Areas of research for the amateurs on eclipsing binaries

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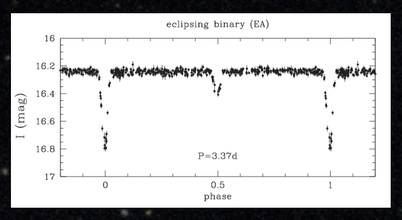
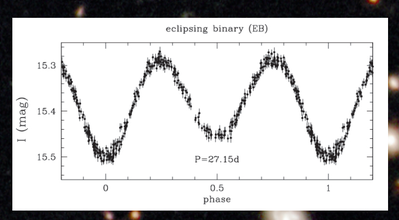
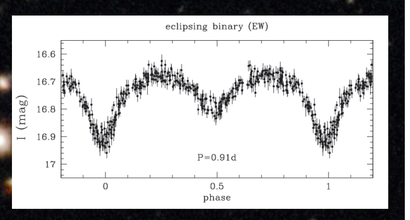
Introduction



Graph of an Algol-type lightcurve



Graph of a Beta Lyrae



Graph of a W Ursae Majoris

Source : http://www.astrouw.edu.pl/~simkoz/projects/stars/variable/

We distinguish three morphological types of lightcurve, all of which are observable with amateur equipment

Mind the curves : Shapes tell us the type of stars present.

Modelling and sending of data

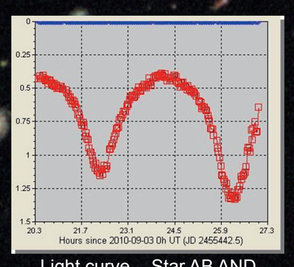
1 - Predict observations of primary and secondary minima of the stars.

2 - Observe this star while completing time-series over a period of time covering several hours in order to not miss the minima

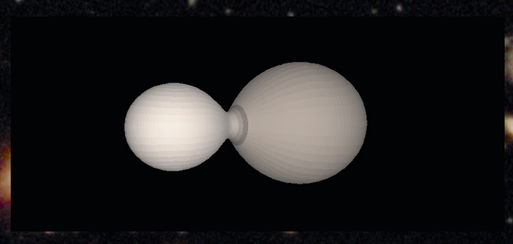
3 - Shifting through the data: after the pre-treatment of the images we must make a light curve and obtain data from it

4 - Modelling: it is possible to carry out 3D modelling from the obtained data if we know the parameters of the system observed

5 - Data sending : it is very important to send the results obtained to an organisation which studies this type of stars (for example AAVSO-https://www.aavso.org) or a professional astronomer.



Light curve - Star AB AND
(c) Laurent Corp



Modelling 3D - star AB And (StarLight Pro 2,1 39)

O-C (Observed minus Calculated)

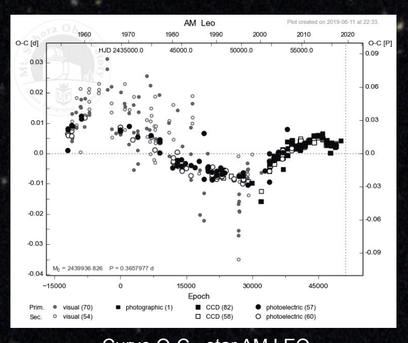
The goal is to obtain a complete light curve : including the minima and the maxima.

Ideally we must have the data with different photometric filters : B-V-Rc otherwise V(Johnson) or r'(Sloan).

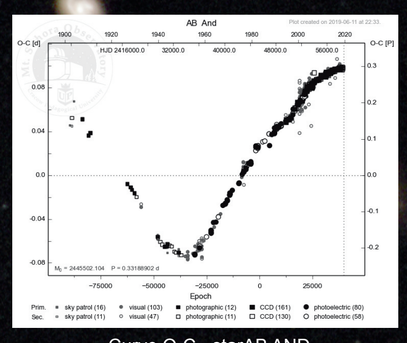
Evidence of the O-C (Observed minus Calculated) : there may be a gap in the time between observation of the minima and the time calculated by the ephemerides.

This gap (O-C) is shown on a curve.

From a lot of measuring points certain phenomena can be then seen.



Curve O-C - star AM LEO
http://www.as.up.krakow.pl/minicalc/LEOAM.HTM
J.M. Kreiner, 2004, Acta Astronomica, vol. 54, pp 207-210



Curve O-C - starAB AND
http://www.as.up.krakow.pl/minicalc/ANDAB.HTM
J.M. Kreiner, 2004, Acta Astronomica, vol. 54, pp 207-210

O'CONNELL Effect

The O'Connell effect only happens for stars of the type EW, therefore we must make a complete light curve in order to detect different heights of the maxima.

