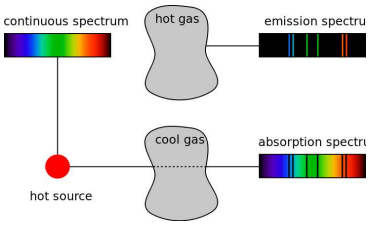
The stars' colour give away their temperature, has it was explored in a previous article. (http://www.scienceinschool.org/content/starlight-inside-light-bulb) But how do we know what stars are made of? Again, light is the awnser, or more specifically, their spectra. (spectrum?)

When the sunlight passes through a prism, it decomposes the light in all the colours of the rainbow. All those colours (or wavelengths of light) is the sunlight spectrum. You can also have spectra of infrared or other kinds of lights, but it is easier to work with visible light.

There are three kinds of spectra, continuous, emission and absorption, that are formed according to Kirchhoff's Laws:

https://commons.wikimedia.org/wiki/File:Kirchhoff-spectroscopy-law.svg



1. A continuous spectrum is emitted by an incandescent solid, liquid or gas under high pressure.
2. An emission spectrum is emitted by a hot gas under low pressure.
3. An absorption spectrum is formed when cool low-density gas is passed trough a continuous spectrum.

A little bit of history

The history of the spectral lines is linked to our knowledge of the atom's structure and even to the birth of Quantum Physics in the early 20th century. But even before that, it had a huge impact in the world of Chemistry.

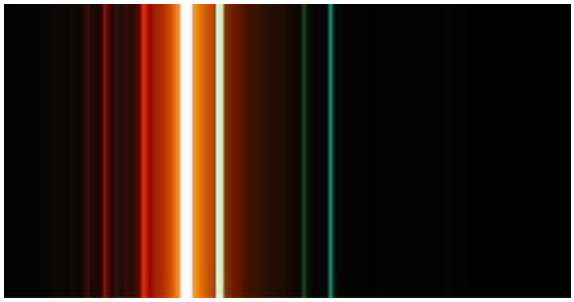
The rainbow (sunlight's spectrum) seems to be continuous, i.e., there is no gaps in the colours.

https://commons.wikimedia.org/wiki/File:Double-alaskan-rainbow.jp

But in fact, it presents dark lines which were observed by Joseph von Fraunhofer in 1814 and catalogued by him: the Fraunhoffer lines. These dark, or absorption, lines would be important to determine the composition of the Sun.

https://commons.wikimedia.org/wiki/Fraunhofer_lines#/media/File:DBP_1987_1313_Joseph_von_Fraunhofer,_Sonnenspektrum.jpg

But it is also possible to have a spectrum that is made of by only some colours that appear as bright lines, like the spectrum of a low-pressure sodium lamp, used in public illumination.



https://upload.wikimedia.org/wikipedia/commons/4/42/Low-pressure_sodium_lamp_700-350nm_widened.jpg

In 1860 Robert Bunsen (the same as the Bunsen burner) and Gustav Kirchhoff defended that the chemical elements could be identified using these bright, or emission, lines because they would be specific for each chemical elements. With that in mind they found two new elements within two years: cesium and rubidium.

Kirchhoff continued its work and realised that the bright yellow line from the sodium spectrum was in the same position as the dark line in the yellow region of the sunlight, the one that Fraunhofer named D. Kirchhoff not only found that a chemical element is responsible for lines (bright or dark) in the same position in the emission or absorption spectrum, but he also discovered that the Sun containes sodium.

So, to know the composition of the Sun, and any other star, we just need to compare the spectra of known elements and the spectra of the stars.