILSWORTH, Battle Creek, Mich. SSO SA

DAVID W. ROSEBRUGH, Meriden, Conn. SSO SA

JUSTIN M. RUHGE, China Lake, Cal. SEA (A-7)

STANISLAUS SCHARLACH, Oakland, Cal. SEA (A-9)

WALTER J. SEMERAU, Kenmore, N.Y. spec. solar obs.; spectroheliograph, quarz monochromator; photography, time-lapse cinematorgraphy of prominences and other

HOWARD D. THOMAS, Coulee Dam, Wash. SSO SA

JOHN THRUSSELL, Herts, Great Britain SSO pol. helioscope; col.in ss.

FRANK TRATHEN, Napa, Cal. SSO SA

S. C. VENTER, Pretoria, South Africa SSO

ANDREW R. WALLBILLICH, Rockville, Conn. SSO

DAVID WARSHAW, Valley Cottage, N.Y. SEA A-1 spec. sol. studies; originated transistorized SEA-Receiver

KARL A. WELLS, Massena, N.Y. SSO SA

R. W. WOMELSDORFF, Lake Charles, La. SSO SA

* * * * * * * *

The above named members participate in the Solar Division's work in one way or another. Their contributions cannot be adequately appreciated as no work of serious amateurs can; one can only be grateful to them. This work is never"publicized", yet it goes on. What more can be said?

hlb

COLOR IN SUNSPOTS OBSERVATIONS made by our members.

Shortly after the AAVSO Solar Division was organized by Neal J. Heines, several of our members followed JAMES C. BARTLETT, Jr., Baltimore, Md. in gathering observations on sunspots which showed color.

James C. Bartlett, Jr. observed color regions in sunspots from 1946 on with regularity. He noted two instances already in 1942. In POPULAR ASTRONOMY, Vol. LVI, No.2, Feb. 1948, Bartlett wrote about "Some Experiments with Color in Natural and Artificial Sunspots".

"Be it as it may /wrote Bartlett/, it is a fact that quite early in the art, solar observers reported color in sunspots; and it is interesting to note that all were generally agreed on certain salient facts:

color was a rarity;
it was seldom vivid;
it was confined largely to very large or active spots, i.e. to spots which might resonably be looked to for something unusual.

Now the same relations are found to hold good at the present time, which is at least a point in favor of the ancient observers."

"As early as 1759, Messier, the unwitting founder of nebular astronomy, reported a deep brown color in 'the great spot' which appeared that year and which was remarkable for a peculiar S-shaped umbra."..."In 1926, Capocd reported violet in the form of a 'haze' surrounding a brilliant bridge over a 'double umbra', and the present writer saw a reddish haze of much the same nature in much the same kind of spot a few months ago /1947, ed/. In 1858 Father Secchi saw a rose-colored "promontory" in a naked-eye spot, and the work of both Schwabe and Schmidt contains many references to reddish, brownish, violet, and yellowish tints. Lockyer saw both violet and copper-red."

In a letter to this editor (10,20,'55), Bartlett tabulated his colored sunspots as follows:

Year	No.	Year	No.	
1946	63	1951	32	
1947	36	1952	14	
1948	22	1953	9	
1949	27	1954	2	
1950	17	1955	10	(up to Oct.)

As already mentioned, two colored spots were observed in 1942; none in 1940, 41, 43, 44 and 1945. These figures, as Bartlett points out, are only rough indicators of the incidence of colored spots. Their rarity stands out even more when we use Bartlett's total number of spots observed (major spots, not groups) in 15 years (1940-55): total of individual spots: 38,115
individual spots with color: 234

In COLOR PHENOMENA IN SUNSPOTS, an Informal Report to the Solar Division - AAVSO by WALTER ORR ROBERTS (13 October 1952) we read among other:

> "Lockyer, Secchi and others have ascribed the visual colors to the rosy hue shown by solar prominences visible at the sun's limb during eclipse. The "clouds", in their opinions, were simply prominences seen in projection against the sunspots. However the question was never conclusively settled, nor was the reality of the color phenomenon established beyond all reasonable doubt."

Here we may point out Waldmeier's conclusion (A.M. 224; cited on page 8), namely: "The red-spots of an umbra are not noticeable in Hα-images; they are photospheric phenomena."

Bartlett in his article (P.A. 1948) mentions: "In this connection, Dr. Menzel (and others, Ed.) contributes the thought that spot colors may also be due to superimposition of chromospheric (flares) eruptions". This view is no longer held tenable.

Roberts continued his informal report:

> "In 1948, at the suggestion of Mr. Heines, and with his aid, I asked observers of the Solar Division of the AAVSO to send summaries of any observations of sunspot colors to me. I also collected some data from sources other than the Solar Division. I felt that if the phenomena were beyond all question real -- an interpretation most solar astronomers appear to doubt -- independent simultaneous observations should confirm the colors and locations of the effect. Moreover, if the colors arise from prominences, then they should be very pronounced at the times when large solar flares, the most intense of all prominences, are present above sizeable sunspots.".

