AURORAL OBSERVATIONS AT THE ALASKA AGRICULTURAL COLLEGE AND SCHOOL OF MINES, 1930-31[1]

By Veryl Fuller

Description of stations—The two points of observation used for the auroral work are located a little over fourteen miles apart. One, designated as Station 1, is on the college campus: The other, Station 2, is on the Richardson Highway in a southeasterly direction from Station 1. The choice of an outlying station is limited as transportation must be reasonably easy. There are only two possible directions in which the outlying station can be situated. A northerly one and the one chosen. Aside from the direction Station 2 is well located. It has a clear view in all directions. It is easily accessible except in the most severe weather

[1]This is a summary of a more extended report submitted on the results obtained during the season 1930-31 at the auroral station, Alaska Agricultural College and School of Mines, at College, Alaska. This station was made possible following the recommendation of the American Geophysical Union, the United States Coast and Geodetic Survey, and the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, by the generosity of the Rockefeller Foundation, whose Executive Committee passed on November 8, 1929, a resolution appropriating to the College the sum of $10,000 to establish, equip, and maintain a first-order auroral station at College near Fairbanks, Alaska, to carry out a five-year program of research on the aurora. The site chosen is particularly favorable for this purpose. In addition to physical and cultural considerations, it has an unique advantage as regards geographical position, being practically 180° distant in longitude from the first-order auroral station in Norway, the existence of which was likewise made possible through the generosity of the Rockefeller International Education Board.

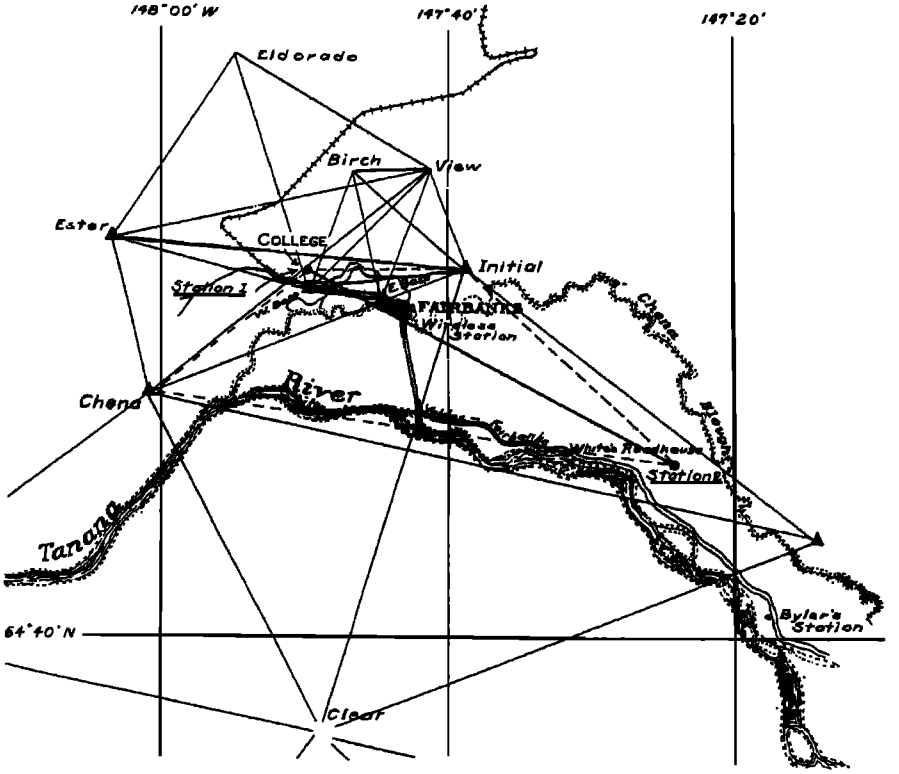

FIG. 1

and is at a distance which has proven to be sufficient for most types of auroras.

The distance between the two stations was determined quite accurately by triangulation, using data and base-lines established previously, by the United States Coast and Geodetic Survey and the Land Office. Because of poor weather conditions it was necessary to turn the angles at night using gasoline lanterns as targets. This work was done by Professor R. W. Chase of the Civil Engineering Department of the College. The results of this work give the following data:

Station No. 1—Latitude, 64° 51′ 26″.83; longitude, 147° 49′ 19″.62; azimuth to Station No. 2, 296° 28′ 54″.2; distance to Station 2, 22822.2 meters.

Station No. 2—Latitude, 64° 45′ 56″.00; longitude, 147° 23′ 34″.36; azimuth to Station No. 1, 116° 52′ 12″.5.

Figure 1 shows the location of the two stations and the system of lines used in the triangulation for the distance between the two stations.

