Using RR Lyrae Stars to Determine Interstellar Reddening

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Abstract

I determined for three RRL type stars many factors about them. Some of which were their amplitude, period and reddening effects from dust particles.

Observing and Image Processing

The entire night begins by starting up Bowling Green State University's .5 M telescope. There is a CCD camera attached to the telescope that needs to be calibrated on a regular basis. The CCD camera needs to be cooled to -28 degrees Celsius below the ambient temperature before any pictures are taken to ensure optimal quality. Once the camera is ready to be used there are BIAS, DOME FLATS and SKY FLATS that need to be taken.

A bias picture measures the amount of signal, or charge, that was placed on the CCD before the image was taken.

A dome flat measures the sensitivity of each pixel.

A sky flat image is repeatedly taken during a short time interval of nights twilight stage. These images will show any dust left on the CCD lens and can be removed during the processing stage.

Each type of image is taken in both the infrared and visible wavelengths.

Photing

- Once the image processing is complete the next step is finding the magnitude. Finding the magnitude of the RRL stars is a time consuming task without the use of AUTOPHOT, a very quick and helpful program. The AUTOPHOT program uses differential photometry, which is accomplished by comparing the brightness of each variable star to at least one non-variable comparison star that correlates to the same frame.

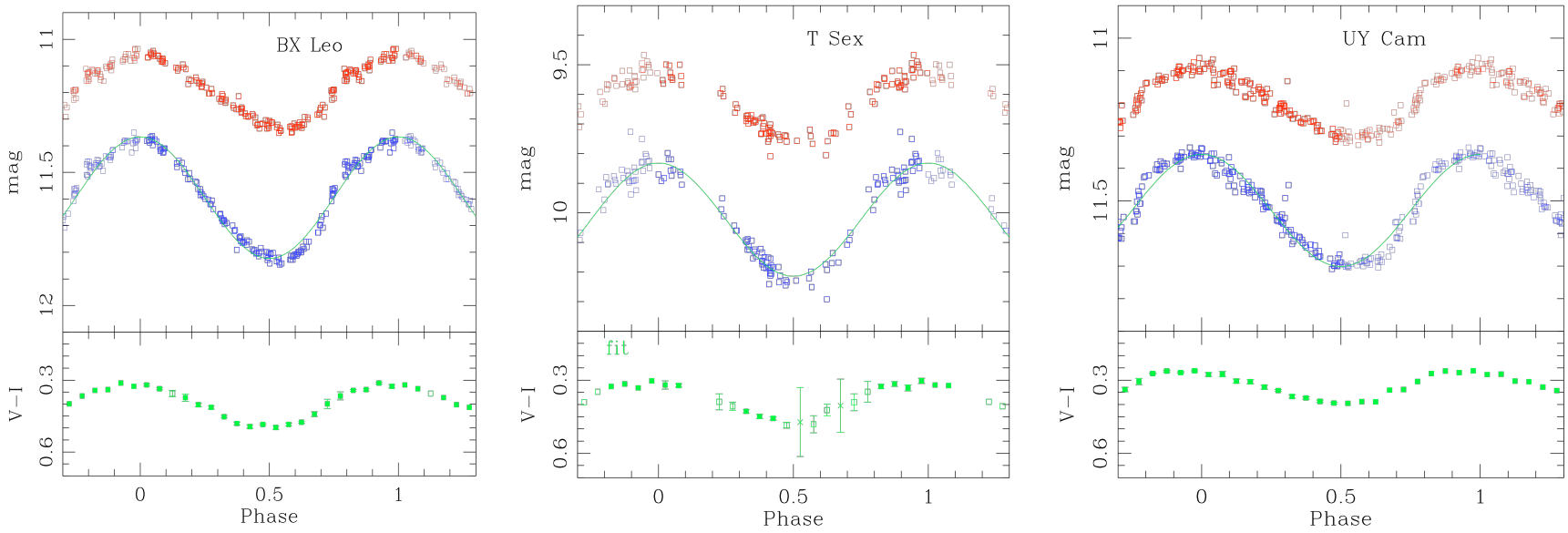
Collaboration

- Michael Wehrung provided much of the initial data regarding the three RRL stars. Mike not only separately observed the stars on many nights, but also processed and photed the images. With his help I was able to provide much more accurate and reliable results.

Color Curves

- Here we have ***BX Leo***, ***T Sex*** and ***UY Cam*** color curves. These stars have a very well defined period. The plot is both magnitude and V-I against the Phase. There are no gaps between data points, and the points follow a sinusoidal pattern.

All of the points in the V and I light curves come from a single image. The color curves are created by combining the V and I light curves and calculating the average in each combination. Afterwards, calculate the V - I.



Observed Schlegel Map

<V>-<I>	E(B-V)	E(V-I)	(V-I)_0	[Fe/H]	Period	Amplitude	Star
0.398	0.028	0.035	0.363	-1.28	0.3629	0.495	BX Leo
0.385	0.050	0.062	0.323	-1.34	0.3245	.500	T Sex
0.326	0.025	0.031	0.295	-1.33	0.2669	0.373	UY Cam

A Schlegel map is a way of estimating dust far from the galactic plane.