> "A substantial number of visual observations have now come to me, and they suggest the following conclusions:

a. The color phenomena are elusive -- so that colors detected by one observer may go undetected by another working at the same time.

b. The colors are reported with reasobale frequency, but for a decided minority of sunspot groups. Color in sunspots is a much less frequent phenomenon than solar flares, if we judge the evidence correctly.

c. Colors other than "rose" or "red" are reported, with brown, orange, yellow, and violet being commonly recorded.

d. Certain sunspot groups -- usually active ones producing numerous flares -- seem more likely to be reported as colored. The color reports persist, as a rule, for several days for a given spot-group.

e. The times and locations of the color phenomena do not (Underscored by Roberts, not Ed.) coincide with the times

and locations of flares. Color observations at or near the times of flares have failed to show correspondence with the flares themselves. And many pronounced color reports have been for times when there were clearly no flares in progress. But flare-producing groups seemed to be favoured as color-producers."

"On 11 April 1950, for example, two observers independently reported colors in a large spot group about 15° N of the equator and 25° east of the central meridian of the sun. One reported red, and one brown, but at times about two hours apart. The region was a great producer of flares."

"The observations are yet too scattered to allow certain identification of the features of one observer's color map with those of another, or with photographs of flares..."

In Waldmeier's classic "Ergebnisse und Probleme der Sonnenforschung" 1941 (Results and Problems of Solar Research), p. 148 "Fig.54 (see below) show such a case /of color in spots/; These grey to brown-red appearing areas can be observed for several days and can be identified on photographs. Apparently these umbral regions have a higher temperature than the normal umbra has."

7 Sept. 8 Sept. 9 Sept.
1937.

Fig. 54. "Brown-red (dotted) and grey (shaded) areas within an umbra of a sunspot."

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Editor's notes: For personal reasons, this Editor was unable to bring out any Solar Bulletins since the May-September 1959 issue. However, while this issue is being distributed, additional bulletins are already in preparation. These will include all data usually published (sunspot numbers, Mt. Wilson sunspot data, etc.), as well as other material.

The Summary Table, showing all sunspot observations by our members, is again being issued and distributed directly to the observers. We are greatly indebted to Dr. Sarah J. Hill and to Miss Carolyn McGiffert. Miss McGiffert has most ably assisted Dr. Hill in the computations and tabulation of our data.

More data and comments on "color" in sunspots in the next issue.

H.L.Bondy

Excerpts from "LE SOLEIL" (The Sun) by P. A. SECCHI S.J. dealing color in sunspots. Translation by Frank DeKinder, Montreal.

"The division of umbrae generally precedes the break up and disappearance of sunspots. But besides this division due to a light-bridge, comparable with the brightness of the photosphere, another phenomenon often occurs, as mentioned before already, and this requires a special study. These are the "veils", often colored, which appear inside the spots.(see example by Secchi below). These are quite often noticeable and if earlier observers did not see them it is on account of the colored (sun-) glasses they used which completely masked the color of these objects. However, with a polarizing helioscope have almost always noticed them in large sunspots, especially in their formative period. What is of importance, however, is their origin and development."

"An enormous spot appeared in the month of February 1866 and we followed it very carefully. The great disurbance bacame first noticeable in a vast region extenting in longitude to 5/22 of the solar diameter or just a little under one quarter. It was visible to the naked eye. One could imagine a great rift (in the spot), assuming the craziest forms among which the shape of an S seemed to predominate. In the middle of this chaos we noticed a region with large masses of red veils as shown (see below)."

"The most remarkable feature was a (light-)bridge in the form of an arc or a horse-shoe.formed of extremely brilliant matter surrounded by a kind of luminous promontory similar to a facula."

"The following day, the 17th, we found the arc broken, the dangling end finishing in a thin and sharp point. The portion that disappeared was replaced by a red veil. Other veils, both red and white, covered the rest of the spot. On the opposite side of this umbra, the large streamer which had been observed the previous day had disappeared and was replaced by a red trail. Hardly had we finished our drawing when the "hook" on the left side had disappeared. Only the base remained visible, the rest was replaced by a pink veil."

"One question forced itself upon us: Is there a real transformation in these phenomena from brilliant arcs to red veils or do we have here a case of accidental superposition?..."

