

For the REVIEW.]

Astronomical Notes.

FOR SUMMER SCHOOL OF SCIENCE, JULY, 1896.

When the Summer School met at Parrsboro for the first time, 1889, star-gazing could be, and was, carried on by day as well as by night. Venus was far out on the west side of the sun, and her brilliant white disc, set in the beautiful blue of the Parrsboro sky, was an easy and a lovely object to the delighted eyes of admiring gazers during those glorious summer afternoons. When the school was there again in the following year she was on the other side of the sun, and though not so brilliant as in the previous summer, was easily seen by all who took the trouble to look for her. And again in July last, when some of the summer schoolmen took a run down from Amherst to Parrsboro, they found Venus smiling down at them from the sunlit blue of a perfect Parrsboro afternoon.

We shall have no such good luck this year. Venus will be impossible to us either by day or by night. What the almanacs call "superior conjunction" happens on the 9th, the day the school opens. This is when the planet is farthest from the earth, away off about seventy million miles beyond the sun, and very nearly in the same line. It is this last fact that makes it impossible for anything but a telescope to see Venus at superior conjunction, or within about ten days on each side of that event. From ten to twenty days after it, a field-glass pointed at the right spot in a good sky will show her without much trouble. After twenty days the naked eye should see her about noon if the same two conditions hold good, but the ordinary star-gazer had better wait until August before trying for her, either at noon or evening.

With a good field-glass Jupiter may be seen in the early afternoon, if the sky is blue, if the observer chooses the right time to look, and if he looks in the right place. But these three conditions must be very exactly satisfied, and even then it will be a rather difficult job, for the big planet is getting very close to the sun's place in the sky. But he *has* been seen with a field-glass under less favorable conditions than will then occur, so we may hope to see him this time too. As to the right time and the right place to look, those who are interested had better apply to one of the star-gazing members of the school.

With the naked eye there will be no celestial objects visible by daylight, except the sun and the moon: the sun on every clear day, and the moon on every such day of the school session after the 12th.

All other kinds of heavenly observation and experiment must be made before sunrise, or after sunset.

On the 11th the sun's declination will be 22° north. Thus in latitude 45° north (which is very nearly that of Parrsboro) makes the day nearly $15\frac{1}{2}$ hours long. If there were no refraction, and if the sun were a mere point, and if everything and everybody were at sea-level, it would be almost exactly 15 hours 11 minutes. Refraction adds $3\frac{3}{4}$ minutes at each end of the day, and the sun takes $3\frac{1}{2}$ minutes to raise his disc above the horizon in the morning and to lower it below in the evening. Thus from the first peep of the sun above sea-level in the morning until his last flicker at evening there are 15 hours and 22 minutes.

That is when his declination is 22° N and when we are in latitude 45° N. For the same latitude when the declination is 20° N (as it will be on the 23rd) the values given in the last paragraph are in order, as follows: Very nearly 15 hours 14 hours, 51 minutes, $3\frac{3}{4}$ minutes at each end, $3\frac{1}{2}$ minutes, 15 hours 2 minutes.

But all the rest of the 24 hours is not available for star-gazing. Twilight has to be allowed for. From the time the sun disappears until the time when the faintest naked eye stars appear, we have all gradations of light from almost full day to almost deep night, and the same thing occurs in the morning in reverse order. One limit of twilight is well marked—it is when the upper edge of the sun's disc is on the horizon—the instant of sunrise or sunset. The other limit is not so easily determined, but it is generally taken to be when the sun is $18'$ below the horizon. For these limits the duration of twilight at each end of the day in latitude 45° N is about $2\frac{1}{2}$ hours when the sun's declination is 22° N as on July 11th, and about 2 hours when the declination is 20° N as on July 23rd.

When the day is fifteen hours long it would seem reasonable to suppose that the sun should rise seven and a half hours before noon, *i. e.* at 4.30 a. m., and set at 7.30 p. m. And so it would if we kept time by a sun-dial, but we have outgrown that. The real sun is too irregular a time-keeper for the needs of the nineteenth century, and a 'mean sun' has been invented which gives us 'mean time.' On July 23, mean time is six minutes ahead of sun time, so the hours of sunrise and sunset are 4.36 a. m. and 7.36 p. m., and the afternoon is twelve minutes longer than the forenoon. But this again is true only on condition that, at every place where the 23rd of July has fifteen hours of daylight, the time kept is the mean time of the place, local time. But just as we outgrew sun-time about a century ago, so we have outgrown local time within the last dozen years. In Nova Scotia we keep the time of the 60th meridian, and as the longitude of Parrsboro is about 64° , its clocks and watches are sixteen minutes fast by its own local time. And so on July 23rd, the hour of sunrise is 4.52 a. m. and of sunset 7.52 p. m. And on July 11th, these hours are 4.40 a. m. and 8.02 p. m. Then as there are from two to two and a half hours of twilight, and as the first half of evening twilight is of little or no use for star-gazing it will be best to begin this business about 9 o'clock.

The brighter stars and planets will be easily visible