

state of vapour. Kirchhoff then suggested that clouds formed in the white-hot photosphere, and that these clouds became darker as they cooled, thus giving origin to the appearance of sun-spots.

Zöllner contested this hypothesis on the ground of the relatively small variation in the shape of the spots, and agreed with the explanation given by Fabricius. Reye and Faye regarded the sun-spots as a result of cyclones in the lower region of the sun's atmosphere. There can be no doubt that storm movements take place at the surface of the sun. This was made evident when Sir Norman Lockyer in 1869, and in his later work on *Solar Physics* (1873), demonstrated the presence of a mantle of glowing vapour from which there projected gigantic torch-like protuberances subject to violent movement. Lockyer called the outer mantle of the sun "chromosphere" on account of its red colour.

All the modern theories about the constitution of the sun agree in assuming that it must have received an immeasurably great supply of heat during its condensation, and that already a considerable quantity has been lost by radiation. Nevertheless, the sun is still in a white-hot condition, and replaces the loss of heat by continued condensation and by absorption of matter attracted from sidereal space. The spectroscopical researches of Kirchhoff, Secchi, Zöllner, Lockyer, Young, and others, have demonstrated that more than half of the terrestrial elements are present in the composition of the sun.

In the present position of astronomical research there is no precise means of determining the temperature of the sun, although its size and density are well known. The sun is more than a hundred times larger than the earth, but has only a quarter of the earth's density. It follows from the continuity of the sun's spectrum that the sun's nucleus is incandescent, but it is difficult to decide whether the material is in a liquid state, as Kirchhoff and Zöllner suppose, or whether Secchi and Faye may be correct in supposing the nucleus to be for the most part gaseous, including some denser portions in a state of stormy movement.

*The Fixed Stars and Planets.*—While the sun represents a celestial body not yet fully consolidated, although in an advanced stage of condensation, the nebulæ, fixed stars, and planets give indication of the phases of development through