

of perpendicularity, giving $R^2 = A^2 + B^2 + 2 \cos AB$. Space geometry gives $R^2 = A^2 + B^2 + C^2$ when A, B, C are orthogonal, and $R^2 = A^2 + B^2 + C^2 + 2 \cos AB + 2 \cos AC + 2 \cos BC$ when that condition is removed.

Further, space-algebra gives a complementary theorem, never dreamt of by either Pythagoras or Euclid. Let V denote in magnitude and direction the resultant of the directed areas enclosed between the broken line $A + B + C + D$ and the resultant line R , and let $\sin AB$ denote in direction and magnitude the area enclosed between A and the projection of B which is perpendicular to A ; then the complementary theorem is

$$4V = 2\{\sin AB + \sin AC + \sin AD + \\ + 2\{\sin BC + \sin BD + \\ + 2\{\sin CD + \\ + \text{etc.}$$

ALEXANDER MACFARLANE

CHATHAM, ONTARIO

A BRIGHT AURORA OF SEPTEMBER, 1908¹

THE finest display of the aurora borealis seen by the writer in Omaha during the last twelve years, took place on the night of Monday, September 28, 1908. Before describing its appearance, it may be of interest to mention the weather conditions that preceded and accompanied it.

No rain had fallen for about five weeks, the temperature during the day time had been unusually high, and strong winds had filled the air with disagreeable clouds of dust. The long duration of this state of the weather had become very monotonous. The expected clashing of a low from the northwest and of a West Indian storm from the southeast, had failed to bring any relief. Another week passed, and after an occasional cloudiness of the sky and an increasing humidity of the air had only tantalized this section of the country with unredeemed promises of moisture, the rain came at last and with it a rapid and great reduction of temperature, the

¹This excellent description was originally sent to the *Monthly Weather Review*, but is transferred to SCIENCE, as it belongs to cosmical physics rather than to climatology, to which the *Monthly Weather Review* is now confined.—Cleveland Abbe.

thermometer fell from the eighties in which it had been hovering down to ten degrees above the freezing point. Monday, the day of the auroral display, opened with a temperature of about 40 degrees and a cold and disagreeable rain. It was still cloudy and misty at noon, but at about three o'clock the sky cleared, the wind came from the northwest, and the night began with a quiet, cloudless, cold and most transparent sky. An occasional glance at the heavens could detect no indications of an aurora. It was noticed rather suddenly at about 9:50 P.M. It then appeared as an arch extending from the northwest to the northeast horizon, and was about 8 degrees high on the meridian. Below the arch was a well-defined black space of uniform tint, which might easily have been taken for a bank of clouds. The arch itself was of a beautiful, soft, silvery whiteness, and seemed to be about 5 degrees in width. Its upper limit was not quite as distinct as its lower one. At this time there were no streamers of any kind, nothing but the arch. There was no moon to interfere with the display as it was seen from the observatory, and the city lights were also far enough away not to blind the eyes of the observer.

In about a quarter of an hour the scene changed. A few detached streamers now began to make their appearance, like the softened beams of search lights below the horizon. They were from about two or three to 20 or 30 degrees in length, and from one fourth to about 4 degrees in width. The short beams seemed to come directly out of the ground and were visible against or through the black space below the arch, and the longer ones passed visibly even through the bright arch itself. They did not seem to have any perceptible lateral motion, but they all seemed to come from the same vanishing point, which was estimated to be about 50 degrees below the horizon and on the meridian. The largest and broadest streamer was in the northwest, at the very end of the arch. It was about four degrees wide and 20 degrees long, and of a decided blood-red tint. A few of the other

beams also showed the same tint, but most of them were of a faint silvery whiteness. They lasted from a few seconds to several minutes.

The arch gradually spread along the horizon until it covered 120 degrees or more, and at the same time ascended the meridian to the height of 15 or 20 degrees.

Then there were two parallel arches separated by a dark space, each arch and the dark space being about five degrees wide. Stars of the first three magnitudes could be seen equally through the bright and dark portions. Even in the group of the Hyades about Aldebaran the stars could be seen through one of the brightest portions of the display.

The upper arch then gradually broke up, its detached pieces appearing like floating clouds. They slowly drifted higher in the sky, until they seemed to be parts of a broken arch which extended from the west to the east points of the horizon. While these detached portions floated away, there seemed to be no streamers, as if streamers and broken arches could not exist together, but of this the writer is not certain, although he wrote down his observations at the first opportunity that presented itself the following morning. He himself observed the aurora for an hour until its gradual return to its first appearance, the dying out of its beams and the drifting of the luminous remnants of the arches gave him the idea that the display was nearing its end. A friend of his, however, kept up the watch for a second hour, and reports that the various stages described above repeated themselves after various intervals, and that some of the luminous clouds drifted as high as the zenith. How long the display lasted is not known, but the next morning at five o'clock the sky was completely overcast and there was no sign of an aurora.

On the following night there was another display of the aurora. It was noticed as early as 7:15 P.M., about an hour after sunset. The sky was not as transparent as on the preceding night, because the wind had been from the south all day. The arch was about the same, except that it had shifted bodily 20 degrees to the east. There were a few streamers of vari-

ous lengths, but they died out quickly. Clouds began to form, and by 9:30 the whole sky was obscured. The aurora could, however, be seen to some extent through the clouds, and appeared like the lights of a distant city reflected from the clouds. It was still visible after ten o'clock. But there was no sign of it the next morning nor on the following night, although the sky was perfectly clear.

WILLIAM FRANCIS RIGGE

CREIGHTON UNIVERSITY OBSERVATORY,
OMAHA, NEBR.

QUOTATIONS

STATE SUPPORT OF MEDICAL EDUCATION

THE wave of reform in medical education moves steadily on, and of much significance is the part which state universities are taking in this reform. Slowly but surely colleges organized and conducted on the stock corporation basis are either obtaining connection with privately endowed universities or are giving way to the state supported university medical school. In the latter instance, the medical school is conducted as an integral part of the state's educational system. The latest instance is in Arkansas, where two independent medical schools, the College of Physicians and Surgeons and the University of Arkansas medical department, both of Little Rock, have been united. The school formed by this consolidation is to be controlled and financed by the University of Arkansas. This is but a repetition of what has already taken place in Indiana, Minnesota, Colorado, and the other states, where only one medical school remains in each instance, that being the medical department of the state university. In several other states, generous appropriations have been made for state university medical schools. This larger state support of medical education has another significance, however. It means that since the state is endeavoring to provide a good training for medical students it will not tolerate the turning out of poorly trained doctors by low-grade institutions. In fact, the inferior medical colleges even now are reading the handwriting on the wall. This accounts for the opposition, direct