Analysis of the Exoplanet Host Star Candidacy of TOI 5938.01

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Summary:

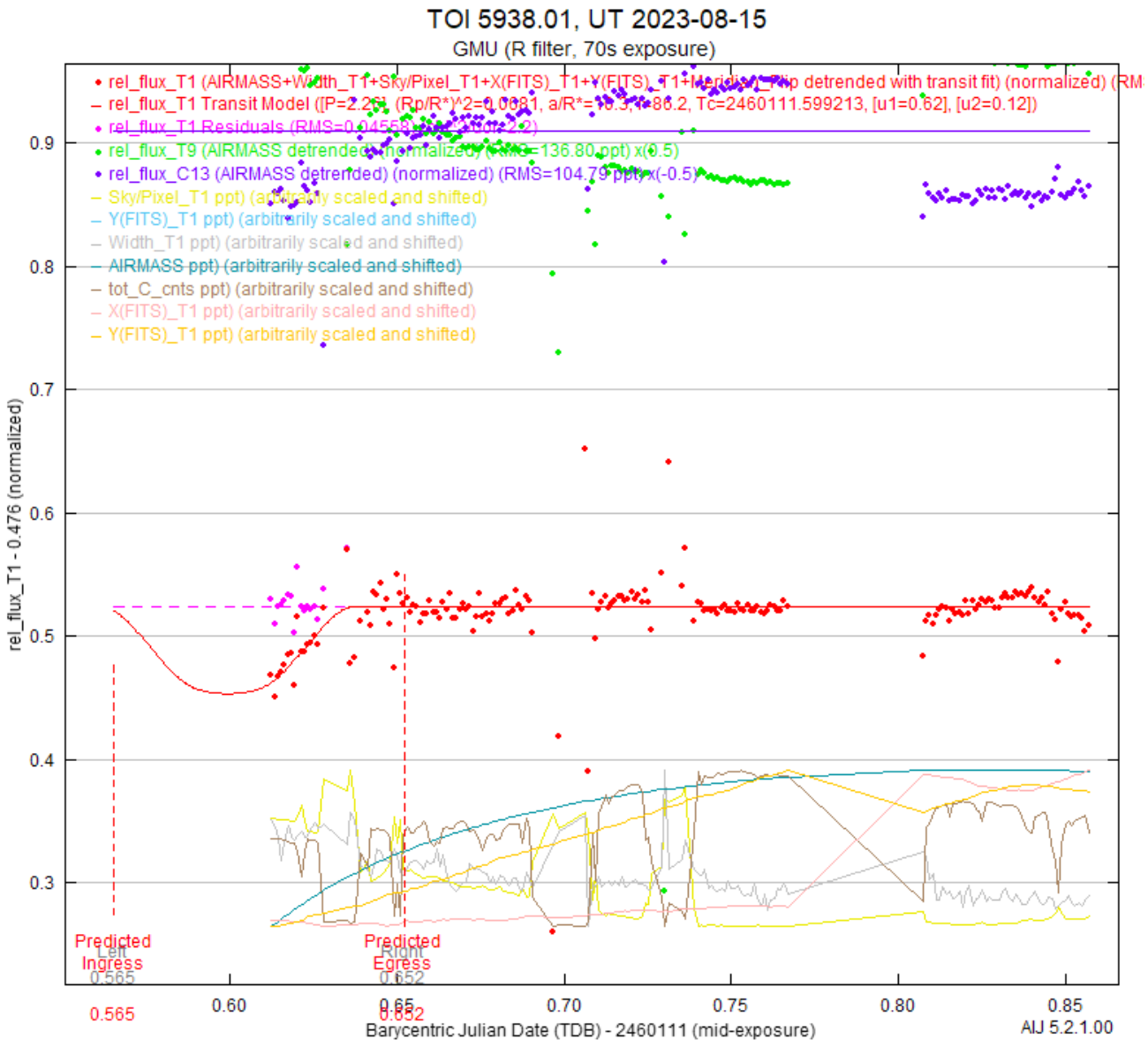
This study aimed to confirm if there is an exoplanet for TOI 5938.01. This goal was accomplished by using AstroImageJ to run multi-aperture photometry to generate a light curve for the TOI and then analyzing the light curve for the results. Through the light curve generated, I was able to confirm that TOI 5938.01 has a planet. This result is important for future missions, as the list of known exoplanets will have expanded with my analysis.

Introduction:

The search for planets outside of our solar system is something that humans have been attempting for a long time. This study of exoplanets allows us to know more about the universe. A method of finding these exoplanets is creating a light curve, which displays the transit of a star. If that star has a planet, then the light curve will show a dip, as the planet is blocking some of the starlight that would be measured. This combined with good timing can generate a light curve in which there is a dip in brightness. The rapid advancement of technology has allowed for more confirmation of exoplanets using the transit method, and one of the more recent missions that have helped this would be the TESS mission. TESS (Transiting Exoplanet Survey Satellite) is a NASA mission designed to find exoplanets that orbit M dwarf stars, as they have the potential to have earth-like stars orbiting them. A TOI (TESS Object of Interest) is an M dwarf star that could have exoplanets.

Method:

I used AstroImageJ (AIJ) to perform my multi-aperture photometry and generate a light curve. I first obtained the data for TOI 5938.01 from Dr. Plavchan and then imported it into AIJ. After importing the fits files, I was able to look through them and remove files that had imperfections that were caused by external factors such as planes or satellites. After finishing that I started the plate-solving process by taking data from exofop.ipac.caltech.edu which I then plugged into AIJ as certain parameters for the plate-solver. I then created master dark and master flat files, that are used by AIJ to plate-solve the images better. After doing this the plate-solver was essentially ready and I started the process. After getting the results of the plate-solving process I then took the resulting images and ran multi-aperture photometry on them. I did multi-aperture photometry by using AIJ to select my target star, in this case TOI 5938.01, and AIJ computed all the similar sized stars that it could use as a reference stars. After running the multi-aperture photometry, I then took the data table that it outputted and created a light curve with AIJ tools and with the help of a manual that Dr. Plavchan kindly provided. The light curve that I was able to generate is the following:



Analysis:

To analyze the candidacy of TOI 5938.01 as an exoplanet host star, I created a light curve, aforementioned and shown above. This light curve shows that there is a noticeable dip in the measured starlight from TOI 5938.01.

Discussion:

Using AstroImageJ to perform multi-aperture photometry, we can see that there is some celestial object orbiting TOI 5938.01, and due to the duration of the dip, we can reasonably assume that the celestial object is a planet. However, there is potential that the noticeable dip is due to another large celestial object such as an asteroid or a comet which happens to be orbiting TOI 5938.01. I cannot confirm which of the two possibilities as of now it is but with more time and more resources, I would be able to analyze the data more and be able to deduce the candidacy of TOI 5938.01 as an exoplanet host star.

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