E(V-I)=1.24*E(B-V)

With B-V representing the metallic properties, color, and period.

(V-I)_0=<V>-<I>-E(V-I)

<V>-<I> and amplitude were achieved from the !/data/layden/BGTEL/PROGS/lc_vi.e command

The period was from the PDM

Dr. Layden provided the iron/hydrogen from literature spectrum studies.

De-reddened plots

Plotted against (V-I)_0 vs Amplitude

The curfit is vio_vamp.dat

V-I= mx+b= 0.3754*A + 0.1558

RMS=0.017

Plotted against (V-I)_0 vs Period

The curfit is vi0_per.dat

V-I = mx+b = 0.6908*P + 0.0107

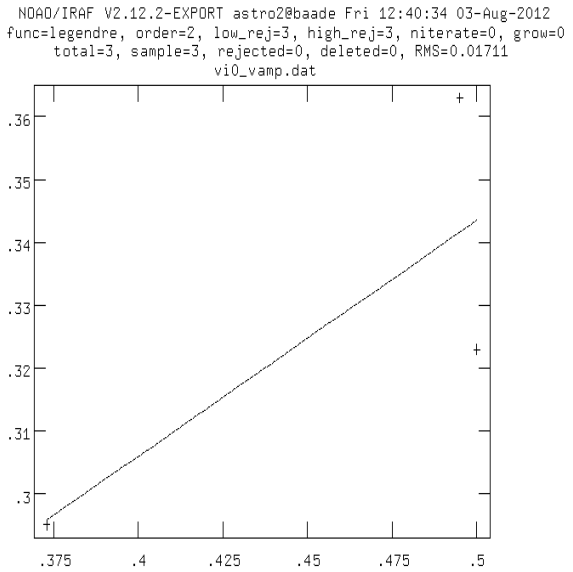
RMS= 0.006

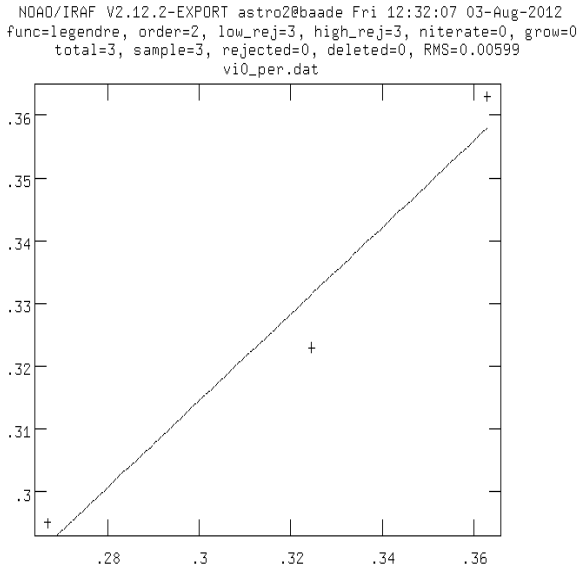
Plotted against (V-I)_0 vs Fe/H

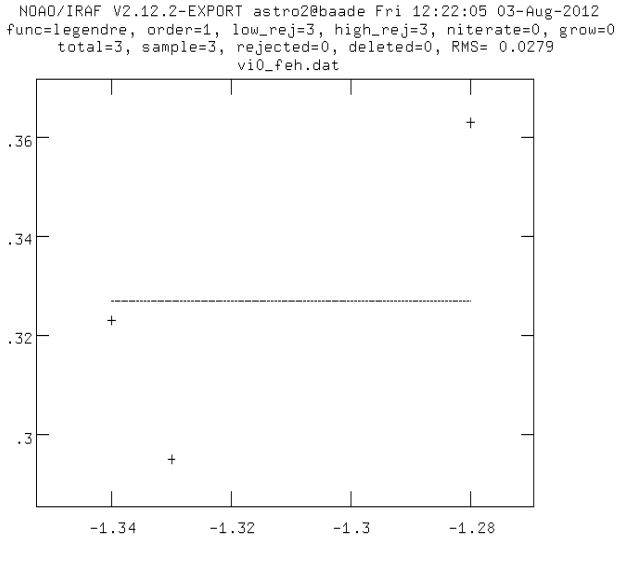
The curfit is vi0_feh.dat

There is a narrow range of Fe/H, so I stayed on the Legendre polynomial of degree 1

(V-I)_0 = 0.327 +/- 0.0197
RMS= 0.0279 [mags]







The (V-I)_0 vs Period has the most linear plot and smallest RMS scatter. It provides the best prediction of (V-I)_0.

References

- Dr. Layden's imagery and photometry cookbook
- http://physics.bgsu.edu/~layden/VarStarProj/vsp_main.html