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THE HEAVENS IN OCTOBER.

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HAT astronomical problem has been so much before the public during the past month as this: How can a man determine when he is at the north pole?

As many incomplete or misleading answers have come to the writer's notice, it may be

appropriate to give a brief review of the matter here.

An observer standing at the earth's north pole would have the celestial pole (not the pole star, which is $1\frac{1}{4}$ deg. distant) in his zenith. The stars, during the long night, would appear to circle round the sky from left to right always at the same altitude ab ve the horizon; the sun to circle similarly, rising slowly from the horizon to its maximum altitude of $23\frac{1}{2}$ deg. between March and June, and sinking again until its disappearance in September. The change in the sun's altitude from day to day (which equals that in its declination) is accurately known, and can be taken from a small and easily portable table.

For an observer near but not at the pole, the celes-

tial pole would be displaced from his zenithtoward that point of the horizon where the earth's pole lay-by one degree for every 60 nautical miles of distance. The starsor the sun after allowance is made for its change of declination-would still appear to circle round the heavens, but would be lowest when due northi. e., toward the pole-and highest when due south. The whole change in their altitude would equal twice the observer's distance from the pole. For latitudes up to 80 deg. or more (that is, more than five or six hundred miles from the pole) this change in altitude is very conspicuous, and observations can easily be made when the sun is highest (at local noon) in the manner familiar to mariners. But for an observer within a few miles of the pole, these changes in altitude would no longer be perceptible to the eye, and it would not be obvious in which direction the pole really was. To make quite sure, it would be necessary to observe the sun's altitude at intervals during the day, and also its compass bearing. (The compass, of course, which points toward the earth's magnetic pole, 2.000 miles away, would be as good a guide there as here, but of no service at all in finding the geographical pole.) It would then be

practically independent of the refraction corrections, and also of any "constant errors" of the instrument.

If the conditions of observation were as good as regards temperature and comfort as lower latitudes, an observer of moderate capacity, with portable instruments (sextant, artificial horizon, and chronometer) should be able from two days' observations to find both his position and rate of drift with an uncertainty of only a few hundred feet. Under the actual conditions at the north pole, everything would depend on the experience and skill of the observer; but in any case, he could fix his position with an error which would be quite imperceptible on even the largest-scale maps of the polar regions.

THE HEAVENS.

Our map shows the aspect of the evening skies; and shows, too, at a glance how dull the southern and eastern skies would be, were not Mars and Saturn there to brighten them.

The most prominent constellation there is Pegasus, which lies high up, south and east of the zenith. It may be instantly recognized by the Great Square about 15 deg. on a side, composed of second-magnitude stars, and standing decidedly alone—which is one of the principal landmarks of the sky for the beginner, as it has no counterpart in the heavens. One of its the map. The whole constellation extends over more than 40 deg. and is one of the largest, though not the most conspicuous, in the sky. Above these constellations are the dullest of the zodiacal ones—Capricornus, Aquarius, and Pisces. The second of these, however, now contains the splendid Mars, and the last the less brilliant but still conspicuous Saturn, which both far outshine any stars within a long distance.

The line of stars running to the left from Pegasus, beginning at the northeast corner of the great square, contains the principal stars of Andromeda. Above the middle one of the three, near the second of two small stars, is the Great Nebula, the brightest in the heavens, concerning whose constellation, and the problems which it still presents, we spoke a few months ago.

Below this is the inconspicuous but ancient group of Triangulum, and the smaller and brighter one of Aries. The Pleiades are visible north of east, and Aldebaran is just rising.

Auriga in the northeast is a little higher up. Above it, in the Milky Way, we come in succession to Perseus, Cassiopeia, and Cepheus; then passing the zenith, to Cygnus, Aquila, and Sagittarius (just setting). Ophiuchus and Serpens are also disappearing, due west. A little to the right is the Northern Crown,

> with the "keystone" of Hercules above it, and the steel-blue Vega still higher. The Great Bear swings low on the northern horizon, and the Little Bear, enfolded by the Dragon, is higher up.

> > THE PLANETS.

