ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations (which are approximate only) and for most of the observations contained in the following notes, I am indebted to students. M.M.

Positions of Planets for December, 1873.

Mercury.

Mercury rises on the 1st at 6h. 57m. A. M., and sets at 4h. 25m. P. M. On the 31st it rises at 6h. 8m. A. M., and sets at 3h. 14m. P. M.

On the 10th, Mercury and Venus will be in conjunction, the latter being two degrees south of Mercury. They should be looked for in the morning before sunrise.

Venus.

At this time (November 15) Venus is very brilliant before sunrise. On the 10th Mercury will be near it, and Jupiter will precede them and come to the meridian four hours in advance of them; all three should be observed in the early morning.

December 1, Venus rises at 5h. 28m. A. M., and sets at 3h. 26m. P. M. December 31, Venus rises at 6h. 37m. A. M., and sets at 3h. 37m. P. M.

Mars.

Mars is at this time (November 15) approaching Saturn, Saturn's apparent motion being much slower than that of Mars, and both being eastward. They can be seen well only in the early evening hours. After the 20th of November Mars will be east of Saturn, and will steadily diminish in its apparent diameter.

Mars rises December 1 at 11h. 10m. A. M., and sets at 8h. 39m. P. M. On the 31st, Mars rises at 10h. 13m. A. M., and sets at 8h. 42m. P. M.

Jupiter.

Jupiter rises December 1 at 1h. 9m. A. M., and sets at 1h. 21m. P. M. Jupiter rises December 31 at 11h. 22m. P. M., and sets at 11h. 30m. A. M., its diurnal path being for the whole month nearly in the celestial equator. This planet is becoming more and more favorably situated for observation, and its apparent diameter steadily increases until the last of March.

Saturn.

Although Saturn is not in a good position for observation, being far south in declination, and therefore low in altitude, yet with a telescope of moderate power its ring can be seen and perhaps one of its moons. With a large telescope, the ring can be seen to be divided, belts are observed on the body of the planet, and five or more moons circling around.

December 1 Saturn rises at 10h. 41m. A. M., and sets at 8h. 4m. P. M. December 31 Saturn rises at 8h. 54m. A. M., and sets at 6h. 21m. P. M.

Uranus.

Uranus having set on the 1st of December at 11h. 20m. in the morning, rises again at 8h. 59m. in the evening. On the 31st it sets at 9h. 19m. in the morning, and rises at 6h. 37m. in the evening. It is among the small stars of the constellation *Cancer*.

Neptune.

Neptune rises December 1 at 2h. 25m. P. M., and sets at 3h. 30m. A. M. On the 31st it rises 27m. after noon, and sets at 1h. 29m. after midnight. It is very near the star *o Piscium*.

Meteors.

A lookout for meteors was kept up on the morning of November 14 from midnight until 6h. 30m., eight students being employed, who divided into sets of two, each set being relieved after half an hour's watch. The night was remarkably fine, but not more than 200 meteors were seen, and of these not more than three fourths seemed to radiate from *Leo*, the point of departure for the meteors of the 13th and 14th of November.

Sun Spots.

Daily photography of the sun at noon, the record extending from October 22 to November 14, shows that the disturbances of spots and faculæ have been comparatively slight. From the 23d the spots, then being very few and small, increased slightly in number, but on November 1 there was only one exceedingly small spot near the center of the disk, which, by its position, could not have come from any of those which appeared on the 30th (the 31st being cloudy). From November 4 to November 5, there was a marked change, a pair of spots of equal size uniting, while the resultant spot was larger than the sum of the original two. On the 10th, a group of fourteen small spots was scattered over an area a third of the diameter of the disk in length, and in breadth about one half its own length. On the 11th this group had begun to pass from view, owing to the revolution of the sun on its axis; and by the 14th, cloudy days intervening, it had disappeared entirely. Faculæ have been visible nearly every day, and were of considerable extent on October 28th and 29th.

Barometer and Thermometer.

The meteorological journal from October 15 to November 15 gives the highest barometer, October 15 and November 7, 30·5: the lowest barometer, October 30, 29·43; the highest thermometer, October 19, at 2 o'clock P. M., 71°; the lowest thermometer, November 7, at 7 o'clock A. M., 20°.

Amount of Rain.

The rain which fell between the night of October 26 and the afternoon of October 27 amounted to 0·91 inch.

The rain which fell between the evening of November 7 and the evening of November 8 amounted to 0·65 inch.

DR. HUGGINS has discovered, by the movement of the lines in the spectrum, that the star Arcturus is approaching the earth at the rate of about 50 miles per second.

THE NEBULÆ.

BY PROFESSOR C. A. YOUNG.

