vestigating some of the scientific questions which have arisen in the course of the manufacture of compressed yeast under present war conditions. The university has appointed the first fellow on this foundation, who is now engaged in research upon the problems.

DR. WILLIAM M. JARDINE has been appointed president of the Kansas State Agricultural College and entered upon his duties on March 1. Dr. Jardine had been connected with the college for about eight years, first as professor of agronomy and for five years as dean of the division of agriculture and director of the Agricultural Experiment Station.

DR. F. E. DENNY, of the University of Chicago, has been appointed research assistant in horticulture in the Oregon Agricultural College, to fill the vacancy left by the resignation of Mr. Magness, the appointment to take effect on April 1.

DR. HELEN M. GILKEY, of the University of California, has been appointed assistant professor of botany and curator of the herbarium in the Oregon Agricultural College, to succeed the late H. S. Hammon.

DR. ETHEL M. TERRY, of the department of chemistry of the University of Chicago, has been appointed to an assistant professorship.

DR. FRED W. UPSON, for the past four years professor of agricultural chemistry in the Nebraska College of Agriculture, will, on June 1, become head of the department of chemistry in the University of Nebraska. A chemical laboratory which is modern in every respect, will be ready for occupancy at that time.

DISCUSSION AND CORRESPONDENCE

AN APPARENTLY NEW PRINCIPLE IN THE FLOW OF HEAT

SUPPOSE a number of horizontal metallic strips are maintained at constant temperatures, the first one at a low temperature, the next at successively higher temperatures, the last one being at the maximum temperature of a Bunsen flame, say a white heat. Let them all be of the same metal and have like surfaces.

Now suppose the same Bunsen flame be applied under like conditions to each strip. According to text-books and the laws of the transference of heat as usually taught, one would be led to believe that the coldest one should absorb the heat from the flame most rapidly, the next one less rapidly, and so on. Tests made by the writer, however, show this to be an error and that up to a certain high temperature exactly the reverse is the case; the coldest one will absorb the least amount of heat from the flame, the next hotter one will absorb more and so on up to a temperature at which the rate of absorption will be a maximum, after which it diminishes again, becoming zero for the one whose temperature is equal to that of the flame.

As stated in the premises, the heat which enters the metal from the flame is supposed to be conducted away as fast as it enters, and it is this heat which is measured. This could be carried out by using flat-bottomed iron cups or crucibles containing various materials having successively higher but fixed boiling points, say like liquid air, water, sulphur, zinc, etc.

When a very hot gas, like that in a flame, impinges on a relatively very cold surface from which the heat is led off as fast as it enters, like in the boiling of water by flame heat, a peculiar phenomenon takes place in that the equivalent of a very thin film of extremely high thermal resistance is formed on the surface exposed to the flame. Considered as a thermal resistance, the writer finds that for a constant temperature flame its resistance decreases rapidly as the temperature of the absorbing surface increases, contrary to what would have been supposed. The transmission of heat therefore increases as the absorbing surface becomes hotter and reaches a maximum which appears to be roughly when the drop of temperature from the flame to the surface is equal to that from this surface to the constant temperature boiling liquid; the transmission then must fall again, becoming zero when the temperature of the boiling liquid is equal to that of the flame. This increase of temperature of the surface (to about a red heat when water is being boiled) can be brought about by inserting a properly pro-

portioned thermal resistance between the heat-receiving surface and the boiling liquid. This was shown by the writer in an article on "A New Principle in the Flow of Heat" in the *Journal of the Franklin Institute,* January, 1918, page 75, and another in *Power* for January 1, 1918. In this way the writer has transmitted heat from a flame to water from 25 to 30 times as fast through the same area of surface.

It seems likely that this supposed high-resistance film is not a true thermal resistance, its estimated resistivity being many times that of good insulators like felt, but that the true explanation is that when hot gases impinge on a relatively very cold surface much of the heat is reflected and but little is transmitted. Perhaps the transference of the momenta of the moving molecules constituting heat is the explanation, in which case that part of the energy which is not transmitted is reflected.

Carl Hering

Philadelphia, Pa.,
February 15, 1918

The Aurora of March 7, 1918

Those who saw the aurora of August 26, 1916, did not expect to see such a display repeated within a life time, but on March 7, 1918, there was a similar spectacle which from reports must have been visible over practically all of the northern hemisphere of the earth. I first noticed the aurora low down in the north, about 7 P.M., but in half an hour clouds had come, which continued for an hour or so. At 9.30 I happened to be out of doors and saw that something startling was in prospect, as the sky was clear and the aurora was growing rapidly. The general effect and appearance of the display was accurately described by Dr. Tomlinson of our geology department,[1] and I shall limit my account to the determination of the position of the radiant or apparent focus of the auroral streamers. It was very striking that just when the display was at its maximum the streamers seemed to come from Saturn.

In the following notes Central Standard Time, 6 hours slow of Greenwich is used, the position being latitude 40° 6′ north, longitude 88° 13′ west.

9h. 31m. Streamers rising. Cloud-like form in southeast.

9h. 36m. Radiant exactly at Saturn. Half of sky or more covered. To west and over Jupiter a broad band of red, 10° or 15° wide. This is southern edge of the aurora in that direction.

9h. 41m. Radiant 2° north of Saturn.

9h. 44m. Radiant 2° northeast of Saturn.

9h. 46m. Radiant fainter.

9h. 51m. Radiant has about disappeared.

9h. 51m. All of light is now below Polaris.

10h. 38m. Only faint glow low down.

No further display was noted by our observers at the telescope, who worked until several hours after midnight.

Averaging the three estimates, we have that at 9h. 40.3m. the radiant was 1°.1 north and 0°.5 east of Saturn. The magnetic elements for Urbana are: declination 3° 13′ east, dip 71° 5′, determined by Mr. Merrymon in 1917, and kindly communicated by the superintendent of the U. S. Coast and Geodetic Survey. From the ephemeris position of Saturn, we readily find then for comparison:

	Declination	Hour Angle
Magnetic zenith	+ 21°.2	+ 1°.1
Radiant	+ 20°.1	+ 0°.2
Difference	1°.1	0°.9

The result shows that within the error of estimate the apparent radiant or focus of the auroral streamers was at the magnetic zenith, which agrees with what was observed in 1916.

Joel Stebbins
University of Illinois Observatory

From reports it is learned that the aurora borealis seen here on the evening of March 7 was observed at the same hours from New York City to Salem, Oregon, also at St. Louis and as far south as Lat. 36° N., in North Carolina. It was probably seen by observers over an area of greater extent in the United States and occurred also in Europe. This synchronous occurrence seems to indicate a widespread uniformity of the atmospheric conditions which produced it and to offer additional evidence

[1] Science, March 22.