

The Society For Popular Astronomy.

The Variable Star Section Annual Report 2019.

Over the course of 2019, three members sent in variable star observations. Those members where: Matthew Barrett, Jonathan Shanklin and Don Matthews. Enough observations where received to produce light curves for seventeen stars.

The two observing highlights for 2019 where a usually bright maximum for Mira during the last quarter of the year and Betelgeuse becoming usually faint during December.

Mira Approaching Maximum - Taken by Robin Scagell.

Date: 28/09/19	Time: 08:32 UT	Exposure Time: 5s	ISO 2500
Camera: Cannon EOS 70D	Lens: Cannon EF-S 18-200 mm. Set at 28mm, F4.		



Semi-Regular Stars.

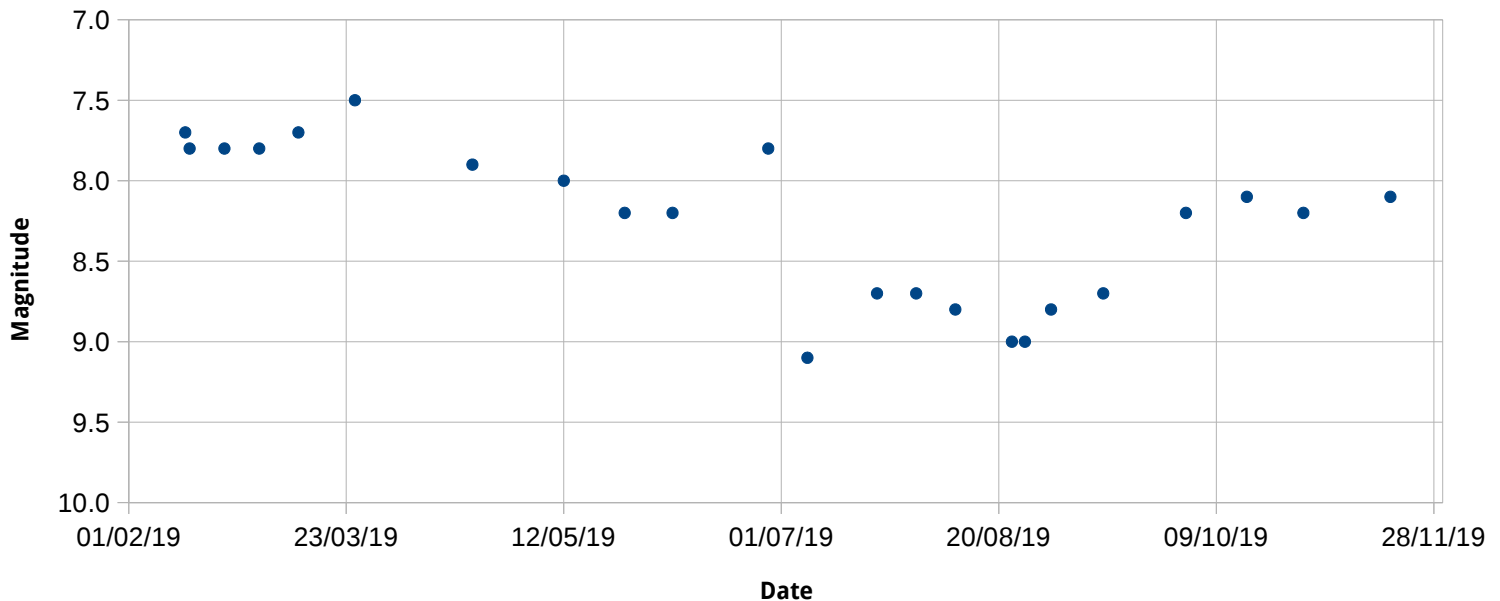
RW Bootis.

Star	Extreme Range	Period (days)	Type
RW Bootis	6.4 – 9.2	209?	Semi-Regular

The light curve for RW Bootis shows a fair amount of scatter. However, it is possible to see that this star slowly decreased in brightness over the year, before reaching a minimum in August. This was a faint minimum for RW Bootis as it reached magnitude nine. A more typical range for RW Bootis is 7.9 – 8.7. The light curve also shows, that following the slow decline to minimum, there was a rapid rise towards maximum. This seems to be rather atypical behaviour for RW Bootis as past light curves have been more symmetrical.

Light Curve for RW Bootis

Based on SPA Observations 2019



AF Cygni.

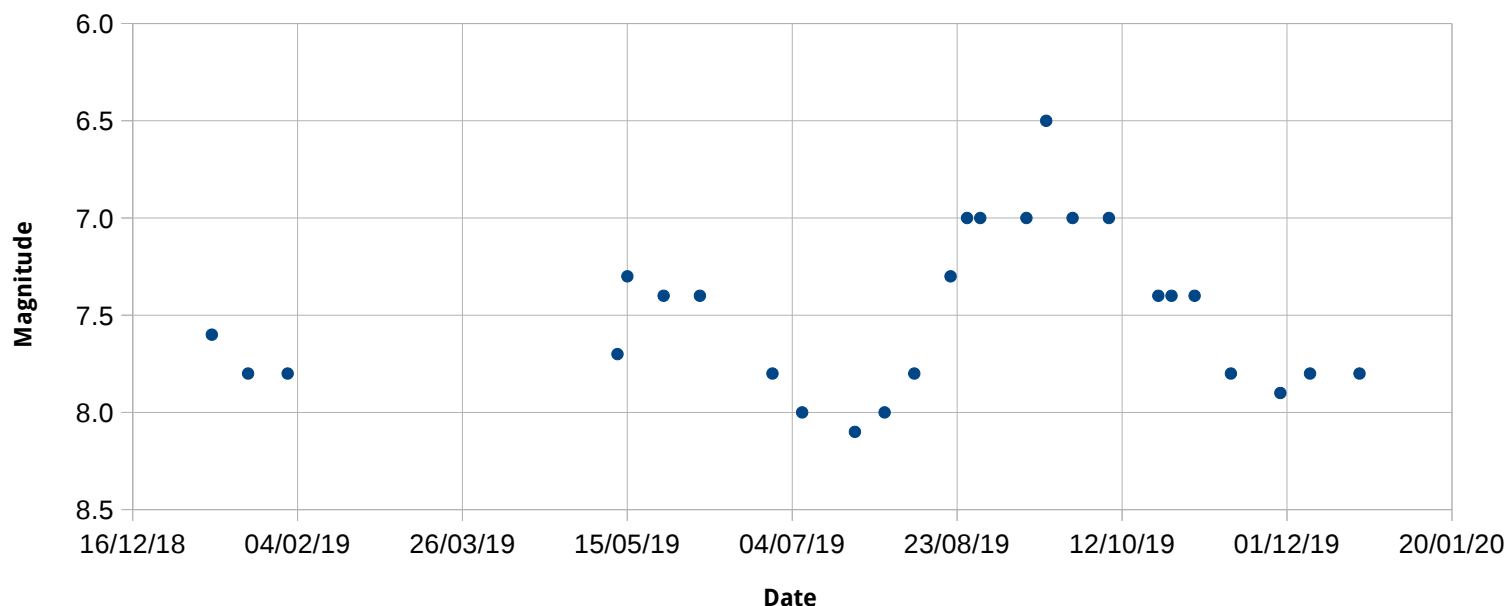
Star	Extreme Range	Period (days)	Type
AF Cygni	6.4 – 8.4	92	Semi-Regular

AF Cygni is a popular semi-regular star that is easily found near delta Cygni. It also has the attraction of being visible almost all year; although it is rather difficult to observe during the early months of the year.