Photographic equipment—The photographic equipment used here consists of two special cameras constructed by Karl Ormestad in Oslo, Norway, according to a design originating with Professor Carl Störmer[2]. They are so constructed that six pictures may be taken on one plate in rapid succession by a simple movement of the lens. Adjustment for vertical swing is accomplished by mounting the camera on a gimbal. Thumb-nuts hold the camera in any vertical position. The horizontal adjustment consists of a swivel in the tripod-head. The shutter is a rectangular metal cover hinged to the camera-frame and is of the right size to cover the lens in each of its six positions. This is operated by a small crank at the top of the instrument. The lens is a Hugo Meyer Kino Plasmat having an aperture ratio of f:1.5 and a focal length of 50 mm. The camera is mounted on a sturdy tripod when in use. Each camera is equipped with twelve 9 by 12 cm single, metal plate-holders, carrying-case, ground-glass, lens cleaner, and dark cloth.

Some minor additions and alterations were made in order to make the instruments easier to use with the scheme of ob ervation employed here. The view-finders with which the cameras were originally equipped were not suited to them since they did not show the same size of field of view as the size of picture taken and were besides difficult to use at night. These were replaced by a simple box-type finder which has proven much more usable. The finder consists of a small sheet-metal box open at the front except for vertical and horizontal cross-wires to indicate the center of view. At the back is a small peep-hole. The size of the opening and the length of the box is so proportioned that the field of view is the same as that of the camera lens.

Horizontal circles divided in degrees were put on the gimbal-frame for the purpose of approximate orientation in a horizontal circle. By establishing a true north-and-south line at each station it is easy by the use of these circles to set the cameras at the two stations so that the optical axis of each has the same azimuth.

Vertical circles with levels were also put on the cameras in order that the approximate elevation of the optical axis could be determined. This circle with its level also serves to set the cameras for the purpose of taking the series of star pictures for constructing the "network" charts used in

[2]Apparatus for auroral photography, manuscript not yet published. For description of apparatus used on earlier expeditions see Geofys. Pub., 1, Nos. 1 and 5 (1921).

measuring parallax. Since the cameras are not intended to be leveled accurately when used for taking auroral pictures no leveling device was incorporated in them and for this reason the level used with the vertical circle is arranged so that it has a vertical motion about the center of vertical rotation of the camera.

Figure 2 shows clearly the construction of the camera and also the view-finder on the upper left corner, the horizontal circle, and the vertical circle with its level.

Communication—Although the two points of observation are located

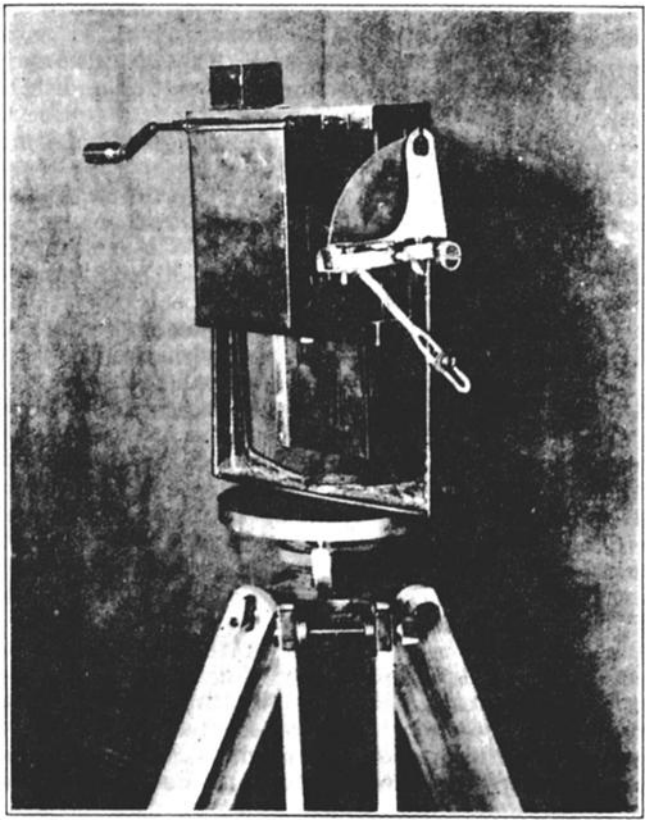

FIG. 2

on the highway near which a telephone line runs it was impossible to use telephones for inter-communication between the stations without constructing a new line because of the interference with regular communication during times of observation. This would have been quite expensive; for this reason therefore it was decided to use radio. Radio has the added advantage that should it be decided to extend the base-line or change it, there would be no difficulty in doing so without added expense.

