## THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

The eastern and western skies must do their utmost at this time of year to atone for the dullness of the southern. As we face the south, the only conspicuous star before us is Spica, in the constellation of the Virgin. The Crow (Corvus) contains some moderately bright stars, but the Cup, and the tail of the Sea Serpent (Hydra) are by no means prominent. Libra (the Scales) contains two brightish stars. The Centaur and the Scorpion, which are now on the southeastern horizon, are fine constellations, but we never see the best part of the former, and the latter has only begun to show itself, its brightest star, Antares, being just at the point of rising.

Round the zenith are three fine star groups—the Lion on the southwest, the Herdsman (Boötes) on the southeast, and the Great Bear to the north.

Included between these three are the unimportant groups of the Hunting Dogs and Berenice's Hair. Regulus, the principal star of Leo, and Arcturus, which holds the same rank in Boötes, are about equally far from the zenith.

The bright star low in the northeast is Vega in the Lyre. Between this and Arcturus are the semicircle of the Northern Crown and the much larger group of Hercules. Ophiuchus, the Serpent Bearer, entangled with the Serpent which he carries, is coming into sight in the east.

In the west, and pretty low down, we see the Little Dog, with its bright star Procyon, then the Twins, which besides the two bright stars, Castor and Pollux, now enjoy the presence of Jupiter, and, farthest to the right, Auriga, the Charioteer, with the very bright star Capella.

Draco and Ursa Minor are to the right of the Pole, and Cepheus and Cassiopeia below it.

It is interesting to compare the colors of the brightest stars. Procyon, Castor, Regulus, and Spica are all white, and Vega is almost blue. Capella and Pollux are yellow. Arcturus is reddish, and Antares and Alpha Herculis are fiery red.

The reason for these differences had long been conjectured to be that the whitest stars are the hottest, and so on; and this theory is more and more confirmed by observed facts. The spectra of some of the brightest of these stars have been very carefully studied, and (just as in the case of sun spots, mentioned not long ago) it is found that as we pass from Antares to Arcturus, and from the latter to Capella or the sun (whose spectra are very much alike) the same changes take place in the relative intensity of the lines of iron, calcium, etc., in their spectra that happen when we increase the temperature of a terrestrial source in our laboratory. Changes of the same sort, and in the same direction, carry us from the spectrum of the sun to that of Procyon, then to Sirius or Vega, and finally to the bright stars of Orion. It is very probable that these denote a further increase of temperature; but in this case we cannot be quite so sure about it, for it is impossible to get temperatures in our laboratories even as great as that of the sun, and so we have no standards of comparison except uncertain ones in electric sparks, where other influences besides temperature are probably at work.

It is probable that the highest steady heat one can at present produce—namely, that of the electric arc—lies between the temperatures of Antares and Arcturus. The strongest evidence of this is as follows: If we put the metal titanium, or one of its compounds, into an electric arc, the hottest part of the arc shows a spectrum of bright lines, due to the metal, while the outer part of the "flame" of the arc gives bright bands, which are believed to be due to the oxide of the metal, which at the higher temperature of the arc is decomposed into its elements.

Now these bands are very conspicuous in the spectra of such red stars as Antares, but in Arcturus they do not appear, and there is no trace of them in the sun, except in some sun spots. We therefore conclude that the surface of Antares is probably cooler than the arc, and that of Arcturus is as hot or hotter. For other reasons we are sure that the sun surface is much hotter than the arc.

It may be asked, Why then does an arc light look so blue—bluer even than Vega? The answer is that part of the light of an arc lamp comes from the incandescent carbon vapor between the poles, and this is almost entirely blue and violet (showing as splendid bright bands in the spectroscope).

### THE PLANETS.

Mercury is morning star till the 24th, when he passes almost exactly behind the sun, and becomes an evening star. He is visible to the naked eye only during the first few days of the month, in the morning twilight.

Venus is morning star in Pisces, and rises at about 3:30 A. M. in the middle of the month.

