

# Methods of Exoplanet Detection for Amateurs: A Work in Progress

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## BACKGROUND

The search for extrasolar planets is becoming one of the most exciting fields in astronomy. Technological advancement has improved the precision of detection methods, allowing for new exploration of the cosmos. Exoplanet detection is one of the only opportunities for amateurs and enthusiasts to participate in scientific research and collaborate with professionals. Interest in discovering Earth-like planets that would sustain life has opened up the possibility of more frequent and successful collaboration and contributions from those outside the profession.

## PURPOSE AND HYPOTHESIS

### Purpose

To increase the accuracy of contributions from amateurs and enthusiasts, an examination of the methods used should take place. Many aspects of exoplanet detection can be reasonably accomplished by the amateur. An increase in individuals familiar with the basics of detection methods who become involved could possibly lead to new developments in our understanding of extrasolar planets.

### Hypothesis

Keeping in mind the unique needs and capabilities of amateurs, I will examine the benefits to exoplanet discovery that could be gained by using additional methods of discovery. Incorporating more obscure methods of detection could increase the precision and accuracy of amateur observations, leading to significant contributions and the possibility of further advancement.



## LITERATURE REVIEW AND METHODOLOGY

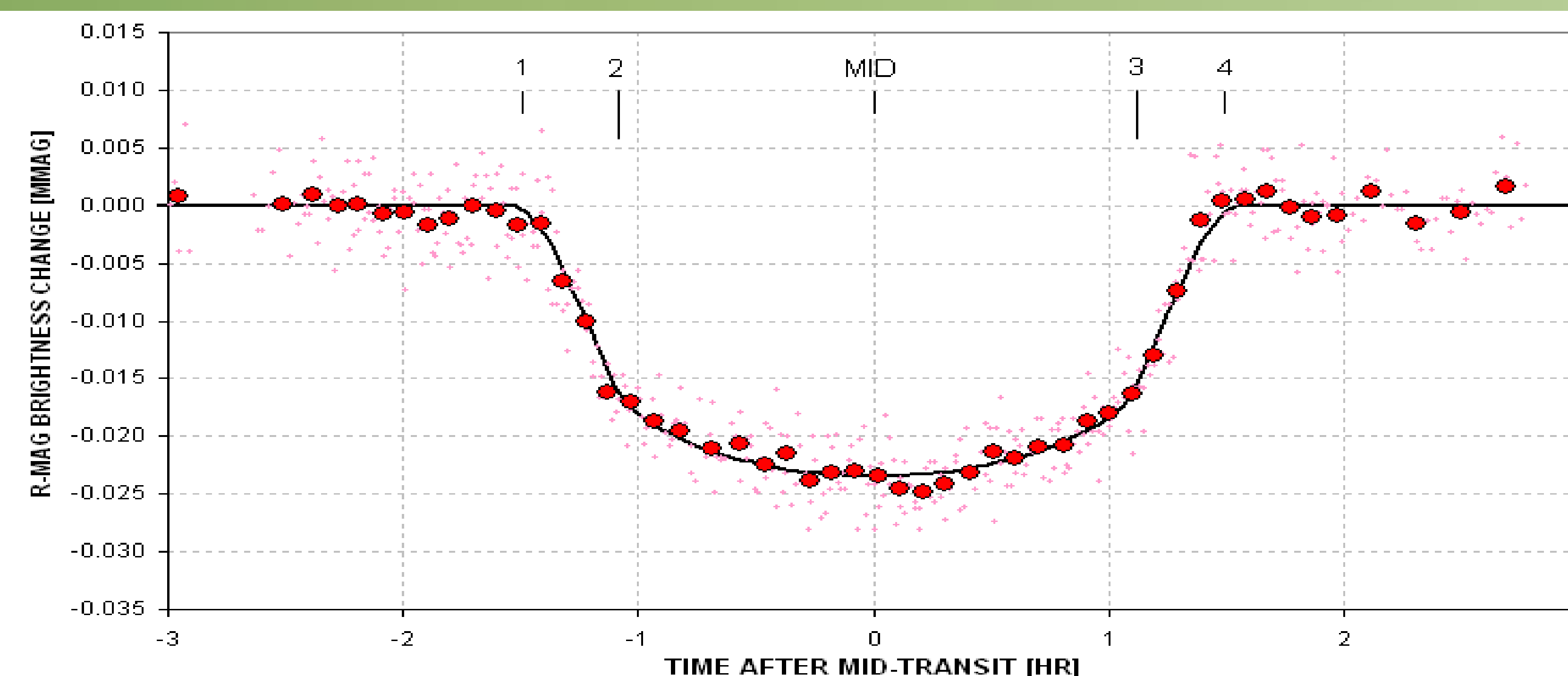
### Literature Review

Methods of exoplanet detection are mostly indirect. In order to make a verification of an exoplanet, one must rely on evidence that points towards the planet's presence. There have been several reviews and considerable research concerning methods of detection and necessary instrumentation. Among the methods for discussion are photometry, astrometry, Doppler spectroscopy, and gravitational micro-lensing. There are advantages and disadvantages to each method, particularly for the amateur astronomer. Photometry or the transit method is the most commonly used method of amateurs. This method involves using observations of an object's transit in front of a star. As the object transits, part of the star's magnitude decreases possibly confirming the presence of an exoplanet. Astrometry is the oldest method of detection. Its precision can be useful, but it requires very long periods of observation. To date, there have not been any discoveries using this method. It has been successful only when applied to confirmed exoplanets.

- According to Alessandro Sozzetti's review of astrometry and its instrumentation, the precision of astrometric measurements could make significant contributions in both ground and space based observations.
- Bruce L. Gary's book for amateurs discusses some of the pitfalls one might experience with Photometry. There is a correlation between equipment and effort. For example, the more "professional" the equipment is, the easier it is to produce good light curves.
- Astrometry has the possibilities of contributing to the understanding and discovery of "Biomarkers" indicating the presence of life outside our solar system.
- Amateurs using photometry have several ways of overcoming disadvantages associated with less expensive instruments. For instance, poor or moderate apertures and less than ideal locations can be overcome with certain image processing techniques.

### Methodology

The process that I will use to conduct my research will be mostly data review and comparisons of available transit, Doppler spectroscopy, and microlensing surveys. This will assist me in identifying the pros and cons of each method and the success rate of each. For the portion concerning ease of execution and practicality I will review all major products available to amateur astronomers. I would also like to conduct field research with amateur astronomers to assess which methods are best for them and typically fit their needs and capabilities. There will also have to be a survey of some sort to review the general level of experience with certain instrumentation and software, as well as astrophysical coursework or study.



## ABSTRACT

I will present the pros and cons of the transit method widely used by amateurs to detect exoplanets, as well as consider what benefits there are to the more obscure methods typically employed by professionals. As the race for discovering terrestrial planets like Earth continues, the contributions made by amateurs will surely increase. By examining several aspects of exoplanet detection and the methods used, I will make comparisons based on several factors particularly ease of execution. I will explore how much knowledge is required of technical issues, as well as problems that would especially affect amateurs like practicality and affordability. While the transit method is probably the best place to start with exoplanet hunting, as technology advances so too does the availability of new ways for amateurs to explore the cosmos. The benefit of less traditional means of detection can include increased accuracy and more in-depth information pertaining to the properties and characteristics of extrasolar planets.

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