Since most of the transmitting would be done at Station No. 1, the

transmitter installed there was one of the lowest possible power which would give assured continuous contact with the outlying station at all times. As the distance was only about fifteen miles a 7.5-watt set was selected as having sufficient power to cover this distance even under the worst conditions. Accordingly a set was constructed designed to work in the 80-meter amateur band and capable of transmitting either code or voice. This set consisted of a Hartley oscillating circuit coupled inductively to the antenna and modulated by the constant-current method. The type 210 oscillator-tube is fed by a type 250 modulator which in turn is fed by one stage of transformer-coupled audio amplification using a type 12 tube.

The transmitter receives its power from a R. E. L. catalogue No. 185 power-pack. This is supplied with 110-volt alternating-current power from a motor-generator set since only 110-volt direct-current is available at the college. It seemed more practical to use the motor-generator and power-pack than to install a high-voltage motor-generator set, for an alternating-current motor-generator was already installed in my home where the set would be used; further if found advisable at a future time to use a more powerful set it would only be necessary to replace the power-pack.

The receiver at this station is a Silver-Marshal four-tube set operated from the conventional "A" and "B" batteries.

The antenna system consists of two complete antennas each with a counterpoise. For transmitting, a quarter-wave system is used. For receiving, a short antenna is used, and because of the poor ground which frozen earth makes, it was found necessary to use a counterpoise for receiving as well as sending.

The equipment is installed in the author's home on the campus and is operated by the person taking notes who is in constant communication with the observer at the camera by means of a telephone. When voice is used the observer's telephone is connected by a switching arrangement to both the person taking notes and the radio transmitter so that the observer is in direct communication with the outlying station and at the same time with the person taking notes.

The radio apparatus to be used at Station No. 2 had to be easily portable and at the same time reliable. For the latter reason a circuit was chosen for the transmitter using the same type of tubes used in the receiver. All tubes in both the transmitter and receiver are of the −01A type. This arrangement was used so that replacement would be simplified in case of accident to tubes and necessitated the carrying of only one or two extra tubes which could be used in any socket of either receiver or transmitter.

Both the transmitter and receiver were built according to designs given in Engineering Circular No. 10 of the Burgess Battery Company and are similar to those used by the Wilkins-Detroit Arctic Exposition.

The transmitter uses the series Colpitts circuit employing two −01A tubes in parallel. The transmitter has proven to be stable in operation and very dependable.

The receiver is the ordinary three-tube regenerative detector-circuit using capacity-coupling to the antenna and needs no description.

The transmitter and receiver are both mounted in a light yet substantial plywood case, provided with a strip for carrying.

The same antenna and counterpoise are used for both receiving and sending as are also the "A" and "B" batteries. A push-button operated change-over switch, which is conveniently located for the operator, makes this possible.

Time was kept by a Waltham watch and checked against standard time-signals as often as possible, on an average of three times a week. Its rate was found to be fairly constant and had a mean of 0.093 second per hour. A pendulum-clock was available but its rate was unreliable and it was located in an inconvenient place for observational purposes.

"Network" charts—In order to measure the parallax shown by the auroral negatives, charts of the same size as the enlarged negatives are necessary. These consist of right-ascension and declination circles having the distortion due to the camera lens and the projector lens introduced in their construction. By having a large number of these charts representing different parts of the sky along the meridian it is possible to measure the parallax directly with a minimum of preliminary calculation.

The method of preparing these charts, which is due to Professor Harang of Tromsö, Norway, is as follows:

The aurora camera is set up with its optical axis in the plane of the above mentioned meridian. Six or more exposures are then made with a time-interval of eight minutes (star-time) between each exposure. The length of the exposure is just long enough to get an image of the stars without showing any appreciable motion. When the six or eight exposures are made the lens is shifted to a new plate and the camera is elevated to a new position about a degree or two higher than the first and the process of exposure repeated. This is done for all positions from the horizon to well beyond the zenith. The resulting negatives each show a series of pictures of the same group of stars spaced exactly two degrees apart, since the motion of the celestial sphere is one degree in four minutes of time.

To construct the "network" charts then one puts the negative in the projector used for the auroral pictures and adjusts the amount of enlargement until, near the center of the plate one degree (along the meridian) exactly equals one centimeter. This is done by identifying two stars near the center of the plate and computing the difference in degrees between their respective declinations. To check this the cosine of the declination of one of the stars just used is found and when multiplied by two should give the distance in centimeters between the successive images of the star.