The light curve for AF Cygni shows it reaching maximum in September. However, the maximum brightness seems to be straddled by a standstill, as the star remained at magnitude seven for an extended period over the course of about a month. Standstills like this are not uncommonly observed in semi-regular stars. It's this type of unpredictable behaviour that makes semi-regular stars so interesting to observe.

Light Curve for AF Cygni

Based on SPA Observations 2019



R Lyrae.

Star	Extreme Range	Period (days)	Type
R Lyrae	3.9 – 5.0	46	Semi-Regular

R Lyrae is a semi-regular star that used to be on the SPA programme and I thought it might be worthwhile to reintroducing it. R Lyrae is easily found in the constellation of Lyrae; not far from Vega. R Lyrae is a red giant with a mass of $1.8 M_{\odot}$ and a surface temperature of 3500 K. R Lyrae typically varies between magnitudes 3.8 and 4.4, although its extreme range is closer to 3.9 – 5.0.

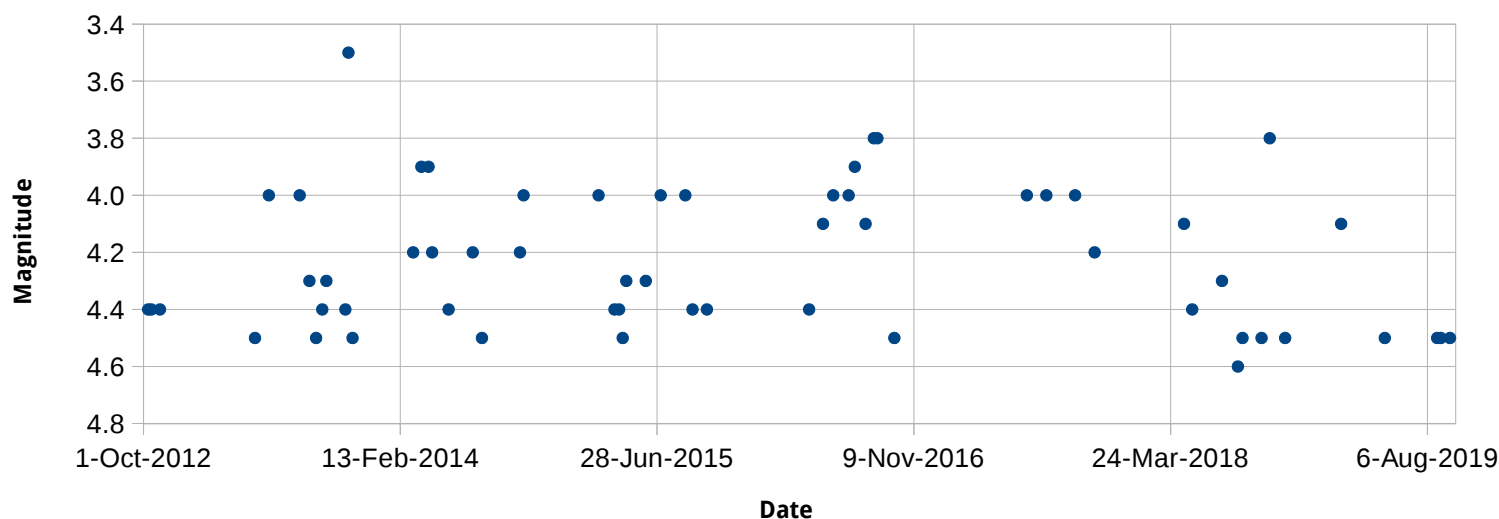
The period of 46 days is the most widely observed period for this star; but other periods have been suggested. Like all semi-regular stars, it can be hard to determine the exact period of variability. Several other periods have been suggested for R Lyrae, including 64, 378 and 1000 days. It would make for an interesting project to see whether this period of 46 days is correct or not.

However, as R Lyrae is a very red star, it can be challenging to make accurate light estimates. One problem facing variable star observers is the Purkinje Effect. This is when red light builds-up on the retina, so as you stare at a red star, the star appears to increase in brightness. When observing red stars with the naked eye, it is best to take brief glimpses and not too stare at the star for any length of time. Mist and moonlight can also affect your ability to estimate red stars accurately; so it is best to observe red stars when the sky is dark and clear.

The light curve below is based on my own observations of R Lyrae and you can see there is a great deal of scatter. More observations, from more members, would make for a more accurate light curve.

Light Curve for R Lyrae

Based on SPA Observations



Alpha Orionis.

Star	Extreme Range	Period (days)	Type
Alpha Orionis	0.4 – 1.3	1460?	Semi-Regular

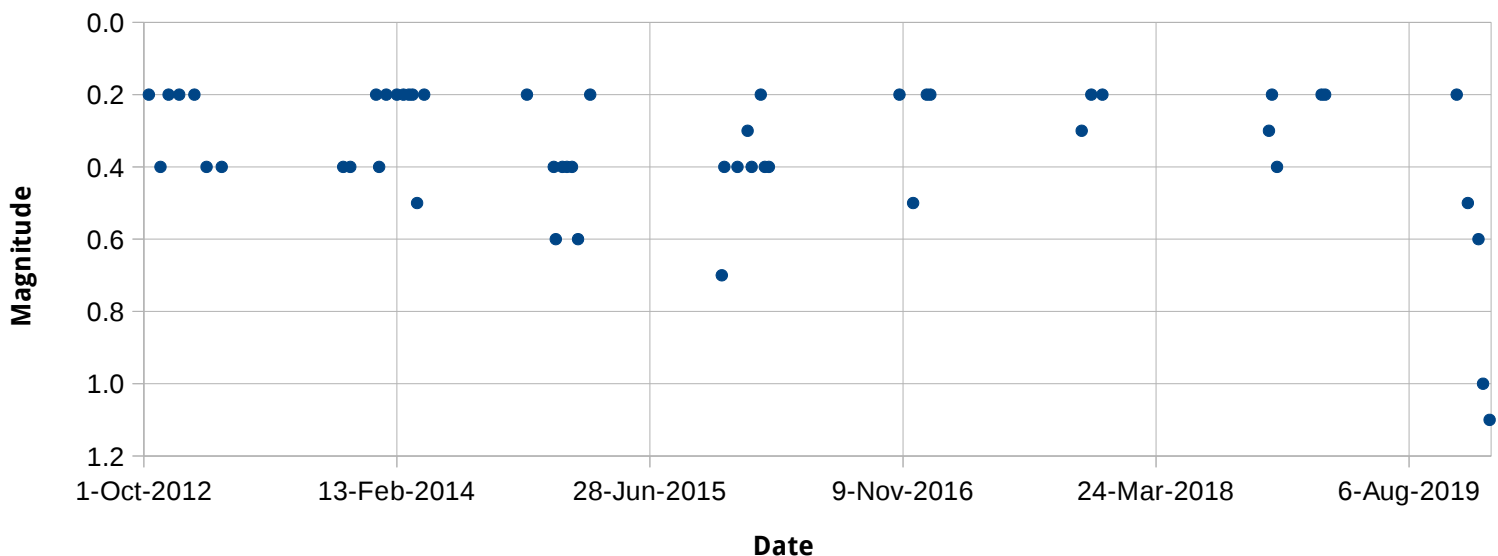
Alpha Orionis, or Betelgeuse, was in the news during December 2019, when it underwent an unusual fade. Betelgeuse usually hovers between magnitude 0.2 and 0.4, but during December, it faded to below the first magnitude. This is not an unprecedented fade for Betelgeuse, but at the beginning of 2020, Betelgeuse is the faintest its been for several decades.

