[Skip to end of metadata](https://www.wiki.ed.ac.uk/display/SP/Deriving+physical+properties+of+eclipsing+binaries+from+photometric+data#page-metadata-end)

* Created by [Keith Brunton](https://www.wiki.ed.ac.uk/display/~kbrunton), last modified by [Nicholas Cross](https://www.wiki.ed.ac.uk/display/~ncross1) on [Aug 27, 2020](https://www.wiki.ed.ac.uk/pages/diffpagesbyversion.action?pageId=284394787&selectedPageVersions=5&selectedPageVersions=6)

[Go to start of metadata](https://www.wiki.ed.ac.uk/display/SP/Deriving+physical+properties+of+eclipsing+binaries+from+photometric+data#page-metadata-start)

Project Information

| **Area of Study** | **Project Type** | **Supervisor(s)** | **Supervisor Pre-Meeting Required?** | **S1** | **S2** | **Total** |
| --- | --- | --- | --- | --- | --- | --- |
| Astrophysics | Data Analysis | [Nick Cross](http://www.roe.ac.uk/ifa/people/njc.html) | No | 1 | 1 | 2 |

Project Description

Binary star systems are the main direct method of linking the mass to other properties of stellar systems, and therefore play a fundamental role in astrophysics since stellar evolution has such a strong dependency on mass. Eclipsing binary systems have been particularly important since they are often easy to spot, give tight constraints on the inclination and the combination of photometric and spectroscopic data at various phases can determine the masses of both components, and the distances and orbital elements. Radii can also be determined and strong constraints can often be put on the ages, since the absolute luminosities of both components that are presumably the same age are known.

There are many wide field photometric surveys that produce high-quality multi-epoch catalogues allowing the selection of eclipsing binary stars, and the folded light-curve, giving the photometry at each phase for hundreds of thousands of stars at the same time. However, there is not the equivalent multi-epoch spectroscopic data for this number of eclipsing binaries so determining the properties for them cannot be done so precisely on large numbers. This project will instead use multi-epoch data and various assumption at various different wavelengths to derive the properties of eclipsing binary systems. The student will use a small dataset of a 100 or so eclipsing binaries (in a few hundred variable stars), but should automate the processes so that it could in principle be run on far bigger datasets of many tens or hundreds of thousands of eclipsing binaries.

This project will make extensive use of data in the WFCAM Science Archive, and the student will learn how to query this, using SQL and table access protocol (TAP) which can be applied to most large astronomical catalogues

Prerequisite Knowledge and Skills

* Ability to program
* Stellar evolution

References

WFCAM Variable Star Catalogue: Ferreira Lopes, C. et al. 2015, A&A, 573, 100 <https://ui.adsabs.harvard.edu/abs/2015A%26A...573A.100F/abstract>

WFCAM Science Archive: Hambly, N. et al. 2008, MNRAS, 384, 637 <https://ui.adsabs.harvard.edu/abs/2008MNRAS.384..637H/abstract>

Archiving multi-epoch data in WSA: Cross, N. et al. 2009, MNRAS, 399, 1730 <https://ui.adsabs.harvard.edu/abs/2009MNRAS.399.1730C/abstract>

Eclipsing binary searches and uses

<https://ui.adsabs.harvard.edu/abs/2014ApJ...780...59G/abstract>

<https://ui.adsabs.harvard.edu/abs/2011ApJ...728...48K/abstract>

<https://ui.adsabs.harvard.edu/abs/2010Natur.468..542P/abstract>

<https://ui.adsabs.harvard.edu/abs/2011MNRAS.418.1156M/abstract>

<https://ui.adsabs.harvard.edu/abs/2012MNRAS.426.1507B/abstract>

<https://ui.adsabs.harvard.edu/abs/2010ApJ...718.1353I/abstract>

<https://ui.adsabs.harvard.edu/abs/2011ApJ...728L..43C/abstract>

<https://ui.adsabs.harvard.edu/abs/2016AcA....66..421P/abstract>

<https://ui.adsabs.harvard.edu/abs/2013ApJ...773..145W/abstract>

<https://ui.adsabs.harvard.edu/abs/2012MNRAS.425.1245H/abstract>

<https://ui.adsabs.harvard.edu/abs/2013A%26A...553A..18S/abstract>

Eclipsing binary modelling

PHOEBE:   
<https://ui.adsabs.harvard.edu/abs/2005ApJ...628..426P/abstract>

<https://ui.adsabs.harvard.edu/abs/2016ApJS..227...29P/abstract>

<https://ui.adsabs.harvard.edu/abs/2018ApJS..237...26H/abstract>

<https://ui.adsabs.harvard.edu/abs/2020ApJS..247...63J/abstract>

Wilson Devinney (Contact binaries):  
<https://ui.adsabs.harvard.edu/abs/1971ApJ...166..605W/abstract>