When the correct enlargement has been obtained each star-image is plotted on a piece of paper and also the center of the plate. A meridian is then located by calculating the distance in right-ascension from the center of the plate for stars having different declination. After the meridian through the center is located, it is an easy matter to draw in the circles of declination and of hour-angles by simply plotting the correct distance as indicated by the star-images. When the lines have all been plotted a tracing is made in ink, the center is marked with the correct declination of the point, and the chart is ready to use. The whole process is a simple one but requires much time and proves rather tedious when a large number of the charts is required, because extreme care must be exercised in plotting the points and often the star-images are faint which

adds to the difficulty. However, the making of them by this method, long as it is, saves much time over the method of calculating the "network" from the empirical equation for the distortion of the camera lens and projector lens.

So far only fifteen of these charts have been made; however, these are made for use in the part of the sky where most of the aurora photographs which are good can be calculated.

Visual record of aurora—It is not always possible to send observers to Station No. 2 in time to obtain observations before the display has ended and sometimes the display is so weak that it is inadvisable to make an attempt to make photographic observations. It is, therefore, with this in mind that a record is kept of all displays observed. This record is kept in tabular form that the data may serve to correlate other natural pheomena with the aurora or to determine frequency- or time-curves.

The record includes the following data as shown by the column headings of Table 1.

(1) The date of the G. M. T. given; since midnight G. M. T. is 2 P. M. local standard time this column shows a date one day ahead of the local date. (This is convenient for one date, therefore, can be used during the entire display and makes also a standard of reference.)

(2) The G. M. T. of the first observation of a display.

(3) The form of aurora according to designations of the Photographic Atlas of Auroral Forms[3], as follows: (1) Forms without ray-structure—*HA*, homogeneous quiet arcs, *HB*, homogeneous bands, *PA*, pulsating arcs, *DS*, diffuse luminous surfaces, *PS*, pulsating surfaces, and *G*, feeble glow near the horizon resembling the dawn, of white or reddish color; (2) forms with ray-structure—*RA*, arcs with ray-structure, *RB*, bands with ray-structure, *D*, draperies, *R*, rays, and C, corona; and (3) flaming aurora, *F*.

(4) Intensity measured by using different thicknesses of celluloid as a measure—28 thicknesses just obscure the full moon.

(5) Altitudes for the lower and upper border at the center of the display—*Z* indicating zenith and *H* horizon.

(6) The western and eastern extremities of the display.

(7) The duration in hours between the first and final appearance of the aurora.

(8) The approximate area of the sky covered as a maximum on a scale of 1 to 8 (8 being the entire sky).

(9) Weather condition at the time of observation, including cloudiness, rain, snow, and wind.

(10) Height of barometer at time of observation, indicating by *r* or *f* whether it is rising or falling.

(11) Any additional notes which need to be entered.

(12) Number of photographic exposures made if any.

[3]C. Störmer, Photographic atlas of auroral forms and scheme for visual observations of auroræ. Published by International Geodetic and Geophysical Union, Oslo (1930).

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*

Date	G.M.T.	Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
				Lower	Upper	West	East						
1930	*h m*			°	°			*h*					
Aug. 9	09 00	*R*	2	20	65	.....	N 45 E	0.5	1	Cloudy	29.2*f*	..	A single ray changing in intensity but stationary
10	08 30	*R*	5	15	65	.....	N 45 E	0.2	1	Cloudy	29.1*r*	..	Single ray visible only short time; rain
14	12 30	*R*	2	35	60	.....	N 45 E	0.2	1	Cloudy	29.3*f*	..	Single ray
15	11 00	*R*	4	20	70	.....	N 60 E	0.2	1	Cloudy	29.1*f*	..	Single ray showing some motion and color; rain
21	09 30	*HA*	3	20	30	N 20 W	E	0.3	3	V. cloudy	29.3*r*	..	Arc seen intermittently through clouds; rain
22	09 30	*HA*	3	25	30	N 20 W	N 60 E	0.2	2	Cloudy	29.4*r*	..	Rain
24	11 30	*HA*	3	20	25	N 20 W	N 60 E	0.5	3	Cloudy	29.2*r*	..	Seen intermittently through clouds; rain
25	08 30	*HA*	4	25	30	N 45 W	N 30 E	0.5	3	Cloudy	29.3	..	
26	07 00	*G*	2	10	45	N 20 E	N 50 E	5	1	Pt. cloudy	29.4*r*	..	
27	10 20	*HA*	5	25	30	N	E	0.2	2	Cloudy	29.5*r*	..	Single arc; rain
29	11 20	*HA*	8	20	30	N 30 W	E	0.4	2	Cloudy	29.4*r*	..	Rain
30	10 00	*DS*	5	....	....	.....	N 45 E	0.3	1	Pt. cloudy	29.6*f*	..	
Sep. 1	06 00	*HA*	3	15	20	N 45 E	N	3	4	Cloudy	29.3	..	Died out at 07^h 00^m; came out as *G* changed to *HA* at 08^h 30^m
3	07 00	*DS*	5	....	....	.....	NE	0.2	1	Cloudy	29.3*f*	..	Diffuse glow in NE
4	08 00	*RB*	12	30	45	N 45 W	E	5	6	Pt. cloudy	29.2*f*	..	Very brilliant; showing color; moving; changing form
6	07 00	*RB*	7	30	*Z*+20	N 45 W	E 20 S	1	6	Pt. cloudy	29.4*f*	..	Moving rapidly; showing color
7	10 00	*RB*	5	25	80	N	E	0.5	5	Pt. cloudy	29.2*f*	..	
8	09 30	*G*	2	....	....	.....	N 30 E	0.3		Cloudy	29.2*r*	..	
9	12 00	*HA*	4	15	20	N	N 45 E	0.5	2	Clear	29.4	..	
15	10 00	*HA*	6	15	20	N 20 W	E	2	3	Pt. cloudy	29. *r*	..	Changed to *RA* at 10^h 50^m; back to *HA* at 11^h 00^m