Like all brightness changes that occur in red giant stars, the change in brightness is primarily caused by changes in size. As the radius of the star increases, the surface temperature drops and the star's brightness decreases. At its smallest, Betelgeuse would fill the Solar System out to the orbit of Mars. At its largest, Betelgeuse would fill the Solar System out to the orbit of Jupiter.

This dramatic fade has prompted speculation that Betelgeuse is soon to go supernova; but this is unlikely. Betelgeuse has a mass about eleven times that of the Sun, so it is destined to end its life as a supernova. Betelgeuse is also in the end-stages of its evolution, so will go supernova in the astronomically near future, possibly within the next million years or so. Some people are even more optimistic and think Betelgeuse will go supernova in the next 100,000 years, but given the timescales involved, it is improbable that Betelgeuse will be seen to go supernova in our lifetime.

Light Curve for Alpha Orionis

Based on Observations 2012 - 2019



R Scuti.

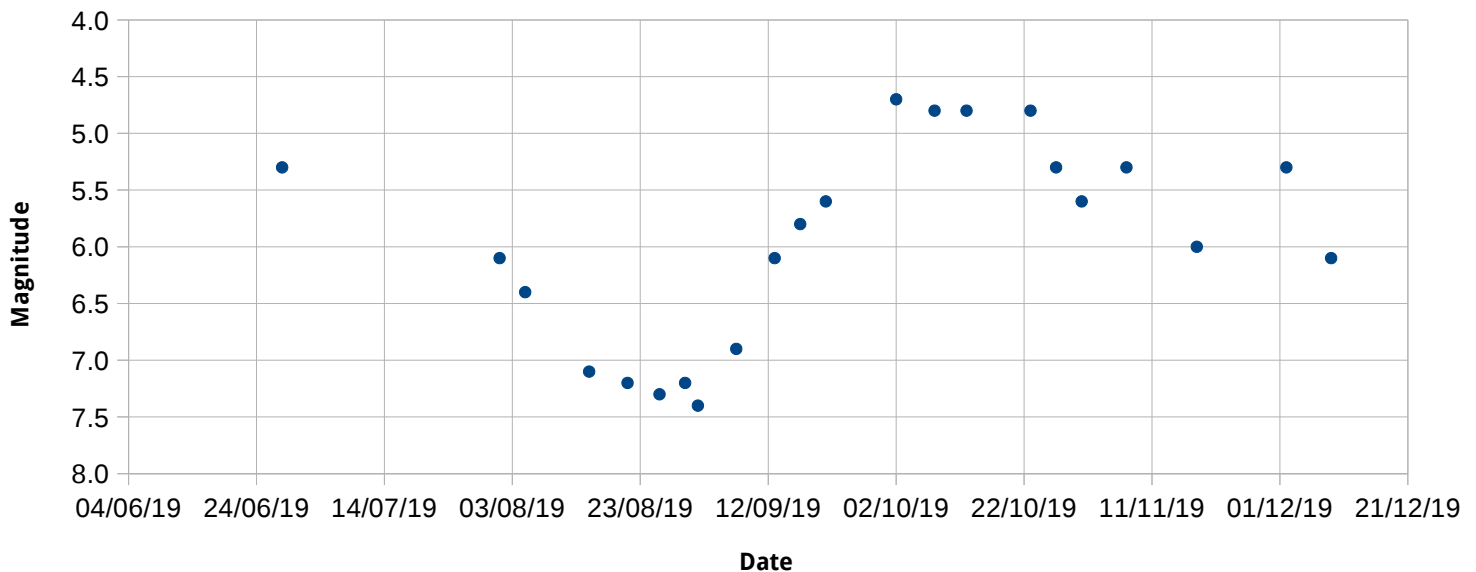
Star	Extreme Range	Period (days)	Type
R Scuti	4.5 – 8.6	142	RV Tau

R Scuti, like all RV Tau class stars, shows behaviour that is both complex and hard to predict. R Scuti is often described as having alternative deep and shallow minimum; but this description doesn't always match the star's actual behaviour.

Compared with last year, R Scuti displayed less complex behaviour. In 2018, R Scuti experienced a total of three minimum: one bright minimum, followed by two deeper minima. However, in 2019, R Scuti experienced only one minima, about one year after then its last minima in August 2018. This was an even deeper minima then the last two, with R Scuti becoming a full magnitude fainter then its last minima.

Light Curve for R Scuti

Based on SPA Observations 2019



Long-Period Variables.

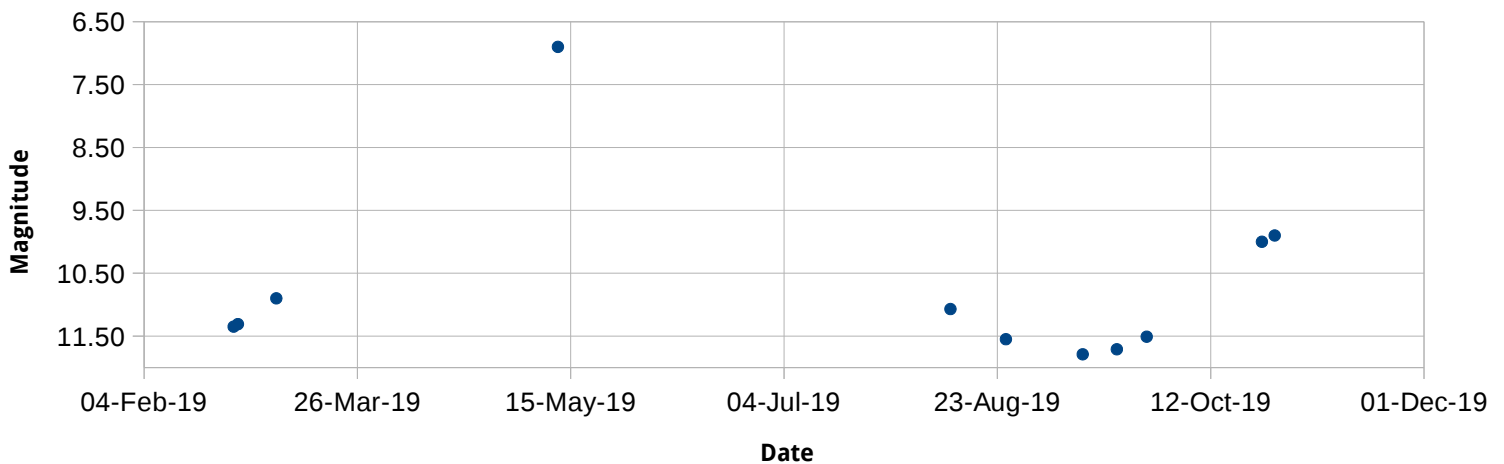
R Bootis.

Star	Extreme Range	Typical Range	Period (days)	Type
R Bootis	6.2 – 13.1	7.2 – 12.3	223	Mira

Few observations of R Bootis were received over the course of 2019. However, enough observations were made to determine that R Bootis reached maximum brightness in May and reached minimum in September. R Bootis did move outside of its typical range, with a maximum brightness of magnitude 6.9, which is quite bright for this star.

