Exoplanet projects

Updated 2019 August 7

1.0 Introduction

If you have other projects on the go or would like to suggest a project which the Division might pursue please let me know.

Included are projects which might be suitable for;
- those new to exoplanet imaging
- more experienced observers
- those wishing to collaborate with professional astronomers

In addition, I include a Citizen Science project and one utilising a remotely operated, robotic telescope. The options are summarised below and further details can be found in the project details listed on the Projects page.

2.0 For newcomers

2.1 Imaging stars with a known exoplanet

In Chapter 3 of his book 'Exoplanet Observing for Amateurs', Bruce Gary describes a project which might be of interest - Bright Transiting Exoplanets (BTEs)– which he defines as host stars brighter than mag 14. Using the Exoplanet Transit Database Transit predictions website you can obtain data, including magnitude and magnitude drop, for future transits for your location. Selecting any particular object from the list on the left of the page leads to a list of previous observations against which you can compare your results.

3.0 For the more experienced

3.1 Exoplanet imaging and discovery project

Known exoplanets may well have additional companions so observing the BTEs mentioned above at times other than those for known transits may yield a discovery. To maximise the chances of such a discovery the impact parameter, closeness of the known transit to the centre of the star, needs to be much less than 1.0 which indicates a grazing transit. This value can be obtained from the Extrasolar Planets Encyclopaedia website by selecting All Catalogues and then the star/planet of interest.

3.2 Stars in multiple star systems

The Catalogue of exoplanets in binary star systems lists both binary and multiple star systems (70% of Main Sequence stars in the solar neighbourhood are members of such systems). Exoplanets can be detected by both the transit method and Eclipse Timing Variations (ETVs). An orbiting planet will cause variations in eclipse timing and does not need to be in the line of sight. ETVs are in the order of seconds so this would represent a fairly challenging project.

4.0 Citizen Science

4.1 Planet Hunters TESS

This project uses data from the Transiting Exoplanet Survey Satellite. Over the next two years TESS will be busy surveying two-hundred-thousand bright nearby stars, measuring and recording their brightness every two minutes. This project's findings may even bring us one step closer to answering the question: Are we alone in the Universe?

5.0 Remotely operated robotic telescopes

5.1 MicroObservatory Robotic Telescope Network

A chance for those without access to a suitable telescope to observe and analyse exoplanet transits. Martin Fowler mentioned this facility during his presentation, Adventures with a robotic telescope – from supernovae to exoplanets, at the BAA meeting on 2019 March 17 (the exoplanet part of the presentation begins at approximately 26 minutes). There is also a video of Martin's procedure for analysing exoplanet transits using Muniwin photometry software and an article in the Observers' Forum of the 2019 Jun issue of the Journal of the British Astronomical Association. I must thank Martin for his considerable help with this project.

6.0 Pro-am collaboration

6.1 The Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) mission.

University College London (UCL) is leading this mission – the Principal Investigator being Professor Giovanni Tinetti. The BAA Exoplanet Division is in contact is PhD student Billy Edwards with a view to collaborating on this project.

Ariel has been selected as the ESA M4 (fourth medium class) mission in ESA's Cosmic Vision programme and will launch in 2028 with the aim of studying the atmospheres of 1000 exoplanets. During its 4-year mission, ARIEL will study what exoplanets are made of, how they formed and how they evolve, by surveying a diverse sample of about 1000 extrasolar planets, simultaneously in visible and infrared wavelengths. It is the first mission dedicated to measuring the chemical composition and thermal structures of hundreds of transiting exoplanets, enabling planetary science far beyond the boundaries of the Solar System.

For Ariel to observe a planet, the ephemeris must be well-known to ensure that transits are not missed. An extensive ground-based campaign is planned to regularly follow-up currently-known planets, as well as the new TESS discoveries which will make excellent targets for atmospheric characterisation, over the next decade.

The plan is to create a network of individuals and institutions, who have access to different sized telescopes, dedicated to observing exoplanet transits. An open-access website will show all the targets Ariel could observe and the current ephemeris uncertainty. The idea is to rank the planets as well as indicating when to observe the transit and the size of telescope required to achieve good quality data (typically 0.35m to 0.6m). This should ensure efficient use of telescope time and maximise the science gain. Data can then be uploaded to the website in a similar way to the ETD. This should allow for efficient follow-up hundreds of planets over the coming years.

This would appear to be an excellent project as it;
- selects targets and when to observe them
- indicates the size of telescope required
- provides a data repository