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*—Continued

Date	G.M.T.	Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
				Lower	Upper	West	East						
1930	*h* *m*			°	°			*h*					
Sep. 16	07 30	*DS*	3	20	*Z*	N 45 E	E	2	2	Clear	29. *r*	..	
17	08 00	*DS*	2	Near *H*	Near *H*	.....	N 45 E	2	1	V. cloudy	29.1*r*	..	
18	08 30	*HA*	5	25	28	N 30 W	E	0.5	3	Pt. cloudy	29.2*r*	..	
19	07 00	*DS*	2	25	40	.....	N 20 E	5	4	Cloudy	28.9*f*	..	
21	07 15	*HB*	10	....	*Z*	N 15 W	E 20 S	0.5	2	Pt. cloudy	29.4*r*	..	Brilliant; showing color
22	06 00	*HA*	7	20	25	N 30 W	E	7	2	Pt. cloudy	29.4*f*	..	
23	08 45	*HA*	5	25	30	N 20 W	E	4	4	Clear	29.4*f*	..	
24	12 00	*HA*	3	15	18	N	E	2	2	Cloudy	29.2*f*	..	
27	10 00	*HA*	5	20	25	N	E	1.5	2	Clear	29.0*f*	..	
28	06 00	*HA*	6	15	35	N 45 W	E	2	3	Cloudy	28.7*f*	..	Series of arcs
30	05 30	*HB*	5	10	*Z*	N	N 45 E	0.5	3	Pt. cloudy	28.7	..	
Oct. 1	08 00	*HA*	4	15	20	N	E	0.5	2	Cloudy	29. *r*	..	
2	09 15	*HA*	2	20	25	N	E	3	2	Pt. cloudy	29.4	..	
3	05 00	*HA*	4	15	20	N 10 W	E	7	2	Cloudy	29.4	..	
4	05 00	*HA*	3	15	20	N 20 W	N 60 E	8	3	Clear	29.2*r*	..	
5	05 00	*HA*	4	20	30	N 10 W	E	5	2	Pt. cloudy	29.3*r*	..	
14	05 00	*HA*	2	75	150	N 45 W	E	7	6	Clear	29.9*f*	..	Lasted until after $12^h\ 00^m$
16	08 20	*HA*	4	10	15	N	N 45 E	5	3	Clear	29.7*r*	..	
17	07 15	*HA*	6	15	20	N 30 W	E	4	2	Clear	29.7	..	
18	09 40	*HA*	5	20	25	N 20 W	E	5	3	Clear	29.7*f*	..	
19	06 30	*DS*	3	30	35	N 30 W	N 45 E	5.5	2	Clear	29.1	..	At $08^h\ 00^m$ began to fade; at $09^h\ 00^m$ changed to *HA*
20	10 00	*HR*	5	15	20	N	N 60 E	1	2	Pt. cloudy	29. *f*	..	
21	05 00	*HA*	5	15	20	N	N 70 E	3	2	Clear	29.1	..	Single arc changed to *G* in NE at $05^h\ 30^m$
22	08 00	*DS*	3	Near *H*	Near *H*	N	NE	5	1	Pt. cloudy	29. *r*	..	
23	11 00	*RB*	4	20	50	N 20 E	N 60 E	4	3	Pt. cloudy	29.1*f*	..	
24	08 30	*RB*	3	15	50	N 20 E	N 45 E	1	3	Pt. cloudy	28.8*f*	..	
25	08 30	*HA*	3	20	30	N	NE	2	2	Pt. cloudy	28.6	..	
26	15 00	*C*	5	30	*Z*	N hemi.	N hemi.	2	5	Pt. cloudy	28.6*r*	..	Changed to *HA* at $15^h\ 30^m$