Light Curve for R Bootis

Based on SPA Observations 2019



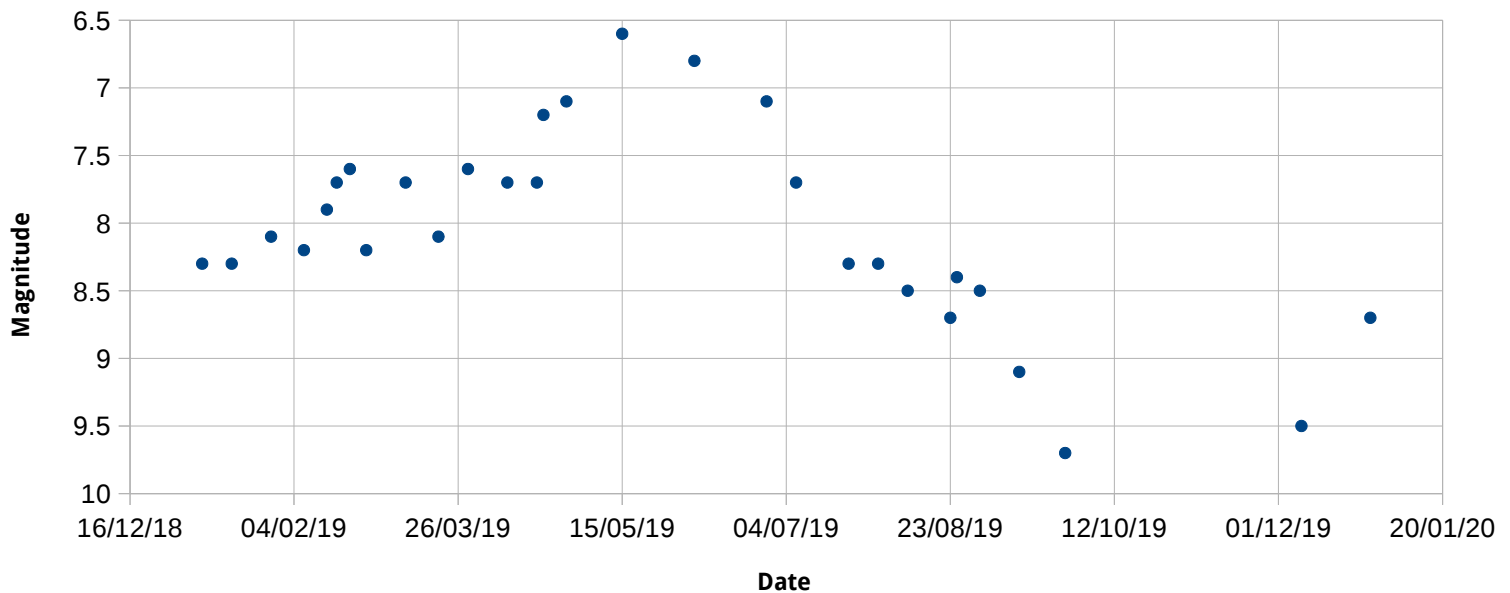
T Cephei.

Star	Extreme Range	Typical Range	Period (days)	Type
T Cephei	5.4 – 11.0	6.0 -10.3	389	Mira

T Cephei is a very popular star with members, possibly as it's visible all year round. The light curve shows T Cephei reaching maximum in May; but not before undergoing a month-long pause at about magnitude eight. This pause at magnitude eight, as T Cephei increases to maximum, is typical behaviour for the star. This was also a faint maximum for T Cephei; as it was not observed to rise above magnitude 6.6.

Light Curve for T Cephei

Based on SPA Observations 2019



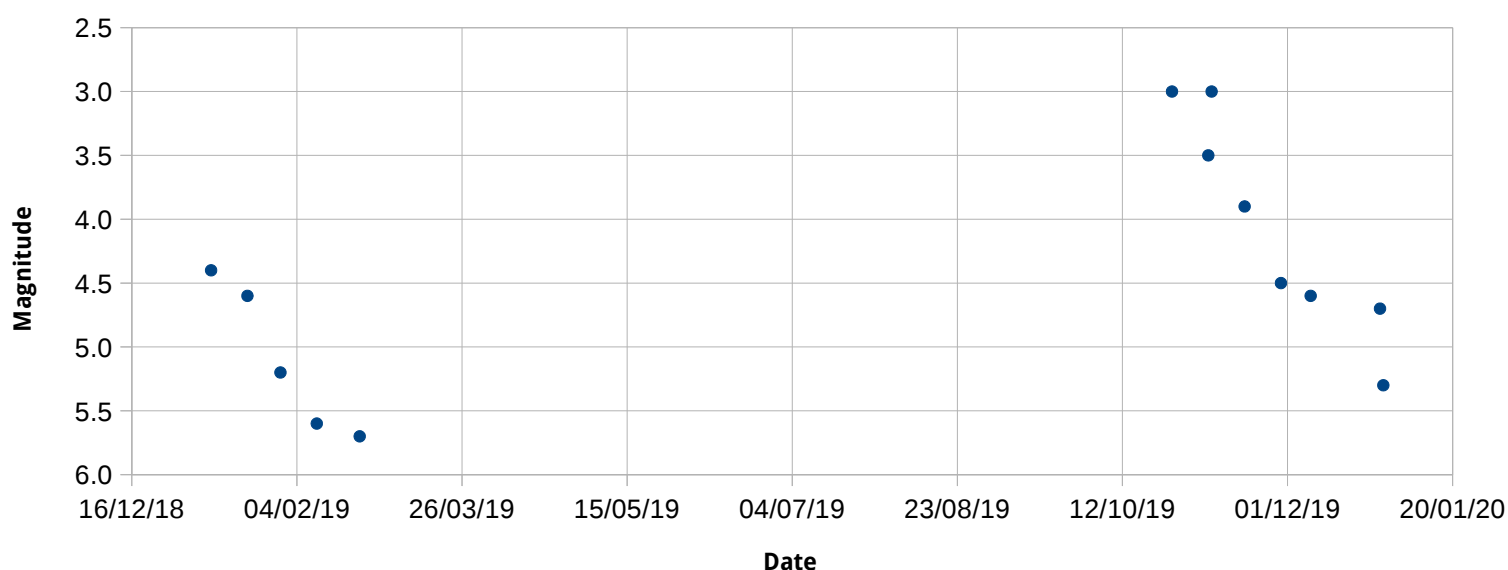
Omicron Ceti.

Star	Extreme Range	Typical Range	Period (days)	Type
Omicron Ceti	1.7 – 10.1	3.6 – 9.3	332	Mira

Omicron Ceti reached maximum brightness in November; as it was predicted to do. However, Omicron Ceti was visible to the naked eye as early as September, when it was observe to be around the fourth magnitude. Excessive amounts of cloud prevented any observations from being made as Omicron Ceti made its approach to maximum. When it was next observed at the end of October, it had already reached magnitude three. This was an unusually bright maximum for Omicron Ceti; but still well within its extreme range. By comparison, Omicron Ceti only reached magnitude 4.5 in 2018.