Mars is in Sagittarius, very far south. He is approaching opposition and growing more conspicuous. He is twice as bright at the end of May as at the beginning, while his distance from us decreases from 69 to 50 millions of miles. He rises a little before midnight during the early days of the month, and appears a little earlier each evening until on the 30th he comes into sight about 10:30 P. M. It will be another month before he is conveniently observable in the evening.

Jupiter is evening star in Gemini, setting at about 10:30 P. M. in the middle of the month.

Saturn is morning star in Aquarius, and rises at about 2 A. M. on the same date.

He will be a very interesting object, for powerful telescopes, for the earth and sun are on opposite sides of the plane of his rings, and we consequently see the dark side of them. Only the edge is visible, and this only with large instruments, as an exceedingly fine hair line of light.

Uranus is in Sagittarius. On the 1st he is in conjunction with Mars, being 46 sec. of arc north of the latter.

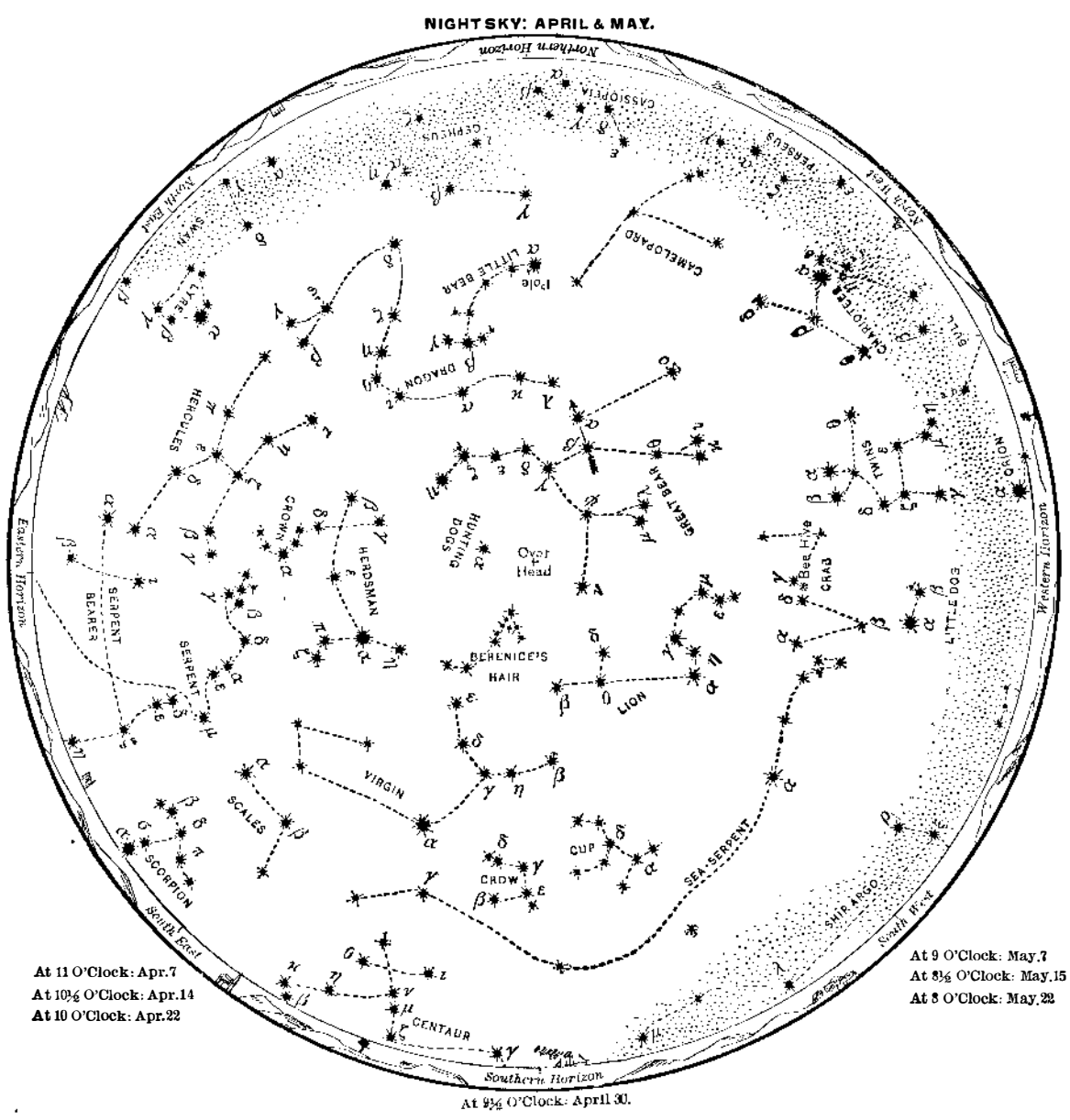
Neptune is in Gemini, close to Jupiter. They are in conjunction on the 21st, Jupiter being exactly one degree north of Neptune.