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*—Continued

Date	G.M.T.		Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
					Lower	Upper	West	East						
1930	*h*	*m*			°	°			*h*					
Nov. 4	08	10	*G*	2	*H*	*H*	N	NE	3.5	1	Pt. cloudy	28.9	..	
14	05	20	*HA*	3	25	30	N 20 W	N 80 E	5	2	Cloudy	28.7*f*	..	Very cloudy near horizon
17	08	30	*HA*	3	Near *Z*	Near *Z*	.....	.....	3.5	1	Cloudy	29. *r*	..	Cloudy near horizon; hazy overhead; snow falling
18	04	00	*HA*	3	15	20	N	E	8	4	Clear	29.1*f*	2	Very brilliant at 06h 30m; sky overcast by 13h 00m; see photo notes
20	05	30	*DS*	2	10	20	N	E	2.5	3	Cloudy	28.6*r*	..	
23	09	30	*R*	5	20	50	.....	NE	0.5	3	Pt. cloudy	29.9*f*	..	
25	03	30	*HA*	3	15	20	NW	E	6.5	2	Pt. cloudy	30. *r*	5	See photo notes
26	07	30	*DS*	2	10	25	N	E	2	2	Clear	29.7*f*	..	
27	06	00	*HA*	1	15	20	N 30 W	E	2	3	Clear	29.3	4	See photo notes
28	06	00	*HA*	5	15	20	N 30 W	E	7	4	Clear	29.5*r*	..	
29	06	30	*HA*	5	20	25	N 45 W	E	3	3	Clear	29.6	..	
30	07	30	*HA*	3	20	25	N	E	2	2	Cloudy	28.8*r*	..	
Dec. 3	08	30	*G*	2	Low N	Low N	.....	.....	0.5	2	Pt. cloudy	28.9*f*	3	See photo notes
4	02	25	*HA*	5	10	15	N	E	15	2	Pt. cloudy	28.3*r*	..	
11	07	30	*HA*	3	20	25	N 20 W	E	2	2	Clear	29.1*f*	..	
14	08	30	*HA*	3	20	25	N	N 75 E	1	2	Pt. cloudy	28.7*r*	..	Much frost in air
17	06	00	*HA*	3	Near *H*	Near *H*	N	NE	13	1	Pt. cloudy	28.8	..	
18	06	00	*HA*	3	Near *H*	Near *H*	N	NE	3	1	Clear	28.8*r*	..	
19	06	30	*HA*	2	Near *H*	Near *H*	N	NE	5	3	Clear	28.9	..	Changed to *DG* at 08h 00m
20	07	20	*HA*	2	10	15	N	NE	12	1	Pt. cloudy	28.9	..	
21	06	00	*HA*	2	10	15	N	NE	9	4	Clear	28.8*r*	6	Corona at 08h 30m; see photo notes
22	06	30	*HA*	3	10	15	N	N	4	3	Pt. cloudy	28.8*f*	..	Rather diffuse
25	09	20	*HA*	5	30	35	N 20 W	E	6	3	Clear	28.6*f*	..	
26	06	00	*RA*	5	30	50	N	NE	9	4	Pt. cloudy	28.6*r*	..	
27	10	00	*RA*	5	20	30	N	E	1	4	Fog	28.7*r*	..	
29	09	10	*HA*	3	10	20	N 30 W	E	10	2	Cloudy	28.9*r*	..	Changed to *DS* at 09h 30m; rays at 09h 40m; came and went until 17h 00m; see photo notes

