

across the South Atlantic. Near St. Helena its direction will change to the north of east. It will strike Africa near St. Paul de Loanda, where there are other observing parties. Then it will sweep northeast across some of the darkest parts of the dark continent, and will leave the earth at 10.35, just after reaching the Indian Ocean. It will be a very respectable total eclipse, being over four minutes long at its best; but this will be in the middle of the Atlantic, and so will benefit nobody.

"Visible at Halifax" is certainly not true of this. Let us try the partial eclipse, caused by the moon's penumbra. That will be visible from Cape Breton to Chili, and from Florida to Arabia. A piece of the northwest corner of the penumbra will be swooping down on the earth just as Nova Scotia is swinging up into the morning sunshine, and it will select our province for its landing-place. This will give some parts of the province a chance to see a part of a partial eclipse. And that will be all. What the almanac should have said is that the eclipse will be partially visible at Halifax as a partial eclipse. And so it will to most of the province. But both the 'partial' and the 'partially' are very emphatic. In the north of Cape Breton and the west of Cumberland there will be no eclipse at all. Along the south coast from Halifax to Cape Sable there will be a small black patch on the lower right edge of the sun for five or six minutes after his disc is above the horizon. The nearer you are to a curve passing through Halifax and Cape Sable, the closer you will come to having that much of an eclipse. And the nearer you are to another curve passing through Baddeck, Pictou, Parrsboro, and along the North Mountain to Briar Island, the closer you will come to having none. At Yarmouth we may see a notch in the Sun's limb, 156 to the right of the vertex, for nearly two minutes after he is above the horizon, but it may be off in less than three-quarters of a minute. The exact time of sunrise at a given place on a given day can't be calculated beforehand.

These are very small eclipse favors, but they are the best we shall get from the sun until October, 1892.

The day before the eclipse, Saturday the 21st, is the day of the winter solstice. At 11 a. m. (60 time) the sun will reach his greatest southern declination, and, according to the almanacs, will enter Capricornus. If you could see the stars on that day while the sun is up you would find that he was in Sagittarius, a little west of the handle of the Milk Dipper, and just where you used to see Jupiter at the end of September. This you must take on faith. But don't squander your faith on things you may

learn by sight. Such things, in connection with the winter solstice, are (1) that on that day the sun rises and sets to us farther south than on any other day of the year, (2) that at midday his altitude is less and the shadows he casts are longer than at any other midday, and (3) that the day is our shortest day. At Yarmouth, in the south of Nova Scotia, the length of the day will be 8 hours 54 minutes; at Dalhousie, in the north of New Brunswick, it will be thirty-two minutes shorter. At Yarmouth the meridian altitude of the sun will be  $22\frac{3}{4}^{\circ}$ , and the shadow of an upright ten-foot pole will be twenty-four feet long; at Dalhousie the altitude will be  $18\frac{1}{2}^{\circ}$ , and the pole's shadow thirty feet. At Yarmouth the points of rising and setting will be S. E. by E. and S. W. by W., at Dalhousie  $3^{\circ}$  farther south. At intermediate places these quantities will, of course, have intermediate values. If you know your latitude you can calculate the values for yourselves, or, better still, take a watch, a compass, a tape measure and a sextant, and get them by observation. Then wait a while and repeat the observation, and compare the two sets of results. But don't expect to find any appreciable difference close to the 21st. All the above quantities are then changing their values very slowly. In length of day, for instance, the 20th and 22nd will differ from the 21st by no more than two or three seconds. For a change of a foot in the length of the midday shadow of our pole, you will have to wait about a fortnight; and for a change of a degree in the sun's meridian altitude, a few days longer. For an increase of an hour in the length of the day, you will have to wait about six weeks; and three or four days more than that for a change of a point in the rising and setting positions of the sun.

Another quantity which reaches one of its extreme values on December 21st is twilight. We shall have ten minutes more of it at each end of that day than we had when it was shortest in October. (See notes in October REVIEW.) This will be its minor maximum (the major one falling at the summer solstice), and its total amount for morning and evening together will be three and a half hours at Yarmouth and three and three-quarter hours at Dalhousie.

And there is yet another quantity which has an extreme value on December 21,—the time that the sun takes to rise or set. This is only a small quantity at best, but it has its variations just like bigger quantities. For a given place it is least at the equinoxes and greatest at the solstices—the December maximum being a little bit the larger. Ask your friends who have not observed or calculated it how much they think it is, and you will likely get some rather wild guessing. I have had guesses all the