the colours were most distinct, being in those parts towards the Sun of a deep orange, but on the inner boundary of the two latter arcs of an indigo blue, the intervening space of a light green."

The radius of the inner ring, as measured by Captain Lefroy, at Toronto, was 22° 53'.

In another halo, observed February 9, 1851, by Mr. James S. Clouston, C. T., at Moose Factory, we find "a horizontal circle of a whitish colour passing through the sun; a halo round the sun of about 22° radius, at the point of intersection of which with the former were two very bright mock-suns; a second halo of about 45° radius, faintly tinged with the prismatic colours, (and as in the previous one) two arcs touching them at their highest points, convex to the sun, both coloured, but the colours of the second being very vivid like a rainbow; on the horizontal circle, two faint elongated mock-suns, each about 120° (90° ?) on either side of the sun, and a third directly opposite to the sun, and very much elongated." Captain Back describes a lunar halo in which a white cross passed through the moon bounded by a halo of 22°, and having a mock moon in the end of each branch of the cross. In a halo of the sun, observed by Hevelius in 1661, A. D., no less than six mock-suns were seen, as also in another observed by M. Lambert, in June, 1858. At Kiakhta, in Siberia, on February 4, 1829, at sunrise, were seen luminous rays issuing on both sides of the sun, (known in that country by the name of the sun's ears,) which extended gradually till they made the complete tour of the horizon, forming a circle in the circumference of which were situated seven mock-suns. But of all recorded halos, the most complex and gorgeous is the one seen at Gotha, on May 12, 1824, and of which a full account may be found in the Ency. Met. Art. Meteorology.

It will be now seen that the term *halo* indicates a phenomenon so complicated as to render its description difficult, no observer having ever yet seen it complete, and the appearances often changing during the time of observation; however, the principal parts of it may be thus defined:—

1. A horizontal white circle passing through the sun and making the complete circuit of the heavens.

2. A vertical white circle, also passing through the sun and terminated by the horizon.

These are produced by reflection of the sun's rays, the former at the faces of the ice-crystals, whose axes are vertical and at the bases of those with axes horizontal; the latter at the faces of the prisms, whose axes are horizontal and perpendicular to the vertical plane through the sun and spectator. The crystals tending to arrange themselves according to the law of least resistance, will naturally be found in greater abundance with their arcs horizontal or vertical, than in any other position.

3. These two circles form the white cross in Captain Back's halo, and at their other point of intersection give rise to a pale and vivid mock-sun, which is consequently just in the opposite point of the heavens to the real sun and at the same height above the horizon.

4. Two other white circles of very rare occurrence passing also through the sun and the above-mentioned image, and equally inclined, though at a variable angle, to the vertical circle (2.) These arise from reflection at the faces of prisms when a considerable number of them happen to have their axes inclined at the same angle to the vertical.

5. Three circular coloured rings, or *halos proper*, surrounding the sun and having radii about 22, 46, and 90 degrees respectively. They all display the prismatic colors, the two interior having red on the inside and violet without, (these being distinguished at a glance from *coronæ* or where the order of colour is the reverse), the third or outermost on the contrary has violet within and red without. Inside the first halo is comparative darkness, but on the outside its violet fades away into the azure of the sky, succeeded again by a darker space just within the second halo, between which and the third is considerable illumination followed by darkness outside the third. Of these the first is produced by rays refracted through two adjacent faces of the prisms in such a position that the refracted ray undergoes the least deviation; the second by those refracted in like manner through a face, and issuing through the base, and the third by rays issuing after one internal reflection exactly as in the primary rain-bow. The results of theory agree in all particulars with regard to these, with the observed facts, but there is mention made in one of Captain Parry's halos of a prismatic circle of 38° radius, and in a halo seen at the Observatory in Toronto, on March 9, 1841, of one of 30° radius; if these were not simple *coronæ* (the order of colours is unfortunately not mentioned in either case), and the measurements be accurate, they must be regarded as facts yet unexplained, and it appears very difficult to frame any hypothesis for them.

6. Two circular coloured arcs, generally of great brilliancy, touching the first halo at its highest and lowest points, and turning their convexity towards the sun, being red outside and violet within. These are formed in the same manner as the first halo, by prisms with axes horizontal, and occurring in great numbers. The circles will have the zenith for their centre, their apparent diameters varying with the sun.

7. Two precisely similar rings, touching the second halo in its highest and lowest points, produced, according to M. Galle, in the same manner as the second halo, by prisms whose axes are vertical; but this explanation does not seem satisfactory.

8. Two other circles—very rare—touching the second halo at points distant 60° from its lowest point, of which no account has yet been given by theory.

9. Lastly, at, or near, all the intersections of the halos proper with the vertical and horizontal circles (1 and 2), have been observed, at one time or other, images of the sun, mock-sun, or parhelia as they are called, in number eleven. Those of the first and second halo generally appear coloured like the halos themselves, and spread out tails tending away from the sun along the white circles; but in those of the third halo, which are extremely rare, the colours have never been seen, owing to the faintness of this halo. They occur generally a little outside of the exact intersection of the circles, which is successfully explained by Venturi, from the fact of the refraction not taking place exactly in a plane perpendicular to the edge of the prisms.

There may be other varieties of the halo which are not included in the above enumeration; and, indeed, the vast diversity of forms which the ice-crystals may take, and the great number of ways in which they may present themselves to the sun, evidently offer a complication of circumstance that baffles analysis or description. There is still a class of phenomena depending on the atmospheric polarization of light whose examination must be reserved for a future occasion, and also a few of which it may be doubted whether they are due to atmospheric action; thus, not to mention the auroral arch and zodiacal light which some have attempted to resolve into atmospheric phenomena, the dark lines of the solar spectrum and the twinkling of the stars may, with much probability, be thus referred. Of the former of these two, no attempt even at explanation has yet been made, and the latter has been the *crux* of optical science for ages. It consists, as may be seen any clear evening, in the star undergoing rapid changes of intensity and colour—

"The fiery Sirius alters here,
And bickers into red and emerald——"

Philosophers, from Aristotle down to Newton, have tried their hands in framing hypotheses, more or less ingenious, to account