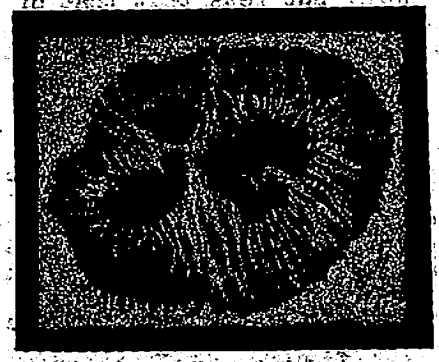
"On 23 January 1866, we were watching a spot in the shape of CO; two brilliant tongues projected themselves from both ends and seemed to just about divide the spot by a bridge. Fig.44 shows one of these sheaves of flame as seen at 10:45. Fifty minutes later this fiery tongue had developed sharp ends as shown in Fig.45. Ten minutes later, on returning the eye to the instrument, they were seen changed into pink veils. Finally the veils disappeared and at 13:45 there remained only a sheaf of flames shorter than those at the beginning. There is thus no reason to doubt that a transformation took actually place."

SOLAR BULLETIN

Examples of colored sunspots from P, A. SECCHI, S.J. "LE SOLEIL"

Since this reproduction cannot show clearly the reddish areas, the sketch below shows the colored areas as hatched parts

Fig. 41.



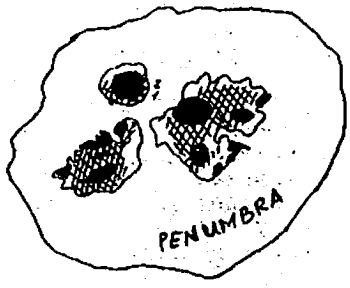


Fig. 43.

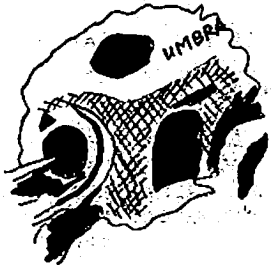


Fig. 44 45 46 47

Rapid development of penumbral filaments (brilliant tongues) seen by Secchi on 23 January 1866; times: 10:45 AM, 11:35, 11:45 and 13:45. "these sheaves".."fiery tongue".."seen changed into pink veils" (pink veils shown in this sketch as hatched area, in 46.)

In "RED SUNSPOTS" (Astron. Mitteilungen der Eidg. Sternwarte Zürich No.224) Dr. M. Waldmeier summarizes his own observations and studies as follows:

> "Some observations of red regions in the umbra of large sunspots are described . Such regions are most likely to occur at the limb of the umbra, often accompanying or preceding the formation of light-bridges across the umbra. Their brightness is larger than that of the umbra, but less that that of the penumbra. Red regions in sunspots represent infrequent but rather stable phenomena. Very little is known at present of their physical nature."

(Waldmeier first mentions color distortions due to inadequate optics.) "The first authentic report about colors in sunspots is found in a letter of Heinrich Schwabe, the discoverer of the sunspot cycle, and addressed to Rudolf Wolf, the originator of the "sunspot number" on 4 October 1852. Schwabe wrote among others: "Did you observe carefully the two sunspots which were visible from 20th to 28th September? I noticed already on the 22nd, that neither had the usual colors and especially the southern one showed this clearly. On 25 September I saw distinctly that the southern spot with penumbra had a fiery brown-red color in its umbra, the northern was only brownish, the western spots were brownish-red, except for one, the largest, which appeared the usual clear black."

P.A. Secchi was the first one to write about red sunspots in a book, his LE SOLEIL - 1870. (for excerpts see elsewhere in this Bulletin) Until Waldemeier's "Ergebnisse und Probleme der Sonnenforschung", 1941, no professional astronomer seems to have delt with this phenomenon. again.

The following are Waldmeier's conclusions about the "Properties of red sunspots" (p.13). He claims that descriptions such as "fiery" or "glowing brick-red" are exaggerated. The phenomenon ranges from a pronounced red to reddish-brown and barely colored grey. The colored areas are generally difficult to identify.

> a) "Location of appearence. The red areas occur only in spots with penumbrae, and here only in the larger ones. The most beautiful cases of red-spots are observed only in the very largest, complex sunspots, whereby even in the largest groups such regions are rare. The red areas are limited only to the umbra; we have never observed colors even in the largest penumbral areas. The red places are usually at the edges of the umbra, often associated with light-bridges or as extensions of bays. Thus they are partially surrounded with the umbra and penumbra. There are, however also cases of completely isolated red areas within the central part of an umbra. In very large umbrae, several isolated red-spots may appear; thus some sunspots show a tendency to have many red-spots, most, however, have them rarely. In penumbral fields which contain several separate umbrae, some umbrae may have red-spots, usually however only one will show color, most often none. A large sunspot group with several large sunspots may have red-spots in every one of them; however there is no tendency to show a preference for either the p- or f-component.

