

Photometric Analysis of Transiting Exoplanets

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Introduction

Variable stars are stars that change in brightness (magnitude). Some pulsate, shrink, and grow in shape, while others may have an eclipsing star or exoplanet affect their brightness. Our research focused on a particular star, CoRoT-2, and the exoplanet, CoRoT-2b, that transited across the star. We took photographs of the star when the planet was and was not in transit. We then analyzed the images using photometry to figure out the magnitude of the star when there was not an exoplanet transit and then the magnitude when there was a transit.

Methods

In order to photometrically analyze the stars and planets, a program named VPhot was used to view a wide plane of thousands of celestial objects. We then had to find which telescope would be best to view the planet at varying times. After getting the latitude in decimal degrees north, and longitude in decimal hours west, research encompassed making a reservation of a telescope to take the digital pictures, viewing those pictures on VPhot, and recording our findings of the magnitude.

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Results

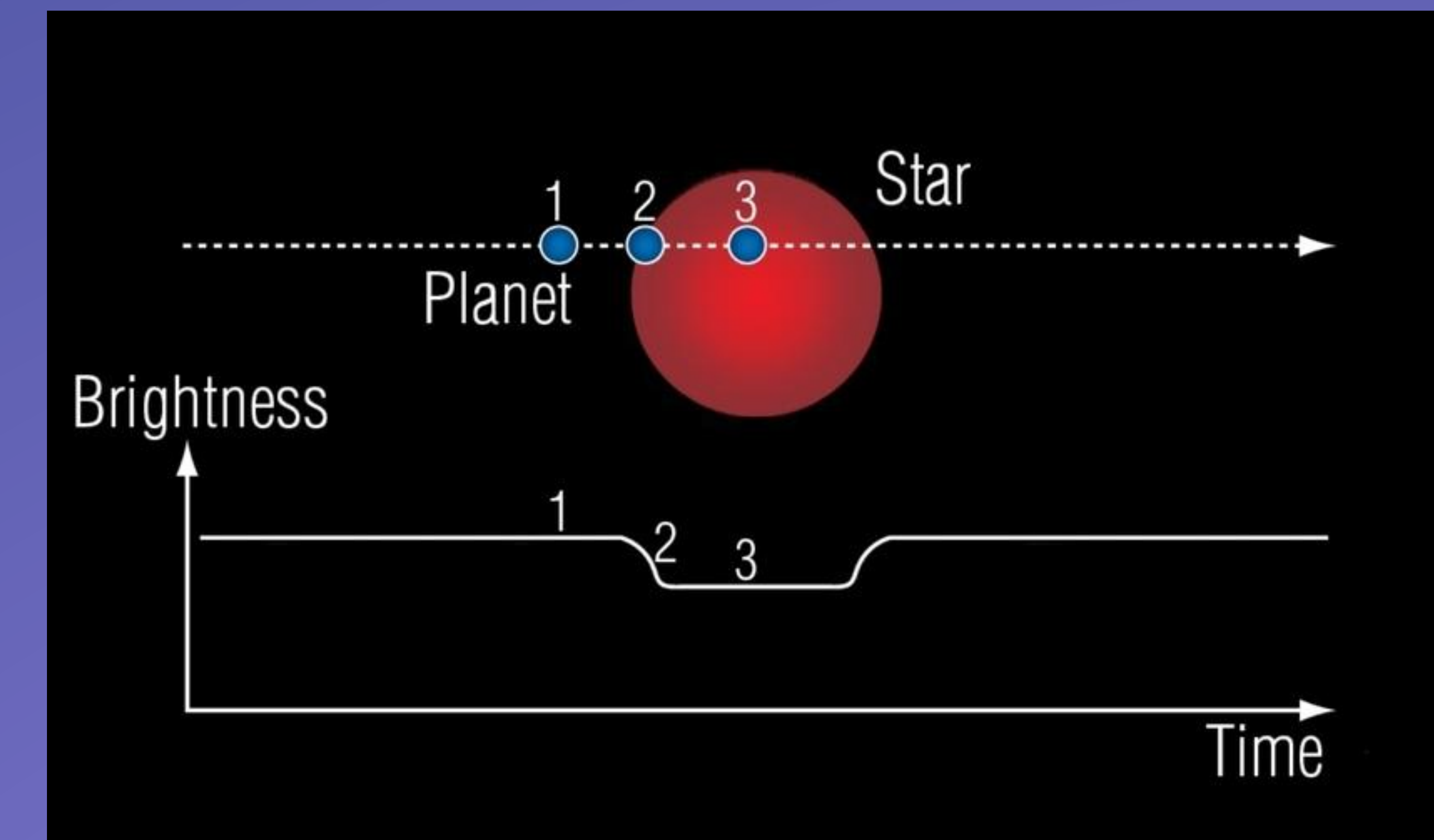
Average magnitude for CoRoT-2b during transit was 12.475, with a standard deviation of 0.01153, and average magnitude for CoRoT-2b out of transit was 12.427 with a standard deviation of 0.01549. Signal to noise ratio error (SNR) was used to tell the quality of the photo, the lower SNR error, the better. Any image with an SNR error less than 0.005 shows the interference during the shutter exposure went nearly undisturbed. As each image was taken, the decline in SNR error directly correlates with a very high quality, accurate magnitude of the exoplanet.

Conclusion

There was a significant increase in magnitude from 12.427 to 12.475, meaning that the brightness of the star decreased a considerable amount. This suggests that CoRoT-2b is a very large planet, most likely a gas giant. The majority of exoplanet transits only result in a change in magnitude of a few thousandths to ten thousandths.

References

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(Above) Diagram showing brightness of star during different points of transit (planetary.org)

Normal Magnitude of CoRoT-2

IMAGE #	MAGNITUDE	% ERROR
1	12.440	.003
2	12.415	.003
3	12.400	.003
4	12.435	.003
5	12.424	.003
6	12.445	.004
7	12.445	.003
AVERAGE MAGNITUDE	12.427	

Magnitude of CoRoT-2 During transit

IMAGE #	MAGNITUDE	% ERROR
1	12.468	.007
2	12.474	.003
3	12.484	.003
4	12.480	.004
5	12.458	.003
6	12.467	.005
7	12.492	.003
AVERAGE MAGNITUDE	12.475	