Light Curve for Mira

Based on SPA Observations 2019



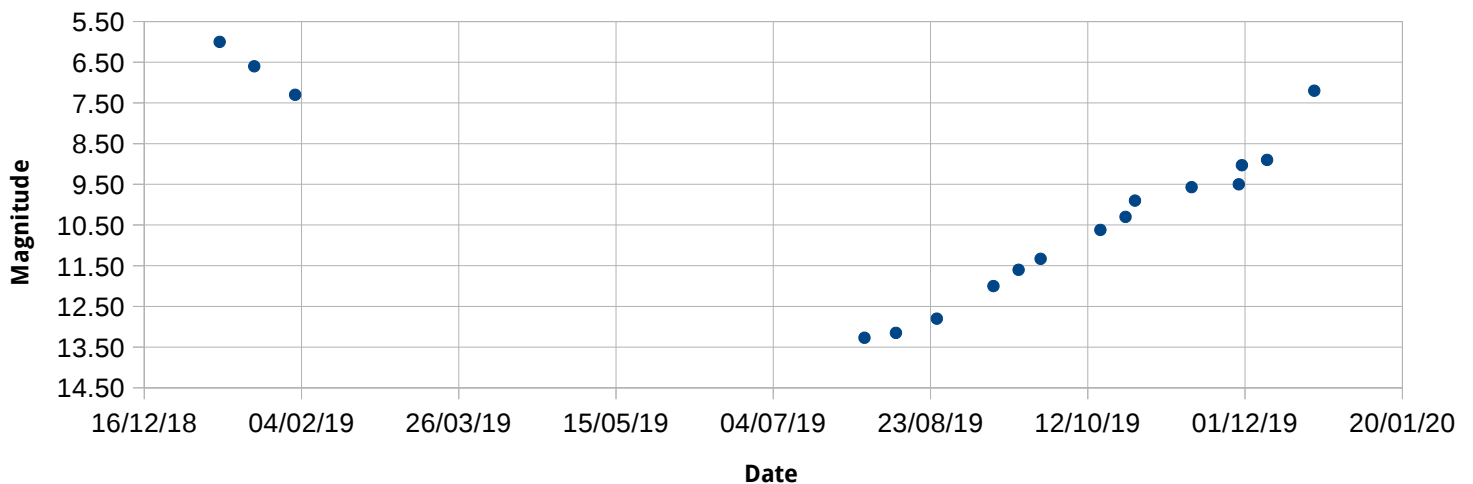
Chi Cygni.

Star	Extreme Range	Typical Range	Period (days)	Type
Chi Cygni	3.4 – 14.2	5.1 – 13.4	407	Mira

A partial light curve for chi Cygni could be constructed from the observations sent in during 2019. Most of these observations were made during the latter half of the year while chi Cygni was approaching maximum. Don Mathews was able to supply observations when the star was too faint to be seen visually. Chi Cygni had yet to reach naked eye brightness by the end of the year; but it will reach maximum in January 2020.

Light Curve for Chi Cygni

Based on SPA Observations 2019



R Leonis.

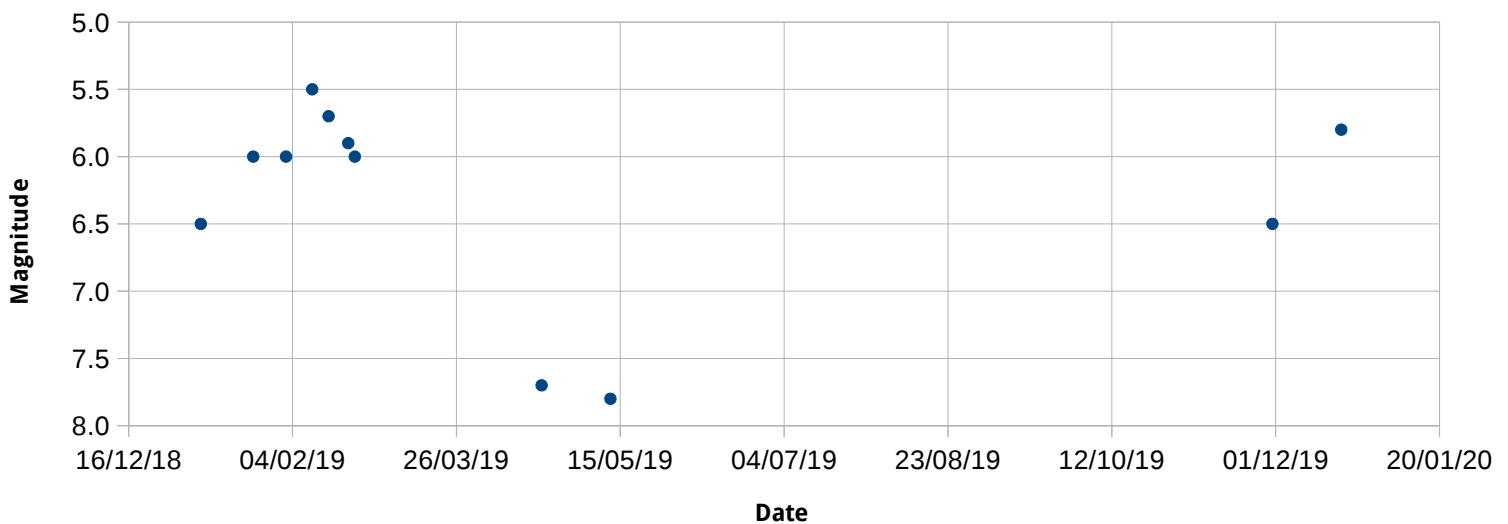
Star	Extreme Range	Typical Range	Period (days)	Type
R Leonis	4.8 – 11.0	5.8 – 10.0	310	Mira

Most of the observations of R Leonis, which were made over the course of 2019, were made during the first two months of the year, when R Leonis was at maximum. R Leonis reached a maximum brightness of magnitude 5.5 in February 2019.

The last observations of R Leonis, made before the end of the year, show a rise to another maximum in December 2019.

Light Curve for R Leonis

Based on SPA Observations 2019



U Orionis.

Star	Extreme Range	Typical Range	Period (days)	Type
U Orionis	5.3 – 12.6	6.3 -12.0	372	Mira

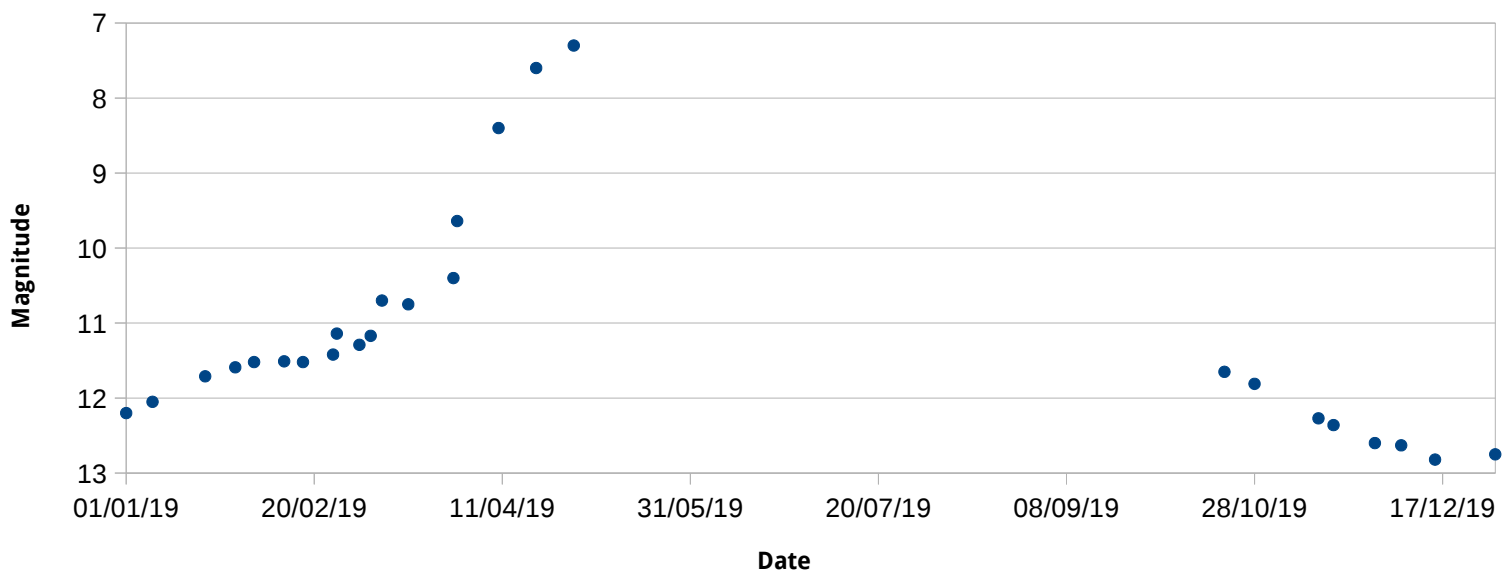
U Orionis was regularly observed during the first four months of the year; as it rose to maximum. Unfortunately, by the end of April, Orion is disappearing into the evening twilight, making it hard to observe U Orionis.