The red-spots cover only a small part of the umbra; cases where half or even the larger part of an umbra appeared red have not been observed.

b) Shape and Area of red-spots. Frequently the areas showing coloring have a shape of a segment of a circle; those appearing more in the interior of the umbra are roundish or oval shaped. Often a colored red band crosses the umbra. The smallest red-spots have a diameter of about 2000 km, the largest extend some 20,000 km.

c) Variation and life-span of red-spots. Since it is difficult to confirm red-spots, little weight should be given if this coloring cannot be identified after a few hours of deteriorating seeing conditions. Rapid changes in red-spots have never been observed; in most cases they can be identified readily the next day. Their evolution proceeds aboabout the same rate as the metamorphosis of the umbra. In large, complex and rapidly developing umbrae which change considerably from day to day, red-spots will also change so that they may be identified only with difficulty if at all; in stable, regular sunspots, red-spots hardly change from day to day. Red-spots appear often with light-bridges, either in association or as precursors. The development of light-bridges, however, in most cases is withoub red-spots.

d) Distribution on the solar disc. Red-spots are best visible when the sunspot is in the central zone. Extended re-spots may be often seen up to 60° from the solar disc's center. The diminution towards the limb is most likely due to the foreshortening effect than to a difference in their relative height above, and the increasing scatter of light.

e) Brightness of red-spots. The brightness of red-spots is always greater than that of the surrounding umbra, regardless whether they are at the centrum or the edge of the umbra, but always less bright than that of the penumbra."

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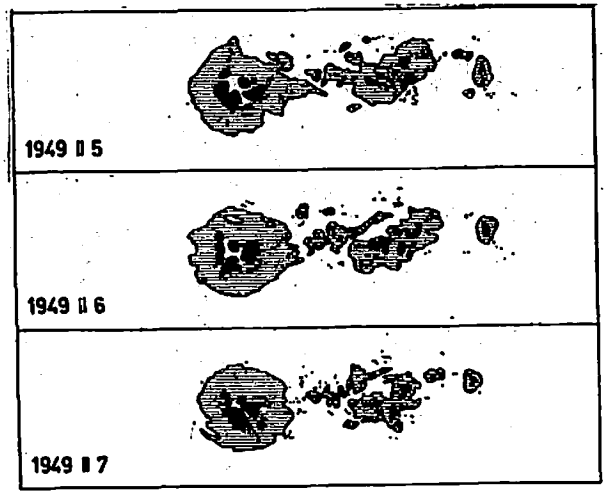
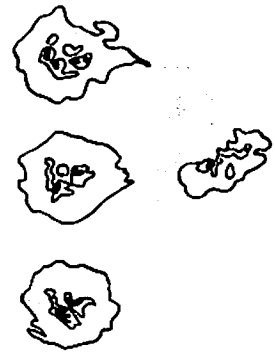
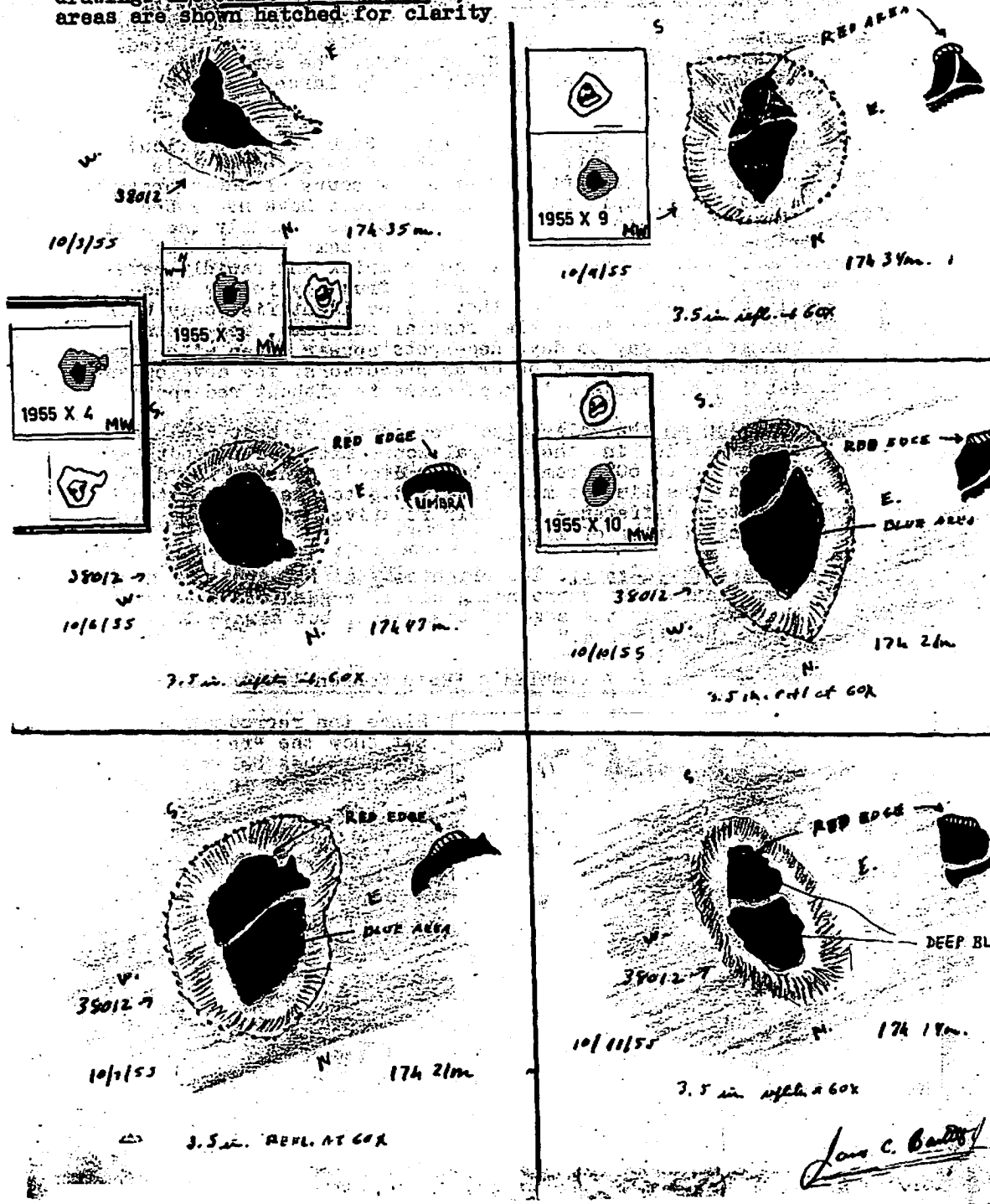
Some examples from M. WALDMEIER's "Rote Sonnenflecken" AMESZ #224

