

# Investigating the Existence of a Potential Exoplanet in the Star System V808 Aurigae

## Isaac Dubash, Marian High School, Mishawaka, IN, USA

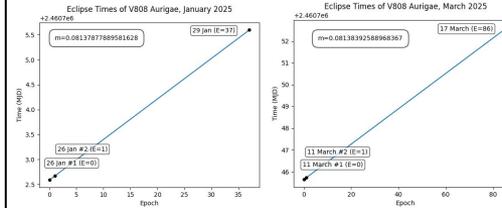
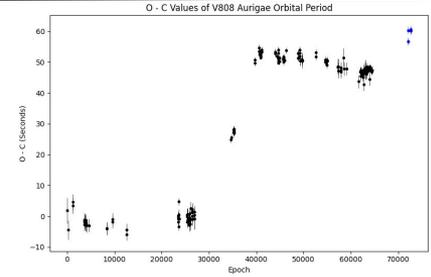
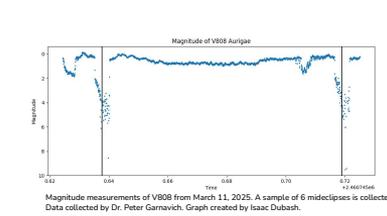
**Introduction:** In 2024, research conducted by the University of Notre Dame suggested that an exoplanet, previously undiscovered, was orbiting around a star system called V808 Aurigae. This system is an eclipsing binary, which means it contains two stars. These stars orbit a common center, and, as the name suggests, periodically eclipse one another. Because of this, measurements of the system's brightness (called magnitude) show regular decreases in light output, which allow us to measure orbital periods. After years of taking these photometric measurements, it was found that the period of the star was changing. Equations suggested that a planet with an eccentric orbit was causing these changes. Research like this is done because it advances our knowledge of planet formation and the search for extraterrestrial life. By studying systems like V808 Aurigae, we can learn more about our own solar system and the conditions that affect it.

**Research Question:** Is there a planet orbiting the star system V808 Aurigae?

**Hypothesis:** If there is a planet affecting V808 Aurigae, then photometric measurements should follow results shown in Fig. 5 in Leichy et al. (2024), because the planet's gravity would pull on the stars, changing the time it takes for them to orbit.

### Methodology

- ★ Photometric measurements of V808 Aurigae were collected with 3-8 second exposures over a time of up to 3 hours. 6 eclipses of the system were documented with time in units of JD (Julian Date).
- ★ Exact times of eclipse (called mideclipse) were calculated as the mean of the two times the system's magnitude was half of its normal level.
- ★ Mideclipse times were converted from JD to BJD (Barycentric Julian Date).
- ★ Using the system's ephemeris (Equation 1 of Schwöpe et al. 2015), epoch values were calculated for each eclipse time ( $E = 0$  in January 2009). Values were rounded to the nearest integer.
- ★ Epoch integers were reinserted into the ephemeris found in Schwöpe et al. 2015 to return a new BJD value (called "C")
- ★ C values were subtracted from their respective observed mideclipse times to find O - C values.
- ★ O - C values were converted to seconds and compared to the O - C value plot found in Figure 4 of Leichy et al. 2024.



Epoch times of V808 in 2025, used to calculate the system's orbital period (m). Data collected by Dr. Peter Garnavich. Graph created by Isaac Dubash.

**Discussion:** Magnitude measurements of V808 from March 11, 2025. A sample of 6 mMy hypothesis states that if a planet is orbiting V808 Aurigae, then photometric measurements should follow the results in Fig. 4 of Leichy et al. 2024. This is because the planet's gravity would affect the stars' motion as it moves closer to them, changing the time it takes for them to orbit. Based on my graph "O - C Values of V808 Aurigae Orbital Period", I would argue that my results support my hypothesis. Data in the graph shows that O - C values collected after about 35,000 epochs are consistently between 40 and 60 seconds. Although a definitive claim is not possible based solely on my data, it is reasonable to conclude that the V808 Aurigae star system contains a planet. Projects like this which study exoplanets are worthwhile because they provide significant information about the life cycles of solar systems, the potential for extraterrestrial life, and the mechanics of celestial bodies.

**Conclusion:** My study went smoothly overall. I was given a diverse sample of photometric data from the last year to analyze and compare to prior collections. Information gathered from this project could be used primarily to continue searching for the cause for the fluctuations in V808 Aurigae's movement. However, generally this research is applicable for learning about solar systems' life cycles, the workings of physics in outer space, and the continuation of astronomy's search for extraterrestrial life. If I had the chance to repeat this procedure, I would have spent more time planning the collection of photometric data so that I could use more recent data. Additionally, I would compare O - C data to the polynomial of best fit found in Fig. 4 of Leichy, et al. 2024 and calculate error using uncertainty metrics from the telescope. These changes would give me more accurate results and more clarity in my analysis.