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*—Continued

Date	G.M.T.		Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
					Lower	Upper	West	East						
1931	*h*	*m*			°	°			*h*					
Jan. 9	05	10	*DS*	2	8	20	N	N 70 E	6	2	Pt. cloudy	28.5*r*	11	See photo notes
10	02	30	*G*	2	10	40	N	NE	10	3	Pt. cloudy	28.7*r*	..	
12	10	30	*G*	3	Low	Low	N	.....	5	3	V. cloudy	28.7*f*	..	Seen through clouds
13	09	45	*HA*	2	Near *H*	Near *H*	.....	.....	4	1	Clear	28.8*r*	..	Seen first as *G* near *H*; rose rapidly to form *HA* show-color
14	08	20	*HA*	5	10	15	N	E	3	3	Clear	28.7*f*	1	See photo notes
15	07	30	*G*	2	Near *H*	Near *H*	.....	.....	7	4	Pt. cloudy	28.6*r*	..	*G*, 07^h 30^m to 08^h 00^m; *HA*, 12^h 00^m to 12^h 40^m; intense arc at 16^h 30^m to 16^h 40^m
16	09	00	*HA*	3	15	20	NW	E	11	3	Pt. cloudy	29.1*r*	..	Cloudy until 11^h 30^m; *HA* at 12^h 00^m to 18^h 30^m
18	05	20	*G*	2	*H*	*H*	NE	.....	1	2	Pt. cloudy	29.4	2	See photo notes
22	06	00	*HA*	5	10	12	NW	E	3	3	Clear	29.4*f*	3	See photo notes
24	08	15	*HA*	5	10	15	N	E	3	2	Pt. cloudy	28.8*r*	..	See photo notes
25	08	30	*HA*	1	10	12	N	E	4	1	Pt. cloudy	29. *r*	..	At 11^h 00^m faint *G* in N
26	06	30	*HA*	2	35	40	N 45 W	E	6	1	Clear	29.1	..	At 12^h 15^m bright drapes
27	08	30	*HA*	5	25	30	N 30 W	E	5	4	Pt. cloudy	28.9	4	See photo notes
28	07	00	*HA*	3	60	65	N	E	8	6	Pt. cloudy	29. *f*	12	See photo notes
29	11	30	*D*	7	20	80	N 45 W	N 80 E	1	3	Cloudy	28.5	..	Showing color; moving rapidly
31	09	00	*HA*	5	25	30	N	E	1	3	Pt. cloudy	28.8	..	Changed to *DS* at 09^h 30^m
Feb. 2	09	15	*PA*	8	*H*	*Z*	N 30 W	E	2	6	Pt. cloudy	29. *f*	..	Seen through clouds
4	07	00	*G*	2	Near *H*	Near *H*	.....	NE	2	1	Pt. cloudy	29.3*f*	..	
6	11	30	*G*	Faint	Near *H*	Near *H*	.....	NE	1	1	Cloudy	29.	..	
7	07	00	*HB*	3	25	30	N 20 W	N 60 E	2	3	Pt. cloudy	29.1*r*	..	Appeared intermittently
8	10	45	*DS*	3	30	*Z*	NW	.....	1	4	Pt. cloudy	28.9	..	
9	07	45	*HA*	5	10	16	N 30 W	N 45 E	9	4	Clear	28.9	5	See photo notes
10	05	45	*HB*	3	15	20	N 45 W	E	9	2	Clear	28.8*f*	2	See photo notes
13	06	40	*G*	3	25	60	.....	NE	4	3	Cloudy	28.7*r*	..	Changed to *HA* at 09^h 00^m
14	08	30	*HA*	4	15	20	N	E	2	2	Pt. cloudy	29. *f*	..	Seen intermittently through clouds

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*—Continued

Date	G.M.T.		Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
					Lower	Upper	West	East						
1931	*h*	*m*			°	°			*h*					
Feb. 15	03	00	*HA*	4	20	22	N 45 W	E	12	5	Pt. cloudy	28.7*f*	10	See photo notes
16	07	20	*HA*	5	15	20	N 30 W	E	8	5	Pt. cloudy	28.7*r*	10	See photo notes
17	06	00	*HB*	5	15	20	N 45 W	E	9	2	Cloudy	29.	..	
21	07	30	*HB*	10	20	25	N 20 W	E	4	3	Clear	28.7	..	Changed to *D* and *R* at 08h 30m; *HA* at 09h 00m
22	11	00	*HA*	3	15	20	N	E	1	2	Clear	29. *r*	..	
28	06	00	*HA*	2	20	28	N	E	3	2	Clear	29.1*r*	..	
Mar. 2	11	30	*HA*	3	25	28	N 45 W	E	0.5	2	Pt. cloudy	29.5*f*	..	
3	07	00	*RB*	6	*H*	75	N	NE	3	4	Clear	29.6	..	At 11h 30m had "*S*" shape from SW to NE; changed to *R* at 11h 50m
4	07	30	*RB*	6	10	75	N	NE	4	4	Clear	29.2*f*	..	Intermittent
5	11	00	*HA*	2	15	20	N	E	5	2	Pt. cloudy	29. *r*	..	
6	07	20	*HA*	3	10	15	N 20 W	E	3	2	Clear	29.5*r*	..	
7	05	30	*HA*	5	15	20	N 20 W	E	4	2	Clear	29.8	..	
8	07	40	*HA*	3	25	30	N 20 W	E	4	3	Clear	30. *r*	..	At 09h 40m half arc from NW
9	05	00	*HA*	2	20	25	N	E	2	2	Clear	30. *f*	..	
10	06	00	*HA*	5	20	25	N 30 W	E	5	3	Clear	29.7	..	
11	07	30	*HA*	10	20	25	N 30 W	E	2	3	Clear	29.7	..	Brightest at 09h 20m; broke into segments at 09h 30m
12	07	00	*HA*	5	20	25	N 20 W	E	9	3	Clear; wind	29.7*r*	..	Snow blowing badly
13	04	30	*HA*	8	25	30	N 45 W	E	3	4	Clear; wind	29.7	..	
14	06	00	*HA*	8	15	20	N	E	6	3	Clear	29.8*r*	12	See photo notes
15	05	00	*HA*	6	15	20	N 45 W	E	8	2	Clear	29.7*f*	..	
16	05	20	*HA*	10	18	22	N 20 W	E	8	3	Clear	29.6*f*	6	See photo notes
17	05	30	*HA*	8	20	25	N 20 W	E	8	4	Clear	29.5	..	
18	09	40	*HA*	8	18	24	N 20 W	E	2	5	Clear; wind	29.3*f*	..	Rather diffuse
19	09	30	*HA*	5	10	15	N 30 W	N 75 E	6	2	Clear	29.2*f*	..	
20	07	50	*HA*	2	10	15	N	E	4	1	Clear	29. *f*	..	Faint all evening
21	06	30	*HA*	6	15	20	N	E	6.5	6	Clear; wind	28.8	..	At 09h 40m *HA* from NW to *Z* and *D* in N 75 E to E
22	06	40	*HA*	5	5	10	N 20 W	E	1.5	1	Clear; wind	28.9*r*	..	Gone at 08h 00m