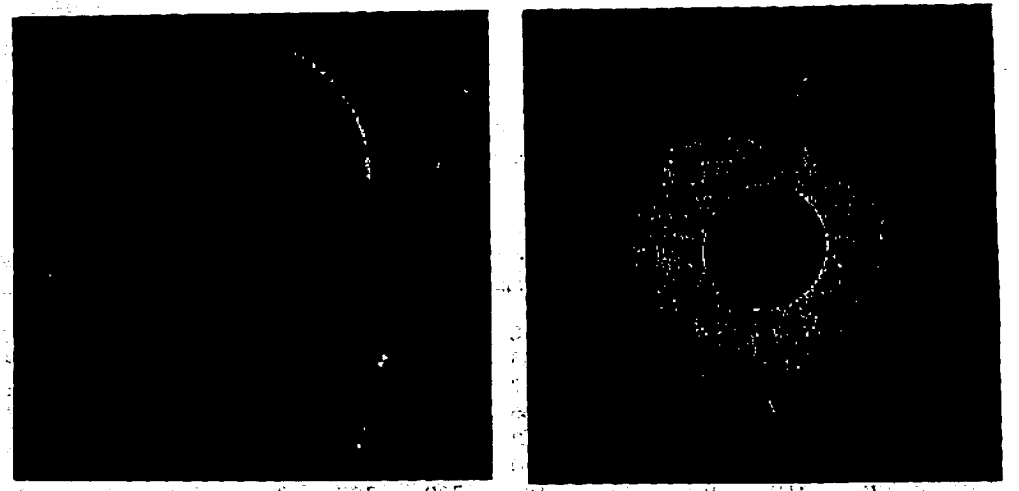


Since the reproduction may not show the "red-spots", the sketches below show the red-spots in dark black



Parallel observations of colored sunspots. Small inserts are those shown in M. WALDMEIER's report (they are noted as MW - the colored areas are shown in black on a sketch next to Waldmeier's reporductions. The large drawings are JAMES C. BARTLETT's, his original report, and the colored areas are shown hatched for clarity

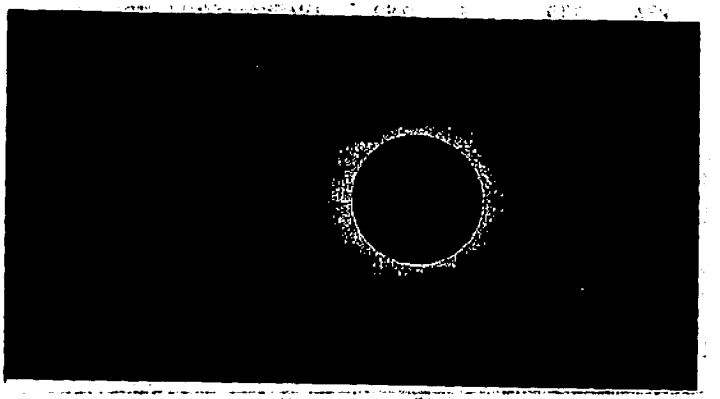




Two photographs received from Dr. Huberta von Bronsart Stuttgart, Germany show the eclipse of 2 October 1959 as seen from the Canary Islands.