U Orionis was again observed during the last quarter of the month, when it was approaching minimum. U Orionis was observed at a minimum of magnitude 12.8; which is quite faint for this star.

As the year ended, U Orionis was seen to have passed minimum and was once again rising in brightness. U Orionis is predicted to reach maximum in April 2020.

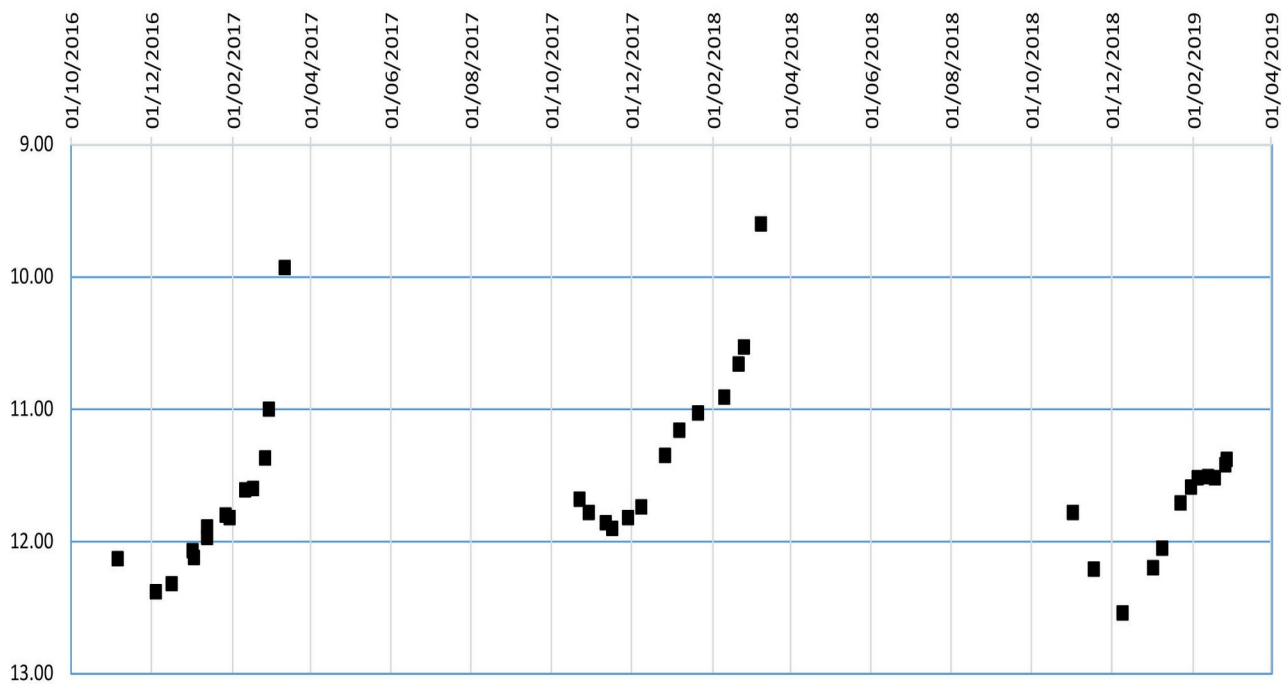
Light Curve for U Orionis

Based on SPA Observations 2019



The light curves below are based on the observations of Don Matthews. They show the last three minima for U Orionis. They show that the minima for 2019 was fainter than the minima for 2018/2017.

U Ori



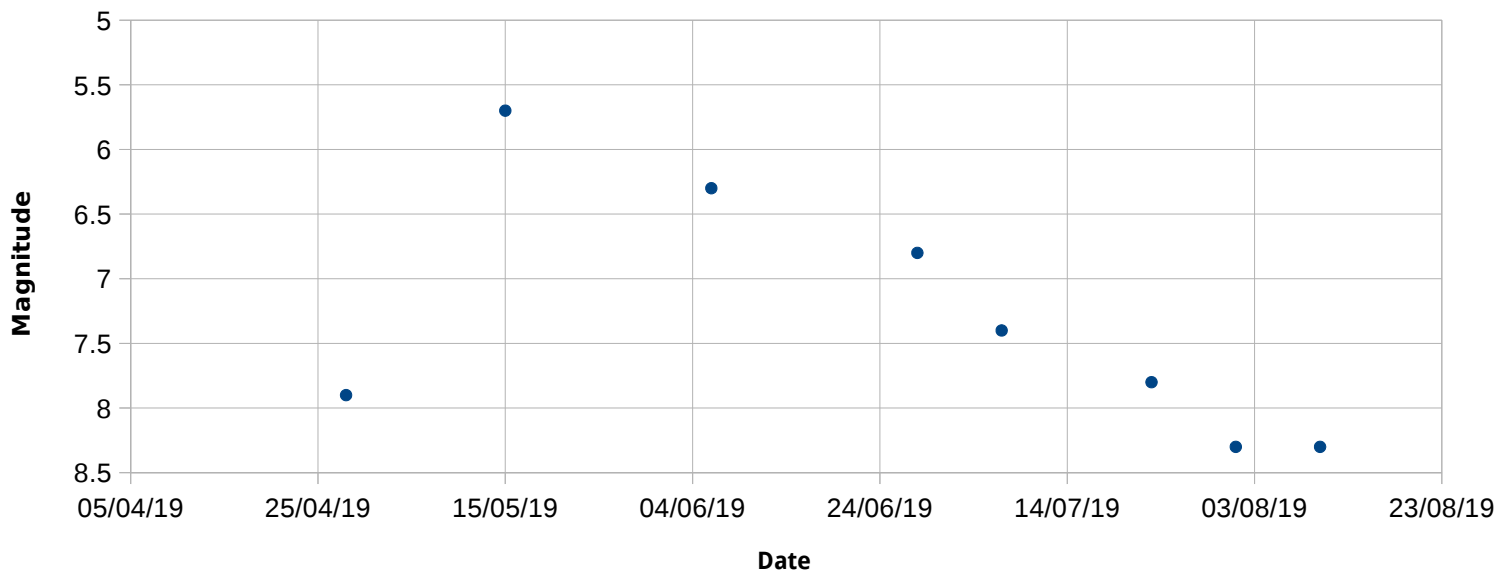
R Serpentis.

Star	Extreme Range	Typical Range	Period (days)	Type
R Serpentis	5.7 – 14.4	6.9 – 13.4	357	Mira

R Serpentis was observed as it passed though maximum in May 2019. R Serpentis reached a maximum brightness of 5.7, which is about as bright as R Serpentis is known to get.

