The mystery of the pulsating blue stars

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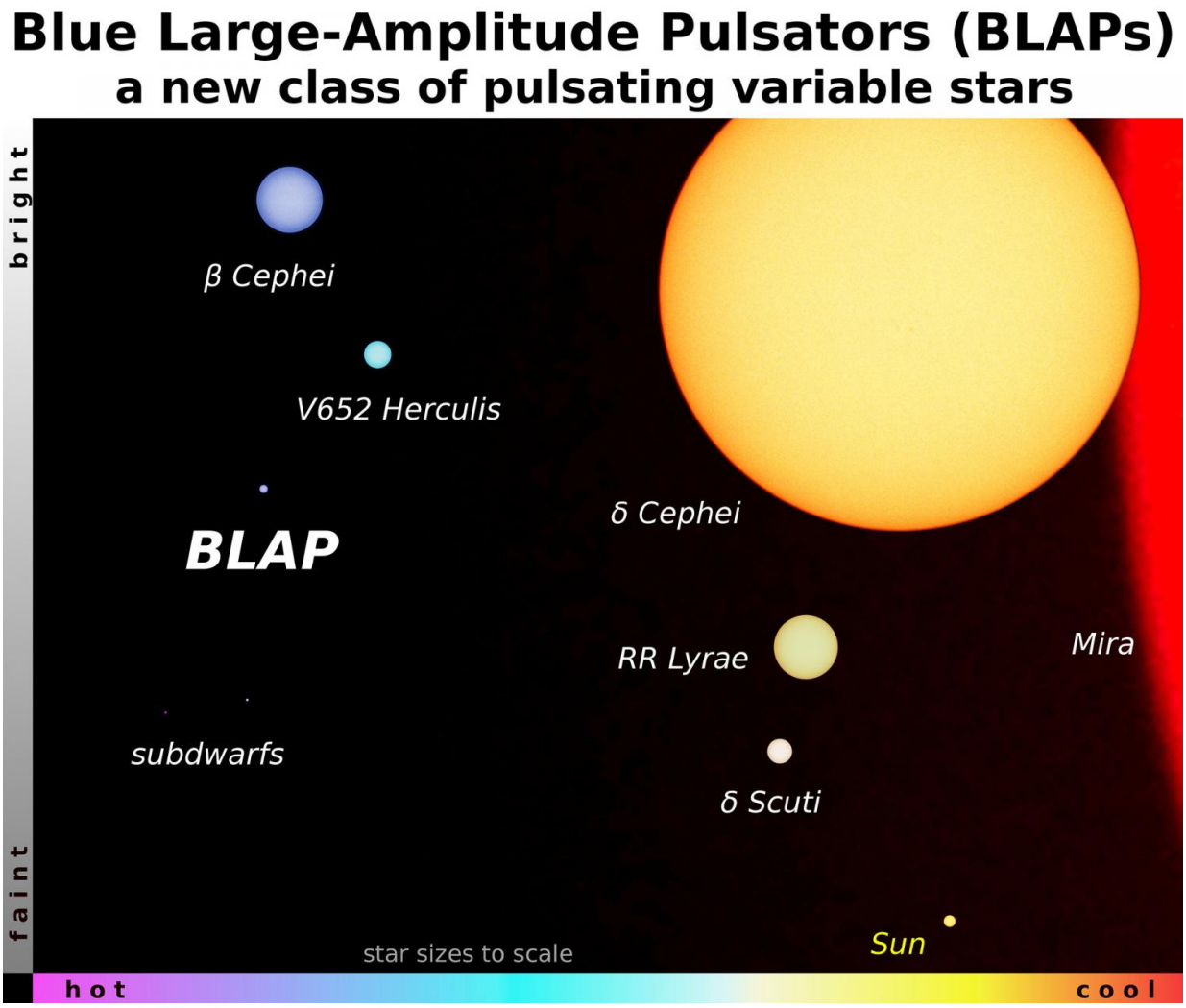

Credit: Paweł Pietrukowicz

In the middle of the large Chilean Atacama desert, a team of Polish

astronomers are patiently monitoring millions of celestial bodies night after night with the help of a modern robotic telescope. In 2013, the team was surprised when they discovered, in the course of their survey, stars that pulsated much faster than expected. In the following years, the team that included Dr. Marilyn Latour, an astronomer from the Dr. Remeis-Sternwarte Bamberg, the astronomical institute of Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), studied these stars in more detail and concluded that they had stumbled upon a new class of variable star.

Many classes of star exhibit variations in brightness. Unlike our Sun, these stars are not stable; their surface oscillates, meaning that the surface expands and shrinks by a few percent. This is what happens in the case of the more familiar Cepheids and RR Lyrae stars, which have oscillation periods that extend over a few hours to hundreds of days.

The researchers discovered a dozen stars that seemed at first sight to show variations that were very similar to those of the Cepheids and RR Lyrae stars but have much shorter (20-40 minutes) oscillation periods and, at the same time, are much bluer in colour. This indicates that the newly identified stars are hotter and more compact. It was because of these characteristics that it was proposed to give this new class of variable stars the acronym BLAPS, i.e. Blue Large-Amplitude Pulsators. What kind of stars these were, however, remained an enigma.

The nature of the newly discovered stars

For the astronomers, these new stars posed a riddle. At first, they assumed that BLAPs could be hot dwarf stars since they have similar oscillation periods. Hot dwarf stars are old stars approaching the end of their lives. They generate their energy by means of the thermonuclear fusion of helium to form carbon. The Sun, being in an earlier phase of its life, is currently converting hydrogen to helium.

In order to find out whether BLAPs are actually hot dwarfs, the astronomers used two of their largest telescopes to make observations. They were able to capture suitable spectra of some BLAPs using the large Gemini and Magellan telescopes, both located in the Chilean Atacama desert. Latour analysed these spectra using sophisticated physical-numerical models. She was able to show that the variations in luminosity are attributable to temperature changes on the surface of the stars. The temperature of the BLAPs turned out to be five times greater than that of the Sun - something that is characteristic of hot dwarfs.

However, the BLAPs are significantly bigger than hot dwarfs, meaning that they form a new class of stars that are similar to hot dwarfs but have a more bloated envelope than the latter. Why BLAPs oscillate like Cepheids and why they are bloated remain puzzles, as does their origin. Further investigations need to be undertaken to solve the mystery of how BLAPs come into being.

More information: Paweł Pietrukowicz et al, Blue large-amplitude pulsators as a new class of variable stars, *Nature Astronomy* (2017). DOI: 10.1038/s41550-017-0166

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