

As many of our deductions will be based on the facts ascertained by the spectroscope, it may be as well to briefly explain its principles. The spectroscope has, in its simplest form and as its essential elements, a narrow slit on which the light from the source to be analysed is thrown, a lens behind the slit, called the collimator lens, which renders the light parallel and a prism, a triangular piece of glass, which decomposes or analyses the light into its constituent colors. The spectrum, as the rainbow colored band which is formed is called, can then be examined with a telescope or photographed by a camera. I have a diagram which shows the arrangement of these parts of the instrument and I can form a spectrum on the screen.

The spectrum shown is that of the white hot carbon rods of the electric arc, which give us what is called a continuous spectrum, one in which the colors shade gradually from one to the other. Whenever you see a continuous spectrum, you know that the light source is an incandescent solid or liquid body. If we were to separate the carbon rods and burn a metal or any substance between them, we would get a spectrum of the vapor of that substance which would consist, not of a continuous band of color, but of a number of separated bright lines, distributed over the spectrum, and varying in number from about a dozen in the case of lithium to many thousands in the case of iron. Such a spectrum is called an emission or bright line spectrum and indicates, first of all, that it comes from incandescent gas or vapor, and, secondly, tells us unmistakably the element which produces it. For each element has not only a distinctive and invariable number of bright lines in its spectrum, but the positions and arrangements of these lines are always the same for the same element, and differ for different elements. When these positions are mapped for all the elements, it is evident that by examining the spectrum of any substance, no matter how complex, we can determine the elements of which it is composed. There is a third kind of spectrum called an absorption or dark line spectrum, in which the bright lines of the emission spectrum become dark lines in exactly the same positions, and it is evident that the elements producing it can be identified in exactly the same way. The absorption spectrum is produced when an incandescent source shines through gases or vapors at a lower temperature, and is the kind of spectrum given by the majority of the stars, showing that their glowing centres are surrounded by atmospheres of cooler gases.

Spectrum analysis tells us then, not only what elements any body emitting light is composed of, but also gives us information as to its physical condition, whether solid or gaseous, and whether surrounded by cooler or hotter gases. This is