Scattered here and there through the sky are thousands of little luminous clouds, for the most part so faint as to be visible only with powerful telescopes. These are the nebulæ, which to the modern astronomer are objects of great and increasing interest. A few of them, perhaps a dozen, can be discerned by the naked eye; of those visible in our northern hemisphere, the brightest, situated in the girdle of *Andromeda*, is favorably placed for observation in the autumnal months; while the second in order adorns the winter sky as the most beautiful, if not the most conspicuous, of the celestial gems which form the wonderful constellation of *Orion*.

The total number at present known is not quite 8,000, but every new investigation increases the catalogue. Many of them consist of separate stars divided by dark spaces, and are known as clusters; others exhibit starry points on a bright back ground; these are said to be resolvable; the majority, however, show no structure, but even under the highest telescopic power remain mere blotches of hazy light; and among those which thus defy all attempts to resolve them are some of the brightest. In form they are most commonly oval, and somewhat brighter in the middle. Sometimes the condensation is so great that the central point appears like a star surrounded by a nebulous atmosphere. In many instances, they are nearly circular and of uniform brightness throughout, and these are called planetary nebulæ. There are also a few annular nebulæ, which are darker at the center, and seem to be rings of the shining mist; and there are double nebulæ, which, like the double stars, probably revolve around each other in elliptic orbits; and spiral nebulæ, whose filaments are so arranged as to suggest almost irresistibly the idea of a whirlpool-like movement of the whole mass. Besides these, there are a multitude in which the nebulous matter is distributed in streaks and patches of most fantastic and unaccountable formation. To this class belongs the nebula of *Orion*.

Unless nearer to us than the stars (which there is no reason to suppose), even the smallest of these objects must greatly exceed the dimensions of our whole solar system; and yet our outside planet Neptune is so distant from the sun that the swiftest express train would require nearly 8,000 years to make the journey. And the great nebulæ exceed the small by many thousand times in bulk.

But what are they? The elder Herschel, who was the first to make a careful study of the subject, concluded that many of them at least are masses of a peculiar cloud-like substance, mainly gaseous,—the material out of which worlds are formed,—and falling in with Laplace's theory, he thought that in these objects we have instances of stars a-making. But when some thirty years ago it appeared that every increase of telescopic power resolved more and more of them into stars, a different theory prevailed, urged especially by certain astronomers who considered the hypothesis of Laplace to be hostile to revealed religion. They jumped to the conclusion that all the nebulæ are merely clusters of stars, the component stars themselves being as large as the other suns which constitute our stellar system, and separated from each other by intervals as vast, but so remote from us that even such suns and such abysses are confounded into these little whiffs of haziness.

This is the view of the matter presented by many of the popular astronomical works still current, and even in some of our text books; but fascinating as it is, it is demonstrably incorrect, and Herschel's original doctrine is much nearer to the truth. Time would fail to indicate the many facts which prove that the nebulæ (and star clusters too) really belong to our stellar system, and are no farther from us than the stars, but are scattered through the star depths, and that not without pretty well marked laws of distribution. For this we must refer to the works of Struve, Abbe, Proctor, and others who have discussed the subject.

But though such evidences are really conclusive, they would probably have produced but slow conviction had not the spectroscope intervened, and by a single observation so settled the main fact of the gaseous nature of certain nebulæ as to render contradiction impossible. It was in 1864 that Huggins first applied the new instrument to the study of these objects, and the very first he examined gave him a spectrum of three bright lines. This of course is absolute demonstration that the nebula in question is mainly a gaseous mass of no great density; and could the lines be identified with those of terrestrial substances, its chemical constitution would be known. In fact, one of the lines apparently coincides with the so called F line in the spectrum of hydrogen, and a fourth, since observed in some of the brighter nebulæ, also coincides with another line in the spectrum of the same gas. The brightest line of the whole is in the green, and very near the principal double line of nitrogen; so near indeed that at first Mr. Huggins supposed it to indicate the presence of that gas. At present, however, he thinks it certain that the coincidence is only approximate and accidental, and that the line is due to some other element, as yet unrecognized. The remaining line is also of unknown origin.

Not all the nebulæ give a bright line spectrum. Those which the telescope resolves into stars present a continuous spectrum like that of the sun; those which are classed as resolvable usually show bright lines upon a faint continuous background; and some of the brighter iresolvable nebulæ (notably the great nebula in *Andromeda*) give a simple continuous spectrum like the clusters. It must be remembered, however, that such a spectrum may come from gas under strong compression, as well as from incandescent solids or liquids. It may be added that all the nebulæ which give a spectrum of bright lines show the same lines, so far as yet observed, and that the appearance of the lines indicates that the gaseous matter is but slightly compressed, and at a temperature much lower than that of the sun and stars.