This can be done with multifilters.

Even if this is not totally understood, it will be due to hot points on the stars or dust between the stars.

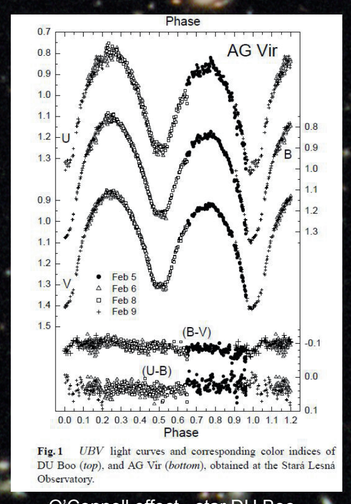


Fig. 1 *UBV* light curves and corresponding color indices of DU Boo (*top*), and AG Vir (*bottom*), obtained at the Stará Lesná Observatory.

O'Connell effect - star DU Boo
Astron. Nachr. / AN 332, No. 6, 607 – 615 (2011) / DOI 10.1002/asna.201111569
O'Connell effect in early-type contact binaries DU Boo and AG Vir T. Pribulla et al.

oEA Stars (Oscillating Algol-type stars)

Variations in levelling off for stars of the type EA may be seen, these stars are named oEA stars

The study consists in detecting the micro-amplitude of the order of the mmag, the pulsations may last between 30mn and 3 hours.

The main component is A or F spectral type, pulsating star of the class Delta Scuti.

To date, dozens and hundreds of such stars have been detected by ground and space observations, respectively.

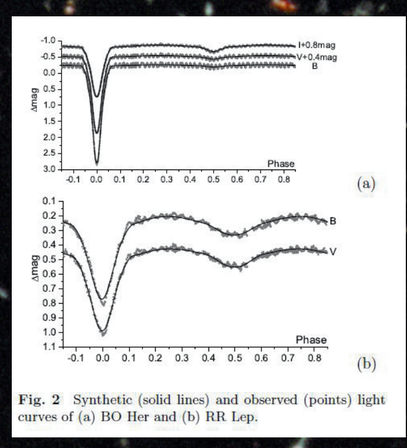


Fig. 2 Synthetic (solid lines) and observed (points) light curves of (a) BO Her and (b) RR Lep.

Source : The oEA stars QY Aql, BW Del, TZ Dra, BO Her and RR Lep : Photometric analysis, frequency search and evolutionary status
A. Liakos • P. Niarchos

Change of the orbital plane of the second component

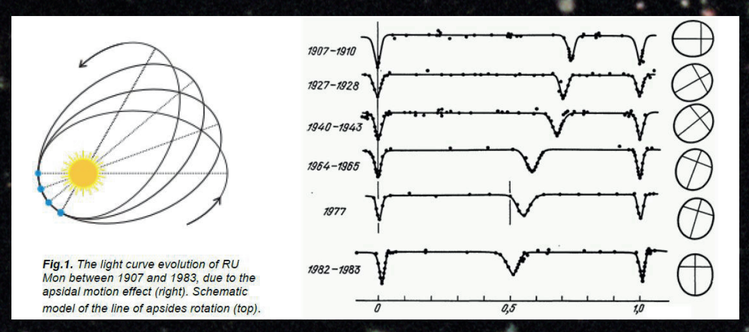


Fig.1. *The light curve evolution of RU Mon between 1907 and 1983, due to the apsidal motion effect (right). Schematic model of the line of apsides rotation (top).*

The secondary star changes its orbital plan, this type of phenomenon necessitates observations over many years in order to be seen
Eclipsing binary systems with eccentric orbits - Ivan Adamin - pages 10-12 -Variable Stars Observer Bulletin - December 2013 -ISSN 2309-5539

Lost eclipsing binaries

60 non recorded stars since 2016 must be found and re-studied

For these stars we have lost length of time, the amplitudes of the minima or the duration of the eclipses.

The list can be obtained from the head of the commission eclipsing binaries (AAVSO) from the organisation on request

Conclusion

The 6 points have not been developed in their entirety since amateur astronomers are too few to collaborate with professionals on these subjects.

It is hope that there would be better collaboration on their part.

References

- AAVSO American Association of Variable Star Observers : http://www.aavso.org
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- Bob Argyle - Observing and Measuring Visual Double Stars - (see my chapter 20) - Ed springer-
- O'Connell Stars list : https://www.aavso.org/sites/default/files/O'Connell_Effect_Target_List.csv
- Negligected Stars : https://www.aavso.org/sites/default/files/images/Otero%2Bv02.xls

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