The inner corona, with prominences, was photographed by von Bronsart with an Amstar refl. 88 mm prime foc. 1/1000 sec. exp. on Agfa Record; enl. 4x

The outer corona photograph was taken H. Behrends, Berlin, Tessar 4,5/250 mm; 1 sec. Isopan F with a RG-1 filter; enlarged from original sol.diam of 2,5mm



The 15 February 1961 eclipse from the "Mission Hellenic" in Island Hvar was received from Demetrius P. Elias, National Observatory, Athens, Greece. It already shows the transition from the maximum-type corona of preceding years.

Eidgen. Sternwarte Zürich (Switzerland)

Definitive Sunspot - Numbers for 1959

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	221	141	158	243	120	152	147	194	290	65	136	170
2	225	141	151	242	112	133	118	210	256	76	121	165
3	229	140	151	174	113	152	138	213	202	89	97	160
4	231	137	146	159	105	166	158	225	161	101	103	163
5	243	128	152	124	112	162	136	212	148	115	91	142
6	238	114	148	108	138	180	127	207	152	128	98	147
7	247	124	150	107	156	181	120	179	135	130	114	141
8	246	90	155	136	188	192	131	175	136	115	131	145
9	245	87	164	161	238	188	129	170	157	103	136	94
10	224	100	156	177	262	160	127	155	141	91	142	89
11	218	100	148	197	287	172	133	180	155	87	153	82
12	203	101	126	189	276	176	135	160	170	81	154	75
13	192	106	159	178	257	165	160	125	148	78	149	73
14	128	129	173	193	227	170	180	139	151	102	137	88
15	120	133	216	174	204	158	176	144	161	96	127	123
16	143	144	225	153	182	172	190	157	130	116	113	113
17	168	170	228	126	187	161	193	166	87	107	83	107
18	179	170	230	114	198	174	195	174	100	116	73	117
19	202	175	234	117	185	182	184	182	120	111	69	134
20	240	160	238	135	187	173	160	180	149	108	65	133
21	255	163	230	128	151	162	132	200	143	111	70	131
22	278	171	208	138	145	170	94	204	157	129	110	126
23	270	186	194	186	149	188	113	205	143	135	131	122
24	261	190	178	186	143	157	108	217	155	143	151	116
25	255	181	199	203	178	180	118	212	132	137	162	121
26	252	176	190	204	188	184	134	220	110	126	161	124
27	263	163	178	175	177	186	156	231	102	128	157	132
28	239	186	173	172	132	160	181	274	91	129	151	127
29	213		217	160	99	158	182	301	87	129	161	136
30	167		233	141	106	147	193	292	86	131	175	127
31	143		248		131		190	284		141		153
Mean	217.4	143.1	185.7	163.3	172.0	168.7	149.6	199.6	145.2	111.4	124.0	125.0

