Köppen, Herbertson, and Ravenstein; the meteorological and biological characteristics of the zones; the hygiene of the zones; the conditions of human life in each zone; and, finally, the questions relating to changes of climate within historic times.

As Professor Ward deals mainly with the effects of *climate*, so Prof. Carl Kassner, of the Royal Prussian Meteorological Institute, in a little book brought out about the same time as above,[4] gives an interesting and up-to-date account of the effects of *weather* upon agriculture, commerce, transportation, communication, manufactures, health, mortality, crime, etc. (This subject is discussed in Part III; the rest of the book deals with the general subject of weather and weather forecasting.)

Both of these books are, as the French say, "full of actuality;" they summarize the most recent literature of the subjects treated, and their illustrations are largely drawn from events of recent occurrence.

CLOUDS OVER THE CHELSEA FIRE.

The formation of cumulus clouds over great conflagrations has frequently been reported. Features of special interest, however, were presented by the clouds observed over the fire at Chelsea, Mass., April 12, 1908, as described by Messrs. A. Lawrence Rotch and B. M. Varney in Science of May 15. Owing to the low relative humidity (14 per cent at Blue Hill Observatory) the heated air rose to a great height before condensation occurred, and the result was the formation of cumulus at an elevation of between four and five miles (i. e., four or five times the normal height of this form of cloud). Mr. Rotch notes, however, that in thunderstorms the cumulo-nimbus clouds rise into the cirrus level, and their tops have been measured at Blue Hill above eight miles.

TWENTY-FIFTH ANNIVERSARY OF THE GERMAN METEOROLOGICAL SOCIETY.

The German Meteorological Society (Deutsche Meteorologische Gesellschaft) is preparing to celebrate the completion of its twenty-fifth year of existence at the eleventh general meeting, to be held at Hamburg September 28, 29, and 30. All persons interested in meteorology are invited to attend. This society was founded at Hamburg in 1883, and has now 320 members. Its presiding officer is Doctor Hellmann, Director of the Prussian Meteorological Institute. The society is especially known to foreign meteorologists as the publisher, jointly with the Austrian Meteorological Society, of the Meteorologische Zeitschrift.

WIRELESS WEATHER REPORTS.

M. Angot, Director of the Bureau Central Météorologique, in a note communicated to the French Academy of Sciences, May 4, 1908, summed up the situation of the European meteorological services with respect to wireless weather reports from vessels on the Atlantic. The daily weather report of the British Meteorological Office now provides a small table for the wireless reports occasionally received from vessels of the British Navy. However, any further utilization of wireless reports by the European services is, for the moment, forbidden by financial considerations, altho the Marconi Company has offered to transmit such reports at a reduced tariff.

This recalls the situation of a few years ago with regard to the Iceland cable. As the financial difficulties were overcome in that case, we hope the European services will soon see their way to extend the field of their observations far to the westward by means of wireless messages. A committee was appointed at the Paris meeting of the International Meteorological Committee to investigate this subject, comprising Messrs. Shaw (chairman), Angot, Herz, Moore, and Rykachev.

A SUMMER CAMP OF METEOROLOGY.

We understand that some friends of the Weather Bureau are interested in a meteorological encampment—a summer school for meteorology—to be located in the beautiful and famous open glades of oak, cedar, and hickory on Cedar Heights, a bluff 100 feet above Cedar River, in Black Hawk County, between Waterloo and Cedar Falls, Iowa. This is not far from a permanent Chatauqua summer school, and we can not too strongly encourage this and all similar meteorological enterprises. The open air is the place for the enthusiastic observer of the atmosphere. Here alone he meets with frost and dew, rainbows, clouds and winds, the auroral tints of sunrise, and the twilight colors of sunset.

We recall vividly delightful hours spent during 1885–1890 at the camp of the Worcester Natural History Society. An hundred boys and teachers spent the summer in tents on Lake Quinsigamond. Instruction was given in every form of woodcraft and natural history. The editor's privilege was to talk about the clouds, how they are made, how high they are, how fast they move, what they mean as to past and future weather.

We bid godspeed to our Iowa colleagues, and hope the campers will send news of their work to the readers of the MONTHLY WEATHER REVIEW.

We hope other summer camp schools may be established in the interest of popular meteorological education.

STÖRMER'S WORK ON THE PHYSICS OF THE AURORA.[1]

Reviewed by P. G. NUTTING. Reprinted from Terrestrial Magnetism and Atmospheric Electricity for March, 1908.

With the recent advances in our knowledge of luminescence and electrical effects in rarified gases, hypotheses of auroral formation have become fewer in number and more specific in detail. The spectroscope and transit long ago showed that the aurora is an excitation to luminescence of the upper portions of the earth's atmosphere. Further study with the spectroscope showed that the luminescence is such as could be caused only by a bombardment of cathode rays, corpuscles, or negative electrons, whatever they may be called. If the light had been caused by a steady current of electricity or by an electric wave it would be reddish orange instead of bluish white in color and would exhibit an altogether different spectrum. A disruptive discharge like lightning would produce a yellowish white light, with still a third spectrum composed of heavy lines instead of bands.

In order to account for the necessary cathode rays, Birkeland[2] in 1896 supposed them to be emitted by the sun much as they are emitted by a hot platinum wire or other heated body. Proceeding to the earth with about one-third the velocity of light, these particles would be entrapped by the earth's magnetic field and excite the outer atmosphere to luminescence.

