

Temperature Effect on Mercury's H-filter brightness

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Brief Abstract

The poster summarizes near infrared brightness measurements made of the planet Mercury between 2014 and 2020. The selected photometric constants are summarized in Tables 1 and 2. Some important findings include:

- The Mercury-Sun distance affects the H magnitude by up to 0.14 mag.
- Best fit equations describing Mercury's $H(1, \alpha)$ and $J(1, \alpha)$ values as a function of the phase angle are presented.

Method and Materials

- SSP-4 Photometer [1]
- J & H filters (sensitivity)
 - J (1.15-1.35 μm)
 - H 1.5-1.8 μm)
- 0.09 m Maksutov
- CG 4 mount
- Color & extinction cor. [2]
- Previous results [3]



Analysis

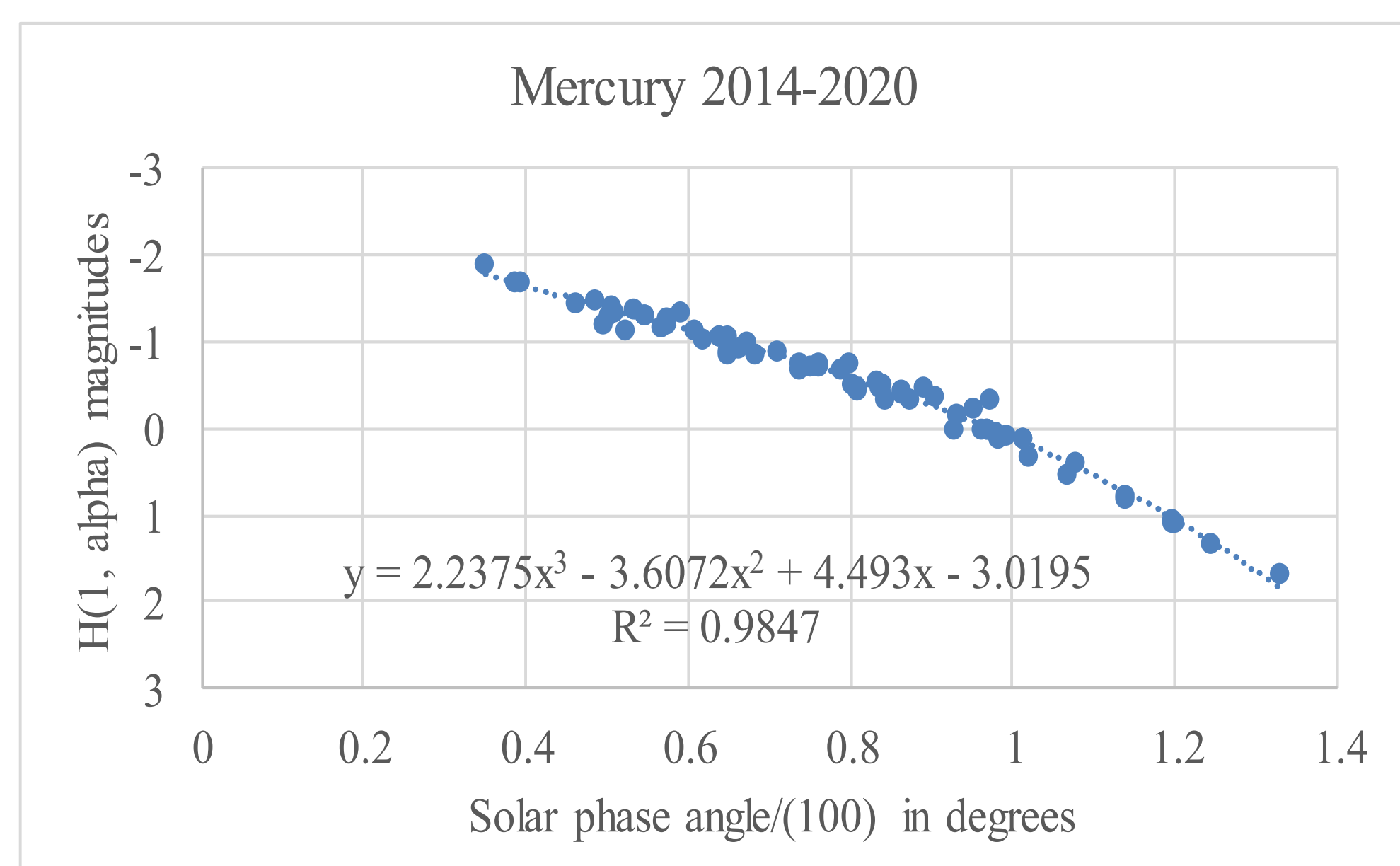
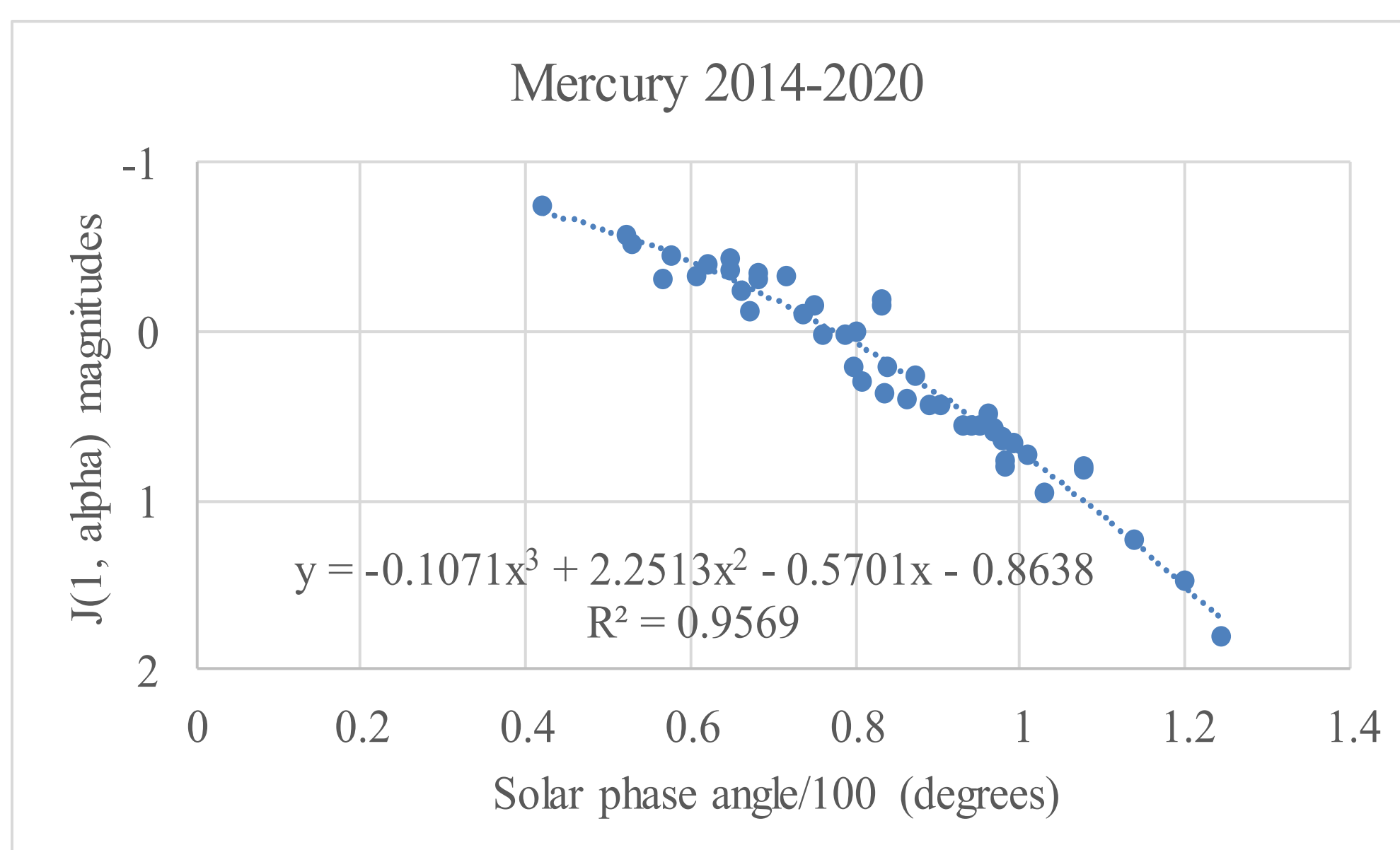
Normalized magnitude