It would seem, therefore, that we are to consider the nebulæ as great clouds of gas, probably sprinkled throughout with minute solid and liquid particles. Whether they are luminous from simple elevation of temperature, as ordinarily understood, or in some other way more analogous to phosphorescence, is not certain. They are in various stages of lecting themselves around a single center to form a single sun. condensation; some granulating into star dust, and some col-

The distance and dimensions of a nebula have never yet been determined. A year or two ago, indeed, it was announced by an English observer that he had detected a parallax of nearly two seconds of arc in a nebula situated in the constellation of *Ursa Major*. This would correspond to a distance about one half as great as that of α *Centauri*, our nearest neighbor among the stars. But the observation has not been confirmed, and deserves but little confidence.

Of course, if the nebulæ are such bodies as have been described, they ought continually to change in form and appearance; and in fact the best observations upon those in *Orion's* sword and near η *Argus* seem to indicate actual alterations within the last fifty years. Yet the observations are so difficult, and what is seen depends so much on the observer, his instrument, and the purity of his atmosphere that great caution must be used in coming to any conclusion.

From what has been said it is easy to understand the interest with which astronomers regard these objects. It almost seems as if in studying them we might come to witness for ourselves the building of suns and systems.—*Boston Journal of Chemistry.*

A Whale Caught by a Telegraph Cable.

We published some time ago a drawing of a portion of the Singapore ocean telegraph cable, which had been pierced and injured by the lance of a saw fish. We have here to chronicle an accident of a still more extraordinary nature, by which the Persian Gulf cable was broken. The particulars are given in *Engineering:*

"The cable between Kurrachee and Gwadur (a distance of about 300 miles) suddenly failed on the evening of the 4th of October. The telegraph steamer, Amber Witch, under the command of Captain Bishop, with the electrical and engineering staff under Mr. Henry Mance, proceeded on the following day to repair the damage, which, by tests taken at either end, appeared to be 118 miles from Kurrachee. The cable was successfully grappled within a quarter of a mile of the fault.

"The soundings at the fault were very irregular, with overfalls from 30 to 70 fathoms. On winding in the cable unusual resistance was experienced, as if it were foul of rocks; but after persevering for some time, the body of an immense whale, entangled in the cable, was brought to the surface, where it was found to be firmly secured by two and a half turns of the cable immediately above the tail. Sharks and other fish had partially eaten the body, which was rapidly decomposing, the jaws falling away on reaching the surface. The tail, which measured fully 12 feet across, was perfect, and covered with barnacles at the extremities.

"Apparently the whale was, at the time of entanglement, using the cable to free himself from parasites, such as barnacles, which annoy whales very much; and the cable hanging in a deep loop over a submarine precipice, he probably, with a fillip of his tail, twisted it round him, and then came to an untimely end."

This is, without exception, the most extraordinary accident that has happened to any submarine cable which has come within our knowledge, although many strange accidents have arisen. In one case the cable across the river Yar, in the Isle of Wight, was broken by a bullock, which, falling overboard, got entangled in the cable, finally breaking it.

A Novel Contest between Horseshoers.

The horseshoers of New York and Brooklyn have been excited for a month past over a wager made between John Burns and George Boyle as to which of them could make a greater number of shoes in a specified time. Both men work in Brooklyn. Burns bet Boyle $50 that the latter could not turn out as many shoes as he could in eight hours. A day was assigned for the contest. Several hundred horseshoers from New York and New Jersey were attracted to Brooklyn to witness the contest, and considerable money was staked in outside bets on the result. Work was begun at eight o'clock, Burns being at Slavin's shop in Atlantic avenue, and Boyle at his brother's shop in Livingston street. Burns was watched by Pat. Boyle, and his opponent by Slavin. Each of the contestants had a "helper" and used the following described material: Two dozen and a half pieces of iron, an inch and an eighth wide by nine sixteenths of an inch thick; two dozen and a half, an inch by nine sixteenths; two dozen and a half, an inch by half an inch; two dozen and a half, an inch by seven eighths. Each piece of iron was 13 inches in length.

Both shops were crowded throughout the day, the spectators going from one to the other to watch the progress of the work. In seven hours Boyle made 10 dozen shoes, and at the expiration of the eighth hour he had turned out just 11 dozen and 10 shoes to his opponent's 11 dozen. Boyle was accordingly declared the winner. His was the fastest work that has ever been performed.

THE largest bar of gold ever produced was lately made up for exhibition at Helena, Montana. Its value was $50,000; weight, about 172 pounds; fineness .900.