Birkeland, however, did not consider his theory sufficient to account for the known structure and variability of the aurora. In 1900 he advanced a second theory[3] according to which he supposed the cathode rays produced within the atmosphere by other rays from the sun. In this manner he obtained more unknown variables as factors in the aurora, but left the matter in such an unsatisfactory state that three other theories of the aurora made their appearance.

Arrhenius[4] in 1900 supposed the necessary cathode rays to be produced in the earth's atmosphere by particles larger than molecules emitted by the sun and propelled by radiation pres-

[4] Kassner, Carl. Das Wetter und seine Bedeutung für das praktische Leben. Leipzig: Quelle and Meyer. 1906. (Wissenschaft und Bildung 25).

[1] Carl Störmer. Sur les trajectoires des corpuscles éléctrises dans l'espace sous l'action du magnetisme terrestre avec application aux aurores boreales. Arch. Sc. Phys. Genève, July, August, September, October, 4 periode, v. 24, 1907, p. 140, with 2 pl. Compt. Rend., 142, 1580–1583; 143, 140–142, 1906. Cf. also Vol. IX, T. M., p. 149 and Carl Störmer: sur un probléme relatif au mouvement des corpuscles électriques dans l'espace cosmique, (Videnskabs-selskabets skrifter. I. Math.-naturv. Kl. 1907, No. 4) p. 10, 27½ by 18½. Kristiania 1907.

[2] K. Birkeland, Geneva Arch. des Sci. (4), 1, 497, 1896.

[3] K. Birkeland, Geneva Arch. des Sci. (4), 12, 478, 1901.

[4] Svante Arrhenius, Phys. Zeit., 2, 81, 97, 1901.

sure. Nordmann[5] in 1903 advanced the theory that they were produced by electric waves from the sun ionizing the upper atmosphere. Paulsen[6] later put forth a theory similar to the second of Birkeland's, but providing for an accumulation of "auroral material," a mixture of ionized air and cathode rays, produced by cathode rays and ultra violet light from the sun.

Finally Störmer, in the paper here under review, taking up Birkeland's first theory, worked out mathematically the trajectories of cathode rays projected into such a magnetic field as that of the earth. He showed that so great is the variation in path produced by slight differences in the velocity and original direction of such particles that Birkeland's simple first theory is ample to account for observed phenomena.

A negative electron projected into a magnetic field in an equatorial plane, moves in a curved path the form of that described by a point on a circle rolling on the inside of a larger circle. The stronger the magnetic field the smaller is the generating circle. Shot obliquely into a field, such a particle moves in a spiral path and if the field be convergent the spiral path is conical. The particle moves along the cone to where the field reaches a certain intensity and back again on another cone with its axis slightly displaced from the first. Störmer shows that in the earth's field the trajectory has the form of a wire wound on a cow's horn with its apex toward a magnetic pole.

Cathode rays would not be emitted freely at all times from all parts of the surface of the sun on account of the residual positive field. We should expect them to break forth in limited clouds during severe electrical storms in connection with sun spots. A small group just reaching the earth after sunset in winter would strike the earth's field tangentially in an oblique direction, move on a curved spiral path toward the North Pole, reverse and move toward the South Pole, again reverse and so on until absorbed by the atmosphere. On each trip north or south they would move in a different group of paths, hence the serrated structure of the simple aurora. Linear velocity and hence luminescence produced would be greatest at the north and south ends of the paths. The trip from north to south would occupy from about half a second to five seconds, according to the inclination and original velocity of the rays. This would be a plausible origin of the magnetic fluctuations observed during the smaller but more active displays.

More extended clouds of electrons from the sun would produce draped and diffused auroras. More intense displays might even be accompanied by ordinary electrical conduction and hence the reddish tints sometimes observed.

All things considered, the Birkeland-Störmer theory is by far the most satisfactory thus far advanced, both in its simplicity and in its explanation of widely varied phenomena. It is indeed the only theory thus far advanced that is free from radical objections.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them. Anonymous publications are indicated by a ——.

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Paris. vi, 223 p. 8°.

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Weather opinions; a book of quotations with interleaves on weather subjects. San Francisco. [1907.] 98, xxiii p. 8°.

Halbfass, W.
Klimatologische Probleme im Lichte moderner Seenforschung. Zweiter Teil. n. p. n. d. 26 p. 4°.

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Hungary. K. ung. Reichsanstalt für Meteorologie und Erdmagnetismus.
Erdbeben in Ungarn im Jahre 1907. Budapest. 1908. 46, xxviii p. 8°.

Kassner, Karl.
Das Wetter und seine und Bedeutung für das praktische Leben. Leipzig. 1908. vi, 148 p. 12°. (Wissenschaft und Bildung. 20.)

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Otchet. 1905–1907. St. Petersburg. 1907–8. 8°.

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Amount of precipitation in each month and year since the commencement of the observation at 63 stations in Japan. Tokio. 1906. 46 p. f°.
Maximum daily amount of precipitation in each month and year since the commencement of the observation at 63 stations in Japan. Tokio. 1906. 46 p. f°.
Mean air temperature in each month and year since the commencement of the observation at 63 stations in Japan. Tokio. 1906. 46°. f°.
Number of days with precipitation in each month and year since the commencement of the observation at 63 stations in Japan. Tokio. 1906. 46 p. f°.

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[5] C. Nordmann, J. de Ph., 3, 282, 1904.
[6] Adam Paulsen, Bull. Acad. Sci. Danemark, 2, 109, 1906. Cf. Vol. XII, T. M., p. 94.