Light Curve for R Serpentis

Based on SPA Observations 2019



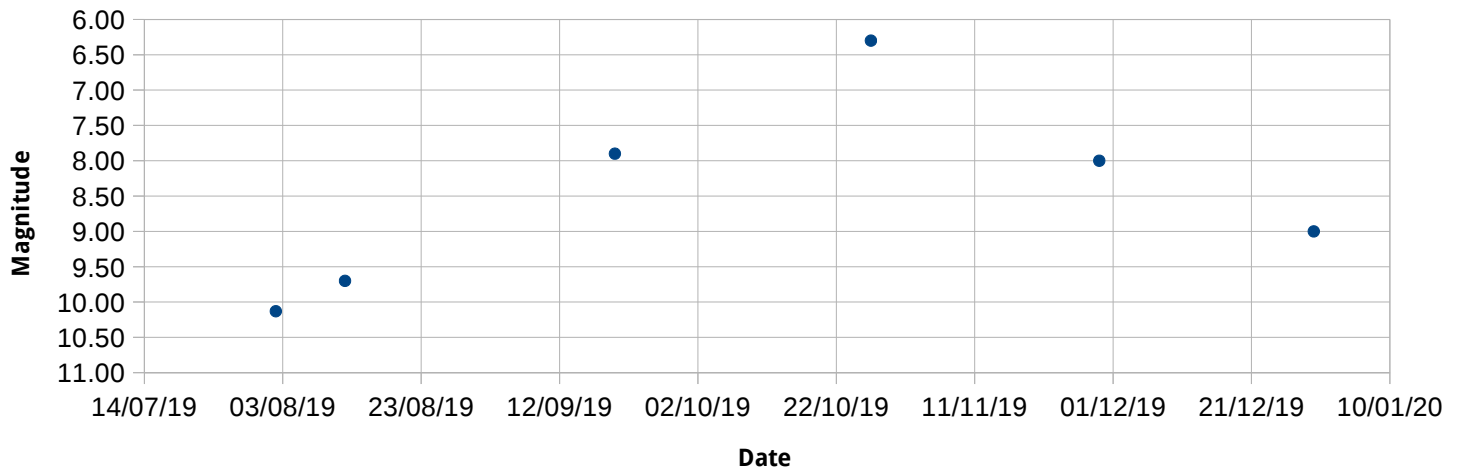
[R Trianguli.](#)

Star	Extreme Range	Typical Range	Period (days)	Type
R Trianguli	5.4 – 12.0	6.2 – 11.7	266	Mira

Although few observations were made of R Trianguli in 2019, the star was observed reaching a maximum brightness of 6.3 in October.

Light Curve for R Trianguli

Based on SPA Observations 2019



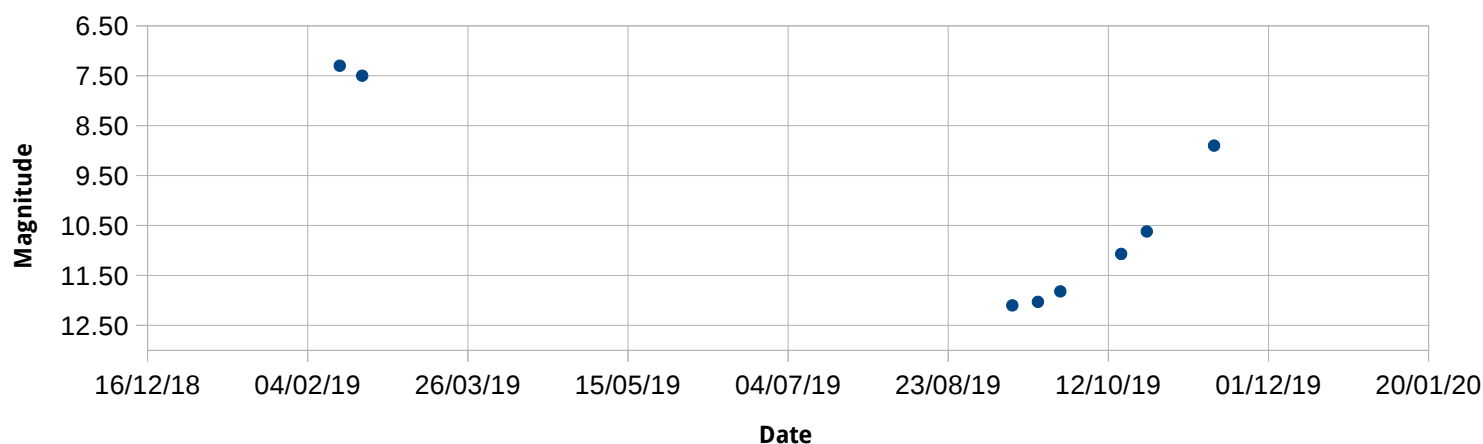
R Ursa Majoris.

Star	Extreme Range	Typical Range	Period (days)	Type
R Ursa Majoris	6.7 – 13.4	7.2 – 13.0	302	Mira

Although only a few observations of R Ursa Majoris were received during 2019. We were able to observe the star's rise from minimum in September. Don Matthews supplied the observations of the star, when it was too faint to be observed visually. These observations show an unusually bright minimum; with the star not dipping much below magnitude 12.

Light Curve for R Ursae Majoris

Based on SPA Observations 2019



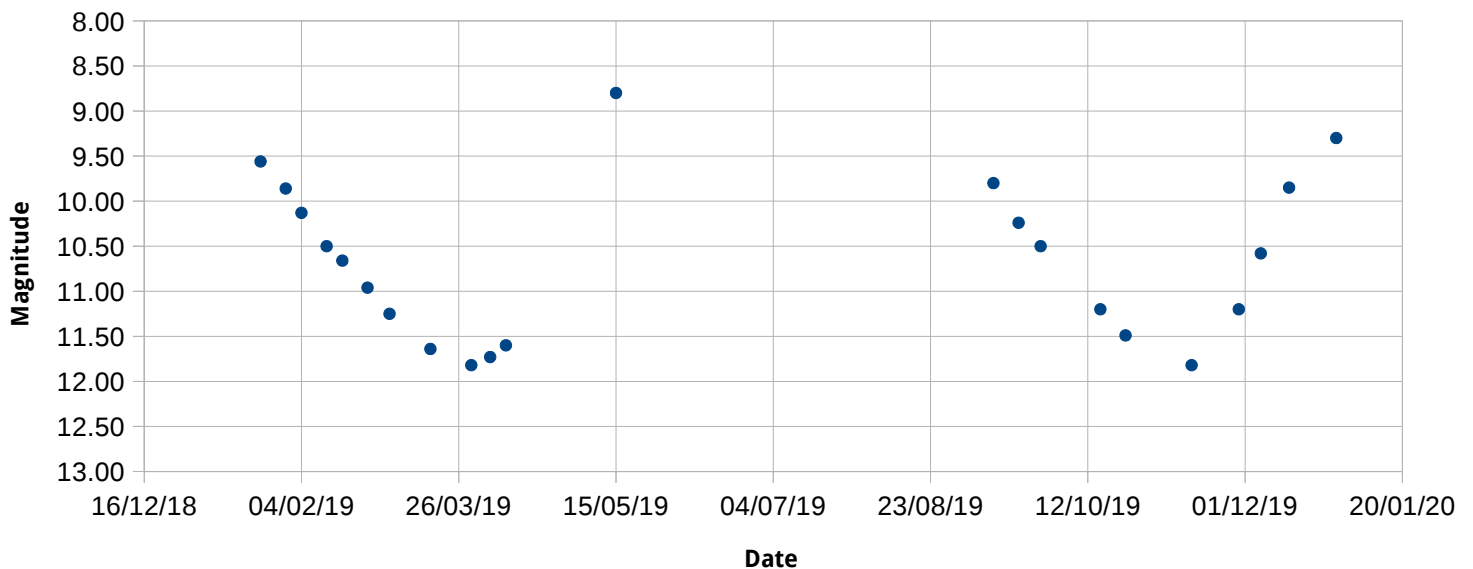
S Ursa Majoris.

