

NEBULAE EXPLAINED.

Instructive Information for Students of Astronomy.

According to Late Researches Nebulae Are Neither Very Distant Clusters of Stars Nor Masses of Gas, But Merely a Cluster of Meteorites.

Ptolemy was the first to point out, when he was making his map of the stars, that there were certain "cloudy" stars, of which he gave five on his map, writes J. Norman Lockyer in Harper's Magazine; and Tycho Brahe, whose work was done before the invention of the telescope, although he did not notice any bodies which we now class as nebulae, was firmly convinced that that nebulous luminosity which we call the Milky-Way was something entirely different in its nature from the stars. He imagined it to be what he called an ethereal essence, a sort of fire-mist, so that when in his time, in the year 1572, a new star appeared, he supposed it to be a considerable agglomeration of this ethereal fluid. Galileo was able to show that the Milky-Way, the "ethereal substance" of Tycho, was only an appearance due to enormous numbers of stars lying in the same visual ray; the stars of which it is composed can indeed be seen with very small optical power.

It was not till 1612, a few years after the introduction of the telescope, that we got the first real definition of a body which we now call a nebula. The first observation we owe to Simon Marius, who stated that some of the bodies visible in his telescope exactly resembled the appearance produced by the flame of a candle seen through horn. It was not till 1666 that the nebula in Orion was discovered, although now to the trained eye it is very easily visible, so that it seems rather wonderful that it was not discovered before. In 1714, in England, attention began to be paid to these bodies, but it was not until the time of Sir William Herschel that the most magnificent revelations were made. He was the first to construct very large telescopes, by means of which objects which appear to the eye as excessively dim, or objects entirely invisible to the naked eye, may be brought into full visibility. In this way Sir William Herschel convinced himself of the existence of a true nebulous fluid differing from stars.

After not only Sir William Herschel, but his son, Sir John Herschel, had accumulated vast stores of facts, Lord Rosse took up the story, and made a telescope very much more powerful than any which had been employed by the Herschels. His telescope has a light-gathering power compared with the eye of 130,000. The chief result of Lord Rosse's work to which we need here refer is the idea that in a great many bodies which had been classed as nebulae this enormous increase of optical power suggested that we were only dealing with very distant clusters of stars.

Lord Rosse was able to get the suggestion of "resolvability" in so many bodies which had been classed as nebulae by Sir William Herschel and others that gradually the idea came to be held that the most nebulous nebulae, if we could get sufficient optical power to bear upon it, would be broken up into stars just as certainly as the Milky-Way had been by Galileo.

This would mean that the nebulae were simply clusters of stars so infinitely remote from our ken that even with the power of Lord Rosse's instrument they retained the appearance of an ethereal essence. This was the general opinion in 1864, in the early days of spectrum analysis, when Dr. Huggins turned his spectroscopic eye to one of the planetary nebulae. At first he thought that something had gone wrong in the apparatus, because he could only see a bright line instead of the usual sort of spectrum obtained from a star. Further work on other nebulae showed him, however, that the spectroscopic was doing its level best, and that the cause, the anomaly, was really that the nebula gave out monochromatic light, while stars gave out light of all colors.

In some cases another line was seen, easily proved to be due to hydrogen, and in another planetary nebula other observers have since shown that there is another hydrogen line visible. It became Dr. Huggins' duty to find out the origin of the first line observed, and he came to the conclusion, after considerable labor, that this line was very nearly, if not exactly, in the position of the chief line seen in the spectrum of nitrogen, and the suggestion was therefore made that these nebulae were masses of nitrogen and hydrogen gases mixed, or if not nitrogen, some constituent of nitrogen mixed with hydrogen. That result made the idea of Lord Rosse concerning the possibility of the resolvability of nebulae into stars untenable. We had to consider from the time that the light of the nebula came from a gas or vapor, and hence it was held that the nebulae were masses of gas.

Another explanation of the origin of the green line has already been given. If we study the spectrum of magnesium, we find a very bright fluting with its less refrangible edge absolutely in the position of the green line; in the nebulae and in comets the same line appears, not nearly as in the case of the line of nitrogen, but absolutely. But not only so. We find another line of magnesium also visible in the planetary nebulae. Again, in the spectrum of magnesium burning in the Bunsen burner can be photographed a line having the exact wave-length of a line also seen in the nebulae of Orion, so that there is a considerable amount of cumulative evidence that magnesium is the true origin of this spectrum, the luminosity being produced by meteorites, the chief constituent of which is a compound of magnesium with oxygen, silicon and iron.

We are therefore justified, until some better explanation has been given, in holding the view that nebulae, like comets, consist of meteorites, and that they are neither very distant clusters of stars nor masses of gas.

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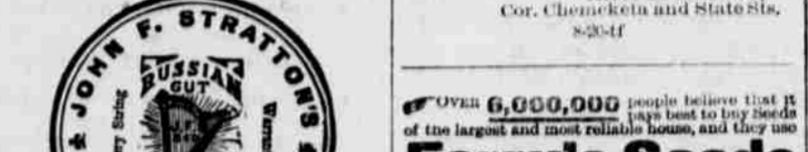
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