

Stellar classification

Stellar classification, scheme for assigning stars to types according to their temperatures as estimated from their spectra. The generally accepted system of stellar classification is a combination of two classification schemes: the Harvard system, which is based on the star's surface temperature, and the MK system, which is based on the star's luminosity.

Hertzsprung-Russell diagram

Hertzsprung-Russell diagram.

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In the 1860s the Italian astronomer Angelo Secchi distinguished four main spectral types of stars. At the Harvard College Observatory in the 1880s, during the compilation of the *Henry Draper Catalogue* of stars, more types were distinguished and were designated by letter in alphabetic sequence according to the strength of their hydrogen spectral lines. Most of this work was done by three assistants, Williamina P. Fleming, Antonia C. Maury, and Annie Jump Cannon. As the work progressed, the types were rearranged in a nonalphabetic sequence to put them in order by surface temperature. From hot stars to cool, the order of stellar types is: O, B, A, F, G, K, M. (A traditional mnemonic for this sequence is "Oh Be A Fine Girl [or Guy], Kiss Me.") Additional letters have been used to designate novae and less common types of stars. Numbers from 0 to 9 are used to subdivide the types, the higher numbers applying to cooler stars. The hotter stars are sometimes referred to as early and the cooler as late. With the discovery of brown dwarfs, objects that form like stars but do not shine through thermonuclear fusion, the system of stellar classification has been expanded to include spectral types L, T, and Y.

Class O includes bluish white stars with surface temperatures typically of 25,000–50,000 K (although a few O-type stars with vastly greater temperatures have been described); lines of ionized helium appear in the spectra. Class B stars typically range from 10,000 K to 25,000 K and are also bluish white but show neutral helium lines. The surface temperatures of A-type stars range from 7,400 K to about 10,000 K; lines of hydrogen are prominent, and these stars are white. F-type stars are yellow-white, reach 6,000–7,400 K, and display many spectral lines caused by metals. The Sun is a class G star; these are yellow, with surface temperatures of 5,000–6,000 K. Class K stars are yellow to orange, at about 3,500–5,000 K, and M stars are red, at about 3,000 K, with titanium oxide prominent in their spectra. L brown dwarfs have temperatures between about 1,500 and 2,500 K and have spectral lines caused by alkali metals such as rubidium and sodium and metallic compounds like iron hydride. T brown dwarfs have prominent methane absorption in their spectra and temperatures between about 800 and 1,500 K. Class Y brown dwarfs are cooler than 800 K and have spectral lines from ammonia and water.

Supplementary classes of cool stars include R and N (often called C-type, or carbon stars: less than 3,000 K), and S, which resemble class M stars but have spectral bands of zirconium oxide prominent instead of those of titanium oxide.

The MK, or Yerkes, system is the work of the American astronomers W.W. Morgan, P.C. Keenan, and others. It is based on two sets of parameters: a refined version of the Harvard O-M scale, and a luminosity scale of grades I (for supergiants), II (bright giants), III (normal giants), IV (subgiants), and V (main sequence, or dwarf, stars); further specifications may be used, such as a grade Ia for bright supergiants and grades VI and VII for subdwarfs and white dwarfs, respectively. Thus the Sun, a yellow dwarf star of some 5,800 K, is designated G2 V; while Barnard's star, a red dwarf of some 3,100 K, is classified M5 V; and the bright supergiant Rigel is classified B8 Ia.

This article was most recently revised and updated by Erik Gregersen, Senior Editor.

CITATION INFORMATION**ARTICLE TITLE:** Stellar classification**WEBSITE NAME:** Encyclopaedia Britannica**PUBLISHER:** Encyclopaedia Britannica, Inc.**DATE PUBLISHED:** 14 May 2013**URL:** <https://www.britannica.com/science/stellar-classification>**ACCESS DATE:** November 21, 2019