

ASTRONOMY

Nebulae Composed of Gases

"A Classic Of Science"

**The Spectroscope Proves That Some Nebulae Are Gaseous
Analyzing Their Light Into Three Bright Unknown Lines**

ON THE SPECTRA OF SOME OF THE NEBULAE. By William Huggins. *A Supplement to the Paper "On the Spectra of some of the Fixed Stars.* By William Huggins and W. A. Miller." Received September 8, 1864. Published in *Philosophical Transactions of the Royal Society of London for the Year MDCCCLXIV* (1864). Vol. 154. London: 1865.

THE CONCLUDING paragraphs of the preceding paper refer to the similarity of essential constitution which our examination of the spectra of the fixed stars has shown in all cases to exist among the stars, and between them and our sun.

It became therefore an object of great importance, in reference to our knowledge of the visible universe, to ascertain whether this similarity of plan observable among the stars, and uniting them with our sun into one great group, extended to the distinct and remarkable class of bodies known as nebulae. Prismatic analysis, if it could be successfully applied to objects so faint, seemed to be a method of observation specially suitable for determining whether any essential physical distinction separates the nebulae from the stars, either in the nature of the matter of which they are composed, or in the conditions under which they exist as sources of light. . .

Some of the most enigmatical of these wondrous objects are those which present in the telescope small round or slightly oval disks. For this reason they were placed by Sir William Herschel in

a class by themselves under the name of Planetary Nebulae. They present but little indication of resolvability. The colour of their light, which in the case of several is blue tinted with green, is remarkable, since this is a colour extremely rare amongst single stars. These nebulae, too, agree in showing no indication of central condensation. By these appearances the planetary nebulae are specially marked as objects which probably present phenomena of an order altogether different from those which characterize the sun and fixed stars. On this account, as well as because of their brightness, I selected these nebulae as the most suitable for examination with the prism. . . .

[No. 4373. 37 H. IV. R.A. $17^{\text{h}}58^{\text{m}}20^{\text{s}}$. N.P.D. $23^{\circ}22'9''$.5. A planetary nebula; very bright; pretty small; suddenly brighter in the middle, very small nucleus.] In Draco.

On August 29, 1864, I directed the telescope armed with the spectrum apparatus to this nebula. At first I suspected some derangement of the instrument had taken place; for no spectrum was seen, but only a short line perpendicular to the direction of dispersion. I then found that the light of this nebula, unlike any other ex-terrestrial light which had yet been subjected by me to prismatic analysis, was not composed of light of different refrangibilities, and therefore could not form a spectrum. A great part of the light from this nebula is monochromatic, and after passing through the prisms remains concentrated in a bright line occupying in the instrument the position of that part of the spectrum to which its light corresponds in refrangibility. A more careful examination with a narrower slit, however, showed that, a little more refrangible than the bright line, and separated from it by a dark interval, a narrower and much fainter line occurs. Beyond this, again, at about three times the distance of the second line, a third, exceedingly faint line was seen. The positions of these lines in the spectrum were determined by a simultaneous com-



THE GREAT NEBULA IN ORION
Proved to Sir William Huggins that certain nebulae consist of glowing gases even though they look like clusters of stars.

parison of them in the instrument with the spectrum of the induction spark taken between electrodes of magnesium. The strongest line coincides in position with the brightest of the air lines. This line is due to nitrogen, and occurs in the spectrum about midway between *b* and *F* of the solar spectrum.

The faintest of the lines of the nebula agrees in position with the line of hydrogen corresponding to Fraunhofer's *F*. The other bright line was compared with the strong line of barium 2075: this line is a little more refrangible than that belonging to the nebula.

Besides these lines, an exceedingly faint spectrum was just perceived for a short distance on both sides of the group of bright lines. I suspect this is not uniform, but is crossed with dark spaces. Subsequent observations on other nebulae induce me to regard this faint spectrum as due to the solid or liquid matter of the nucleus, and as quite distinct from the bright lines into which nearly the whole of the light from the nebulae is concentrated. . . .

The colour of this nebula is greenish blue.

Science News Letter, June 20, 1931

The notion that cow's milk was not good for babies prevailed in England in the seventeenth century.

THE STEAM TURBINE

which drives our ships, generates electricity and does many other modern tasks, is described by its inventor, the late

Sir Charles A. Parsons

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