Yearly Mean = 159.0

M. Waldmeier

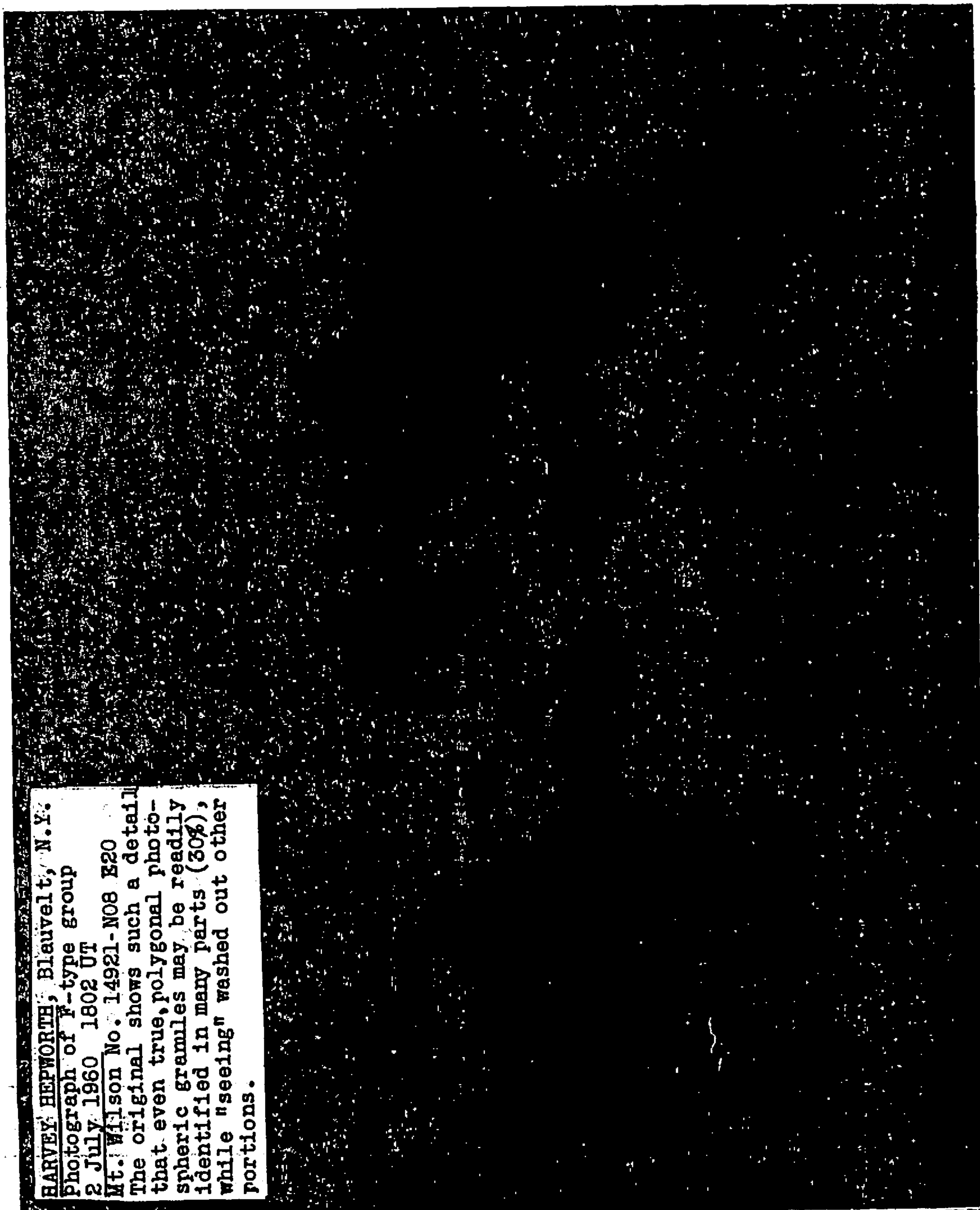
Eidgen. Sternwarte Zürich (Switzerland)