Star	Extreme Range	Typical Range	Period (days)	Type
S Ursa Majoris	7.2 – 12.7	7.9 – 11.7	226	Mira

Don Matthews was able to follow S Ursa Majoris through two minima during 2019. S Ursa Majoris reached minimum in March and again in November. S Ursa Majoris never fell below magnitude 12; so stayed within its typical range. The bright nights of summer, plus Ursa Major's low altitude during the summer, possibly explains why the maximum that occurred over the summer was not observed.

Light Curve for S Ursae Majoris

Based on SPA Observations 2019



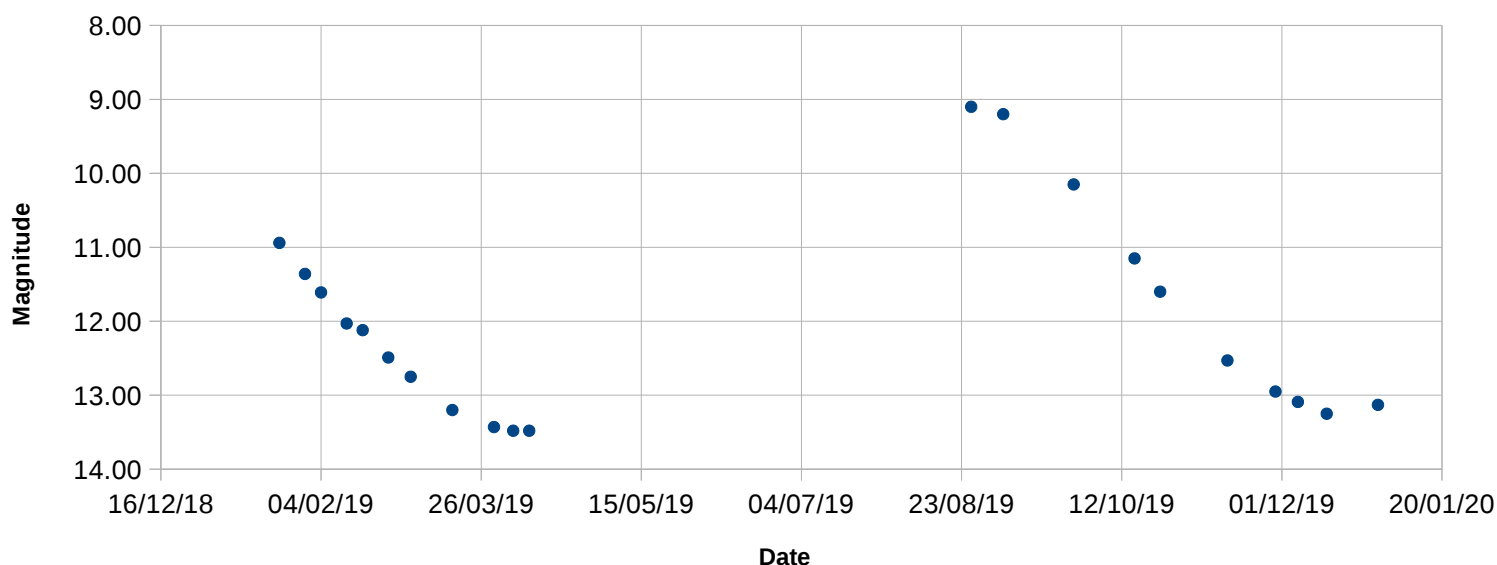
T Ursa Majoris.

Star	Extreme Range	Typical Range	Period (days)	Type
T Ursa Majoris	6.6 – 13.5	7.7 – 12.9	257	Mira

Like S Ursa Majoris, T Ursa Majoris was observed passing through two minima during 2019. At its faintest, T Ursa Majoris was observed at magnitude 13.48, which is about as faint as this star gets. T Ursa Majoris was not observed getting about magnitude 9.1, this might have been due to the actual maximum not being observed over the course of the summer, or this might have been an unusually faint maxima.

Light Curve for T Ursae Majoris

Based on SPA Observations 2019



Particular Stars.

R Coronae Borealis.

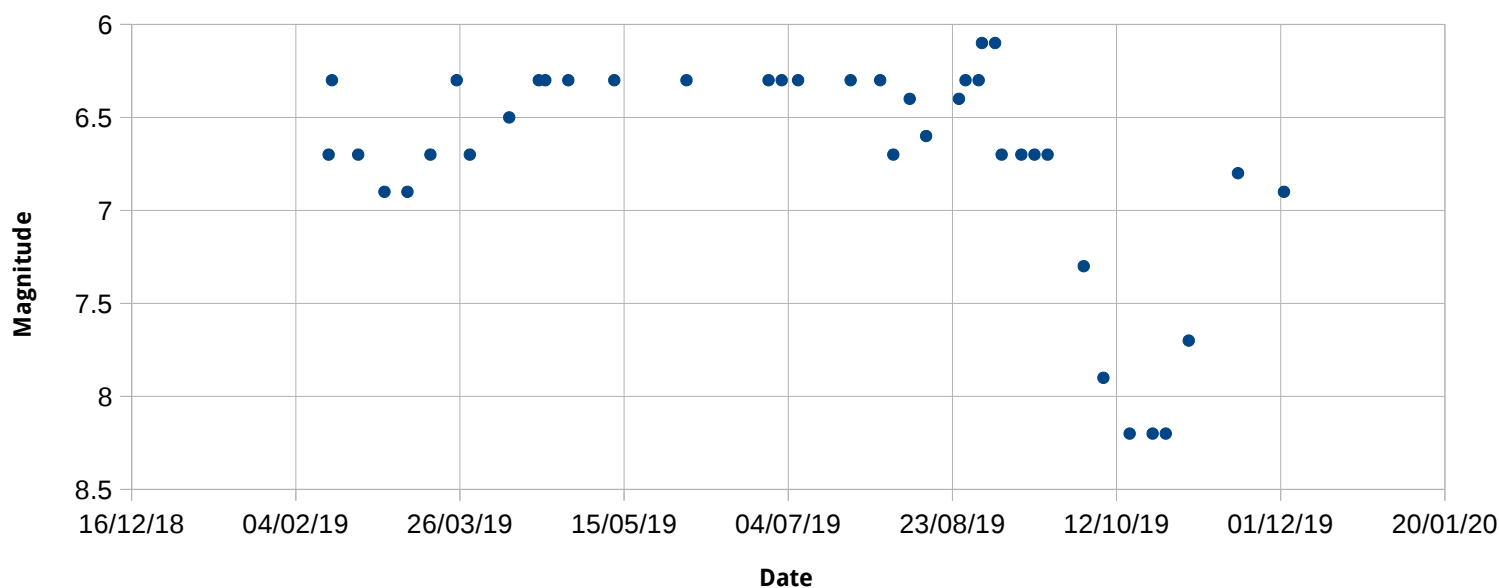
Star	Extreme Range	Period (days)	Type
R Coronae Borealis	5.8 – 15.0	None	RCB

R Corona Borealis has remained visible in binoculars all through 2019. There was brief excitement in September when R Coronae Borealis dropped below magnitude 8, and it was thought this might herald a drop to minimum brightness. However, over the course of the autumn, R Coronae Borealis slowly brighten again.

As of January 2020, R Coronae Borealis is still near maximum brightness and can still be seen in binoculars.

Light Curve for R Corona Borealis

Based on SPA Observations 2019



The light curve below contains observations of R Coronae Borealis for both 2018 and 2019. you can see how the dropped in brightness that occurred in September 2019 was unprecedented in 2018. R Coronae Borealis has stayed in binocular range since the spring of 2017. It will be interesting to see how long we have to wait for another plunge to minimum.

Light Curve for R Coronae Borealis

Based on SPA Observations: 2018 - 2019