### THE MOON.

Last quarter occurs at 5 P. M. on the 4th, new moon at 4 A. M. on the 12th, first quarter at 8 A. M. on the 20th, and full moon at 9 A. M. on the 27th. The moon is nearest us on the 28th, and farthest away on the 16th. She is in conjunction with Uranus and Mars on the 2d, Saturn on the 7th, Venus on the 9th, Mercury on the 10th, Jupiter and Neptune on the 16th, with Uranus once more on the 29th, and Mars on the 30th.

A comet, visible in a small telescope, was discovered by Mellish at Madison, Wis., on the evening of April 14. It is in Gemini, moving very speedily northeastward. From this rapid motion it may be assumed that it is now near the earth, but will soon recede from it and grow fainter.

Princeton University Observatory.




In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed; counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

## DEVELOPING PHOTOGRAPHIC PLATES IN DAYLIGHT.

E. Demole, of Paris, brings out some new points as to the reversal of photographic images, and what has a great practical value is his method of developing a plate in daylight. The present researches were made starting with the following well-known facts, first that a sensitive photographic plate submitted to the action of bichromate of potash has the property, when washed and dried, then exposed under a negative, of reproducing this negative by developing in daylight; second, a long exposure changes the latent image, which is then found to be reversed on developing; third, when the sensitive layer is used in connection with oxidizing substances, these facilitate the reversing of the image. The writer proposes to observe the action of the low oxidizing substances on the latent image. When we plunge into a solution of potassium ferricyanide of one per cent strength a plate which has received a luminous impression, rinsing it and then developing it in a bath of hydroquinone and potash, with sulphite of soda, we find two remarkable results. First, that the plate may have been much overexposed without, however, hastening the development nor injuring the plate. The oxidizer acts here as a regulator of the time of exposure. Second, if we develop by the white light of a candle, the plate will be a positive instead of a negative, as would have happened with red light. The reversing of the image takes place even after a very short exposure, but the image is sharper after a long exposure. Such phenomena resemble those of solarization. The same effect can be produced with certain bromide papers, adding five per cent of glacial acetic acid. If the exposure is prolonged beyond a certain limit, the image undergoes a second reversal in the inverse sense. Thus with a Lumière plate exposed under a negative at 18 inches from an arc lamp, one second exposure will give a good positive plate, if we develop by red light. If we prolong the exposure, and then oxidize the plate, we can expose from 1 to 170 seconds and always obtain a reversed plate, that is, a negative. At 180 seconds we first have a positive on developing, but this soon turns to a negative. Using 7 minutes exposure, the positive comes up and then is not modified much, while at 14 minutes exposure the positive is fixed and indestructible, and here we realize the problem of developing by white light which has been so much sought for. If we suppose that the latent photographic image is formed of a sub-bromide of silver, $Ag_2Br$, coming from the decomposition of the bromide by light in presence of gelatine which can absorb the bromine, the sub-bromide of silver, which is a very unstable body, will easily be oxidized and give an oxy-bromide Ag—O—Br according to the equation $4\ (Ag_2Br) + 4H_2O + 3O_2 = 4\ (Ag—O—Br) + 4\ AgOH + 2H_2O$. This hypothetical oxy-bromide of silver, which is not easily reduced by the sole action of the developer, is more easily reduced by the combined action of the developer and white light, but is less promptly reduced when the surrounding silver bromide has not been altered by oxidation. Then the latent image is stable and the surrounding surface not being so, the image is reversed.