cloud above, almost as soon as formed, the conditions necessary to its full development not existing.

In his excellent article on tornadoes, in the current number of the *Kansas City review of science*, Mr. John D. Parker speaks of the four characteristic motions of these meteors. These motions might be classified as horizontal and vertical. The horizontal motions are the linear, caused by the forward motion of the air-current governing the direction of the storm-cloud; second, the gyratory motion, caused, as above stated, by the mutual resistance of air-currents moving in different directions; third, the swaying motion, due partly to the varying pressure on different sides of the tunnel, and partly to the vertical or bounding motion of the tunnel. This latter motion would not have a very marked effect in producing the 'dentated edges' of the storm's path, if the tunnel-cloud were vertical instead of slanting. What causes the bounding motion it is difficult to say, but it certainly resembles electrical attraction and repulsion. This bounding movement was very marked in the tornado of April 18, 1869, which passed near this locality; but occurring, as it did, in the daytime, I could not distinguish the illumination of the lower part of the tunnel, which may sometimes be seen when these storms occur after dark, and which some think is due to electricity.

It is interesting to produce in miniature the horizontal motions of the tornado by the following simple experiment. When there is a good fire, let a small quantity of light, flaky ashes, or other light material, be sprinkled over the whole top of the cooking-stove. The heat forms quite a strong current, ascending mainly from the central parts toward the pipe. Cool currents flow in from all sides. Now, with the hand or a fan, produce local or opposing currents over the heated surface, and at once little tornadoes are developed, whirling the ashes several inches in the air. I have often produced them on both sides of the stove at the same time; those on the left moving as tornadoes in our latitude, and those on the right in the opposite direction. Now, are not the causes of the gyratory motion of the little whirlwinds on the stove, tiny as they are, the same in kind as those which produced the storms which devastated Marshfield, Grinnell, or Camanche? If this be answered in the affirmative, the rotation of the earth plays no direct part in causing the gyratory movement of this class of storms. Of course, the rotation of the earth causes the higher currents of air to move toward the north-east, instead of due north, as they pass from the equatorial to the arctic zone, and these currents determine the general linear movement of storms in our latitude; but this makes it proper to consider the gyratory motion an indirect result rather than a direct consequence.

S. A. MAXWELL.

Morrison, Ill., Oct. 9, 1883.

The chinch-bug in New York.

Why should Mr. Lintner conclude that the chinch-bug was brought to St. Lawrence county, N.Y., in a freight-car from the west? Harris corrects the erroneous idea that it is confined to the states south of 40° of latitude by demonstrating its occurrence in Illinois and Wisconsin, while Fitch's record of finding it in northern New York would justify us in assuming that it has always existed there, especially when we know that its range is much farther north. Packard found it on the top of the White Mountains; and it is to-day the most serious enemy that threatens the vast wheat-fields of Dakota. It seems to me more rational to consider this injurious manifestation in New York a result of undue increase of a species always there than to call it an invasion. Though we rarely hear of its injury in the Atlantic states, yet it is commonly met with where collecting is done near or in the ground, and in dry years is by far the most common Heteropter in grain and grass fields and dunes. This I know from personal experience, and have found it as far north as Boscawen, N.H.

Should it prove less susceptible to heavy and continued rains in New York than elsewhere, the fact will be remarkable. Such rains affect it most, however, in spring and early summer. My own interpretation of the interesting facts recorded by Mr. Lintner would be, that the species multiplied exceedingly during the very dry seasons of 1880 and 1881, and that the wet season, which it has so far braved (as it often does for a while in the west), will nevertheless tell on the hibernating bugs. In this view there is cause for encouragement rather than alarm. A careful survey would undoubtedly show, as Mr. Lintner suggests, that it exists in many places in the state where it has not yet been detected.

C. V. RILEY.

Washington, D.C., Oct. 24, 1883.

Unusual reversal of lines in the summit of a solar prominence.

On Oct. 17, between 3.45 and 4.30, local time (about 8.45 and 9.30 Greenwich time), a rather unusual phenomenon was observed at Princeton, in a prominence connected with the large and active group of spots which at that time was just passing off from the sun's disk.

The prominence had the very common form of a number of overlapping arches, with a sort of cap above them, or of a cloud connected by several curved stems to the chromosphere below. Its elevation was about 2′, and its extent along the sun's circumference a little less.

The peculiar features were the extreme brilliance of the cloud-cap at the summit of the prominence, and the perfect delineation of the form of this cloud in certain spectrum-lines, which ordinarily are reversed only at the base of the chromosphere; while, at the same time, certain other lines, which not unfrequently are reversed at considerable elevations, showed its form only very faintly, or not at all.

When I first came upon the prominence, in running around the sun's limb with the spectroscope, the brightness of the cloud-cap, as seen through the *C* line, was simply dazzling. I do not remember ever to have seen a prominence, or any part of one, quite so brilliant. At the same time, the line λ 6676.9 (which is in the same field of view with *C*, and is No. 2 of my catalogue of chromosphere-lines, — a line attributed to iron) also showed the top of the cloud quite as well and as brightly as is usual in *C* under ordinary circumstances. The chromosphere, also, was faintly visible in the same line; but the stems and lower portion of the cloud could not be seen at all in it. On turning to line λ 7055 (No. 1 of the catalogue), I was surprised and gratified to find the same appearances conspicuous in this line also. A careful search failed to show any other lines reversed below *C*.

Running up the spectrum from *C* to *D*, I could not find any lines showing the *top* of the prominence, though a considerable number were reversed in the chromosphere at its base. D_3, of course, showed the cloud-cap magnificently, but D_1 and D_2 only very faintly, though *distinctly* enough.

Between *D* and *b* the same remarks apply as between *C* and *D*. The corona-line, λ5315.9, was reversed at the base of the prominence a little more brightly