Mercury is evening star until the 12th, when he passes on this side of the sun, and becomes a morning star. He reaches his greatest elongation west of the sun on the 27th, about which date he rises a little before 5 A. M., and is easily visible before daybreak; being situated in Virgo, a few degrees above the bright star Spica, which however is not as bright as he is.

Venus is evening star, and is very bright, but not very conspicuous, because she is so far south. During the month she passes from Libra through Scorpio into Sagittarius. and at its end she is 26 deg. south of the celestial equator. In one latitude she sets a little after 7 P. M.; but for observers in the southern hemisphere she remains in sight three hours longer, and is remarkably prominent.

Mars is on the borders of Aquarius and Pisces, rising before sunset, and visible almost the whole night. He moves westward among the stars, ever slower and slower, until the 26th, when he begins the eastward march, which will take him over

At 11 o'clock: Sept. 12. At 10 o'clock: Sept. 13. At 10 o'clock: Sep

NICHT SKY: SEPTEMBER AND OCTOBER

necessary to march toward that compass bearing in which the sun had the lowest altitude (corrected of course for changes in declination). The distance to the pole in sea miles would be half the difference of the greatest and least altitude in minutes of arc; so four corners now belongs to Andromeda; but it was cree grouped with the other three, and evidence of this still remains, for the letter Delta, which it bore as a member of the constellation, is now lacking from the list of the stars of Pegasus. The rest of the constellation, extending westward from the Great Square, contains some remarkable double stars (observable only with great telescopes), but nothing to detain us. Our initial letter shows how this constellation, large as it is, is supposed to represent but a part of the winged steed of classic mythology. Any actual resemblance would indeed be difficult to trace. more than a whole round of the zodiac before another cpposition.

Jupiter is morning star in Virgo, rising about 5:15 A. M. on the 1st, and 3:40 on the 31st; that is, about an hour earlier than Mercury at the time the latter is

that it would then be easy to advance to the right spot-in theory at least!

This discussion tacitly assumes that the observer is on firm land. On the drifting p lar ice, the change in his position during the day would complicate matters. But by making observations for a second day, the amount and direction of the drift could be determined; for the sun's altitude (still corrected for changes of declination) would be greater in the direction of the drift, and less in the opposite direction, than on the previous day, by the amount of the drift. The explorer would then have all the information necessary for his purpose.

One other point may be mentioned. The sum's altitude must of course always be corrected for refraction in the usual way. But since the sun's altitude is practically the same all day long, the refraction will be constant (except changes due to weather conditions, which would probably be very small). The observer's position and drift, which are determined from differences of the observed altitudes, will therefore be The western edge of the square, continued far southward, points out the isolated bright star Fomalhaut. The remaining stars of the Southern Fish, though too faint to be shown on the map, are easily visible on a clear night, forming a horizontal line just below the tright one.

The equally lonely star some distance east of Fomalhaut is Beta Ceti. The rest of the constellation follows this to the eastward. First comes a quadrilateral, of which the southernmost star r is one of our nearest neighbors. Then comes the notable variable Mira—also not far from us in space, and now brightening up, and visible to the naked eye; and lastly a group, only the brightest two of which appear on best seen.

Saturn is in opposition on the 13th, and is well observable all through the month. His wings are by this time pretty widely opened out, and he is a very beautiful telescopic object.

Uranus is in quadrature, east of the sun, on the 10th, and south at 6 P. M. Neptune, in almost the opposite quarter of the sky, is in quadrature, west of the sun, on the 13th, and crosses the meridian at 6 A. M.

THE MOON.

The moon is nearest us on the 27th, and farthest off on the 13th. She is in conjunction with Neptune on the 6th, Jupiter on the 12th, Mercury on the 13th, Venus on the 17th, Uranus on the 21st, Mars on the 26th (early in the morning), and Saturn on the 27th. On the evening of the 20th she occults the bright star Sigma Sagittarii (in the Milk Dipper). As seen from Washington, the star disappears behind the moon's dark limb at 7:01 P. M. and reappears on the bright side exactly at 8 o'clock.