T Cephei is one of the brightest Mira-type variable stars and, lying at declination +69 deg, is circumpolar from the UK. It is easy to locate, given that it is only around a degree distant from beta Cephei

Originally catalogued in the Bonner Durchmusterung as +67^{o} 1291, the brightness variations of T Cephei were first reported in 1879 by the Moscow based astronomer W. Ceraski (more common name: Vitold Karlovich Tserasky). Its extreme magnitude range is listed as 5.4 to 11.3 and the average interval between maxima is approx. 389 days. As for other Mira-type variables, the brightness variations of T Cephei do not repeat exactly from one cycle to the next. A magnitude range of 6.0 to 10.5 is more typical. Similarly, it is not possible to predict the exact dates of future maxima in advance and there will always be an uncertainty of a week or more.

A notable feature in the light curve of T Cephei is a "standstill" during the rise to maximum that usually occurs near magnitude 8.0. Similar features, lasting for a week or two, are sometimes seen in the light curves of other Mira-type variables, but it has become rather persistent in the light curve of T Cephei in recent decades and over the past decade has become increasingly prolonged, on occasions lasting for 2-3 months. This was particularly the case during the maxima of 2019 and 2020 when it was showing hints of becoming a "hump".

There has also been a significant shortening of the gap between maxima of T Cephei over the past decade. The average catalogued period would lead to maxima occurring 3-4 weeks later each year, but the time of maximum has stayed within June since 2016. Previous studies have reported spells when the average interval has been as high as 393 days or as low as 379 days, but the recent activity would imply that the current period is closer to 370 days. Coincidentally there has been a reduction in the range of light variation since 2016.

Mira-type variables lie in a part of the Hertzsprung-Russell diagram known as the "asymptotic giant branch". They are red giant stars and their brightness variations are linked to pulsations that cause their outer layers to expand and contract. Their luminosities are typically several thousand times that of our Sun, but they are not high mass stars. The mass of T Cephei, for example, is probably little more than half that of our Sun. Indeed, Mira-type variables represent a late stage in the evolution of stars that are similar in mass to our Sun and therefore massive enough to have undergone helium fusion in their cores. They are losing mass to their surroundings and over the course of a few million years will fully shed their outer layers, leaving behind a white dwarf star.

The reasons for the period changes seen in Mira-type variables are not well understood. The cycle-to-cycle changes are probably related in some way to the stars not being spherically symmetrical and to irregularities within their stellar envelopes, but longer-term trends seen in a small number of Mira-type variables may be related to thermal pulses deep down within the star.

Given their large visual amplitudes, Mira-type variables are excellent targets for amateur astronomers. Much of the brightness range of T Cephei can be followed using binoculars and it can be followed down to minimum using a small telescope. A brightness estimate made once a week or so will suffice. Indeed, our knowledge of the brightness changes of Mira type variables over the decades has been almost exclusively due to observations made and reported by amateur astronomers.

The advance of amateur spectroscopy in recent years also offers opportunities. It is known that, being relatively cool stars, Mira type variables emit most of their light at red (an infrared) wavelengths and that their spectra, in addition to the Balmer lines of hydrogen, contain 'bands' related to the absorption of light by simple molecules such as TiO and ZrO in their outer layers. Systematically capturing spectra at regular intervals during the cycle of a Mira-type variable would allow a study as to how the relative strengths of these and other absorption lines fluctuate as the brightness of the star rises and falls and, in the case of T Cephei, investigate whether there is any correlation with the "standstill" in the light curve.

Light Curve for T CEP