TABLE 1—*Auroral record, College, Alaska, August 9, 1930, to May 7, 1931*—Continued

Date	G.M.T.		Form	Intensity	Altitude		Extension		Duration	Max. area	Weather	Barometer	No. exp.	Remarks
					Lower	Upper	West	East						
1931	*h*	*m*			°	°			*h*					
Mar. 23	07	50	*HA*	3	5	10	N 20 W	E	5.5	1	Clear	29.2*f*	..	
25	06	30	*RA*	5	20	30	N	E	5.5	3	Clear	29.6*r*	..	
26	06	45	*RA*	5	20	30	NW	E	7	7	Pt. cloudy	29.5*f*	..	Gone at 08h 00m; *HA* at 11h 40m; *RA* at 12h 00m covering sky
27	11	10	*HA*	2	15	20	N	E	2	3	Cloudy	29.1*f*	..	
28	07	30	*HA*	2	20	25	N	NE	1	2	Cloudy	29. *f*	..	
Apr. 5	07	40	*G*	2	Low	Low	.....	NE	2.5	1	V. cloudy	28.6	..	Seen through clouds
7	09	00	*HA*	2	Near *H*	Near *H*	N	NE	1.5	1	Pt. cloudy	28.9	..	
8	09	00	*HA*	2	Near *H*	Near *H*	N	NE	1	1	Pt. cloudy	29. *r*	..	Windy
9	07	40	*HA*	2	20	25	N 20 W	E	4	3	Hazy	29.2*r*	..	Seen poorly through haze; changed to *HB* at 09h00m
10	08	00	*HA*	8	Near *Z*	Near *Z*	NW	SE	3.5	4	Clear	29 1*f*	..	See photo notes
11	07	20	*HA*	3	25	30	N	E	4	2	Pt. cloudy	28.9	..	See photo notes
13	10	20	*HA*	3	20	25	N	E	1	2	Clear	28.6*f*	..	See photo notes
14	08	00	*G*	2	....	....	.....	NE	0.5	1	V. cloudy	28.5*r*	..	
15	09	40	*HR*	3	15	25	N 20 W	E	2	3	Pt. cloudy	28.7*r*	..	
16	08	30	*G*	2	Near *H*	Near *H*	.....	NE	0.5	1	V. cloudy	28.8*r*	..	Faint *G* again at 13h 00m
18	08	30	*HA*	2	35	60	N 20 W	E	3	5	Pt. cloudy	29.7*r*	13	Changed to *HR* at 10h 20m; see photo notes
20	08	20	*HA*	3	60	70	N 20 W	E	....	6	Cloudy	30.0	..	
21	09	25	*RA*	3	25	40	N	E	1	6	Clear	29.7*f*	..	Came suddenly; motion; color; died out
May 1	10	30	*D*	2	20	90	N	E	0.5	..	Pt. cloudy	29.6*r*	..	Sky very light; wind
3	10	30	*R*	3	20	75	.....	NE	1	1	Clear	29.6*r*	..	Sky very light
7	08	30	*R*	3	15	75	.....	NE	2	1	Pt. cloudy	29.1*r*	..	Lower end below cloud

Details of photographic auroral log, of methods used to compute distances, and heights of auroras photographed simultaneously at stations 1 and 2 will be given in the second portion of this report to appear in the March 1932 number of the JOURNAL.

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