- $J(1, \alpha) = J - 5\text{Log}[\Delta \times r]$
- J = measured J filter magnitude
- Δ = Planet-Earth distance in au
- r = planet-Sun distance in au
- α = solar phase angle

$$-H(1, \alpha) = H - 5\text{Log}[\Delta \times r]$$

Curve fitting

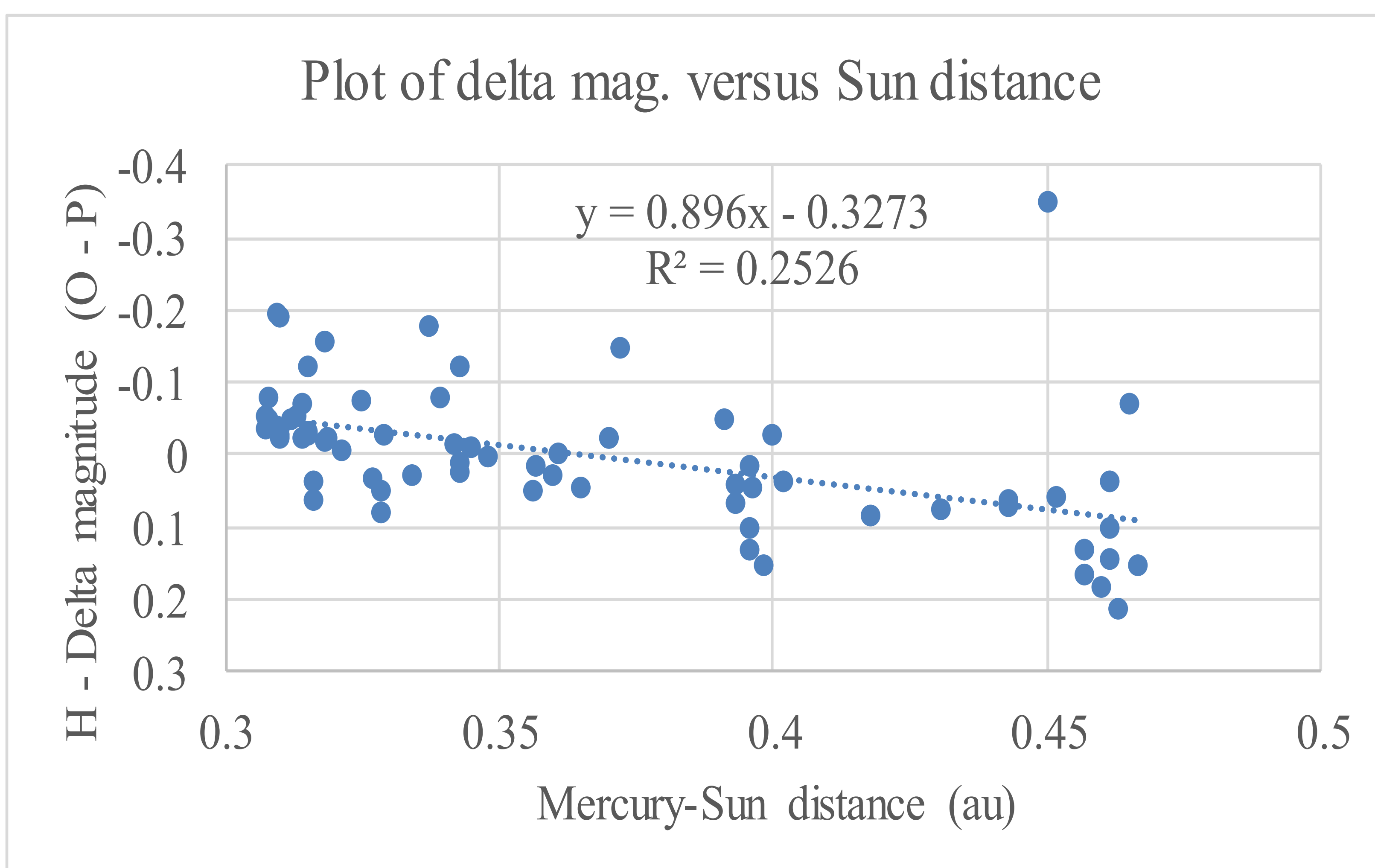
- Plot $J(1, \alpha)$ versus α and compute best-fit cubic equation
- Repeat for $H(1, \alpha)$ versus α
- These equations yield the predicted values



Method

To determine if the Mercury-Earth distance affects the H-filter brightness I did the following:

- Compute Delta H magnitude: difference between the measured and predicted value
- ↓
- Predicted magnitude is from best-fit equation
- ↓
- Plot the Delta H magnitude versus Mercury-Sun distance and look for a trend
- ↓
- Test trend for statistical significance



Conclusions

- There is a statistically significant correlation between Mercury's reduced H filter magnitude and the Mercury-Sun distance
- Mercury's reduced H-filter magnitude is 0.14 magnitudes when that planet is at perihelion than at aphelion
- There is no statistical correlation between the reduced J-filter magnitude and the Mercury-Sun distance.

Acknowledgements

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References

- [1] Optec Inc. Model SSP-4 Solid-State Infrared Photometer Technical Manual for Theory of Operation and Operating Procedures, Lowell MI (2005).
- [2] Hall D. S. and Genet R. M. (1988) Photoelectric Photometry of Variable Stars, Second, Revised edition, Willmann-Bell, Richmond, VA.
- [3] Schmude R. W. Jr. (2016) *Georgia Journal of Science*, 74, No. 2, Article 17.