Definitive Sunspot - Numbers for 1960

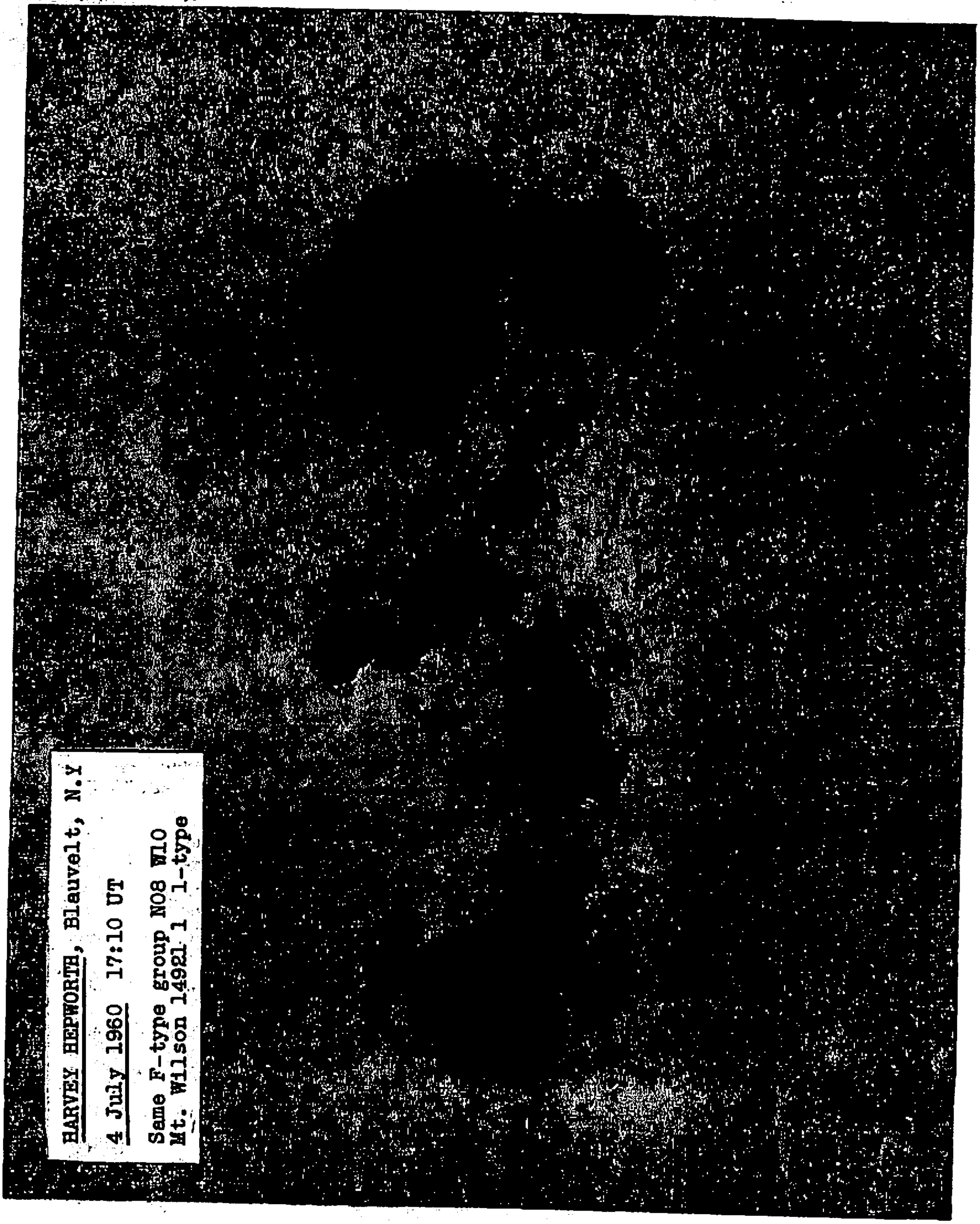
Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	136	173	63	154	97	100	167	75	103	22	76	74
2	141	181	57	143	97	90	157	58	105	34	79	92
3	148	177	62	152	102	109	163	36	80	22	69	101
4	160	156	66	162	96	113	203	30	75	53	67	111
5	168	149	74	156	87	104	168	25	83	70	77	102
6	174	145	79	143	93	109	139	24	100	92	90	104
7	179	123	108	123	125	123	133	56	110	113	116	94
8	171	116	111	112	135	113	134	58	121	110	132	99
9	158	143	109	98	142	129	123	76	138	128	127	97
10	139	143	109	103	149	147	108	94	147	140	137	103
11	143	128	82	114	147	149	95	156	145	133	134	102
12	123	116	68	139	127	151	83	201	147	116	116	101
13	108	106	85	132	135	131	84	235	160	123	122	92
14	118	104	76	149	110	138	89	236	161	106	132	101
15	121	94	84	156	91	144	105	252	151	98	133	108
16	119	84	98	152	101	138	132	244	128	98	121	103
17	117	73	86	124	114	105	136	253	122	103	103	92
18	103	60	85	116	106	91	140	257	153	98	93	82
19	87	44	95	121	108	84	141	228	166	96	83	70
20	94	49	97	116	115	60	137	204	171	92	82	71
21	108	56	115	123	109	56	139	177	177	82	72	63
22	134	64	128	108	118	50	135	168	189	60	66	44
23	138	68	145	106	125	58	127	130	168	54	59	35
24	136	74	123	102	147	68	105	113	157	49	52	37
25	152	89	128	95	148	80	110	131	141	62	42	57
26	209	96	133	96	124	99	92	140	114	72	60	48
27	203	92	138	82	148	116	90	109	97	67	58	70
28	199	87	139	91	142	140	80	98	89	52	57	86
29	193	83	142	92	138	147	94	97	74	72	64	94
30	178		151	100	121	165	82	96	44	82	69	103
31	178		132		111		83	100		68		118
Mean	146.3	106.0	102.2	122.0	119.6	110.2	121.7	134.1	127.2	82.8	89.6	85.6

Yearly Mean = 112.3

M. Waldmeier



HARVEY HEPWORTH, Blauvelt, N.Y.
Photograph of F-type group
2 July 1960 1802 UT
Mt. Wilson No. 14921-N08 E20
The original shows such a detail that even true, polygonal photospheric granules may be readily identified in many parts (30%), while "seeing" washed out other portions.


HARVEY HEPWORTH, Blauvelt, N.Y
4 July 1960 17:10 UT
Same F-type group N08 W10
Mt. Wilson 14921 1 1-type

SOME SUPERB SUNSPOT PHOTOGRAPS BY HARVEY HEPWORTH.

HARVEY HEPWORTH, Blauvelt, New York, has his own astronomical observatory. His main telescope is a 6" Brower f:15 clock-driven refractor which he uses primarily for solar and astro-photography. Here he also maintains his Warshaw-SEA-Receiver, recording events on 27 and 18 kHz, and his Brown Recorders.

The following photographs were taken with full aperture (6"), a Herschel-wedge, Leica camera using a Zeiss split-beam housing for indirect focusing, a 12mm Kellner Eyepiece, Kodak Microfilm, exposures of 1/25; 1/50 and 1/100 sec.with a green Wratten filter.

HARVEY HEPWORTH, Blauvelt, N.Y. photographs of H-type group N27 W40 (Mt.Wilson 14916).