Limb-Darkening of WASP-55

Edgar Escalante, Kezman Saboi, Tiancheng Gong.

Our code is available at:

https://github.com/ASU-CompMethodsPhysics-PHY494/final-2017-wasp_analyzer/tree/master/Work

Background

- Limb-darkening is a phenomenon observed from a star in which it's brightness reduces radially with increasing distance from its center. This implies that the star's limb (edge) tends to appear relatively dark.
- This project primarily focuses on studying limb-darkening of WASP-55 through observations of light curves generated as WASP-55 b transits across it's surface.
- Below is the most vital equation to simulate, study and analyze for the limb-darkening of WASP-55 and the light curves associated.

$$I(r) = I(0)\left[1 - u\left(1 - \sqrt{\frac{a^2 - r^2}{a^2}}\right)\right]$$

Methods

The Python algorithm used in the project is largely based on boolean matrices and masking.

Vital parameters used are:

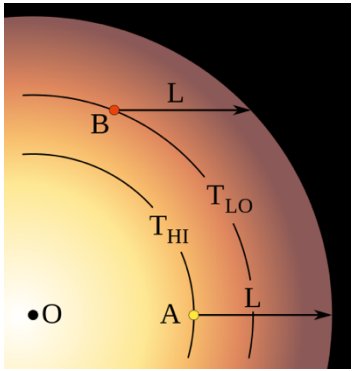
- The radius of WASP-55, and that of WASP-55 b.
- Limb-darkening coefficient of WASP-55
- And surface brightness variation
- Transit path of WASP-55 b over WASP-55

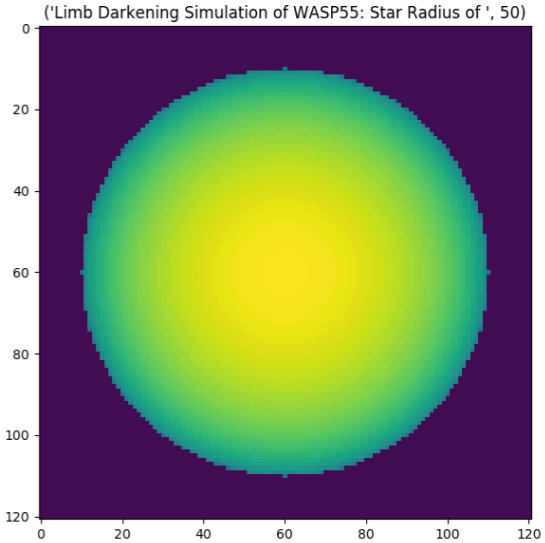
Methods

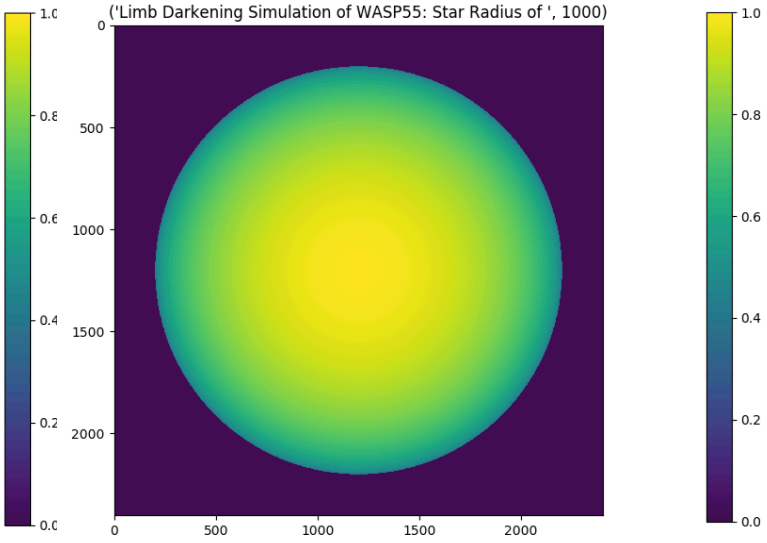
Tasks completed include:

- Building a star to show its brightness using the limb darkening equation.
- Build a planet and mask it over the star.
- Taking the sum of total matrix excluding all values where planet overlays the star.

Results of Star Simulation

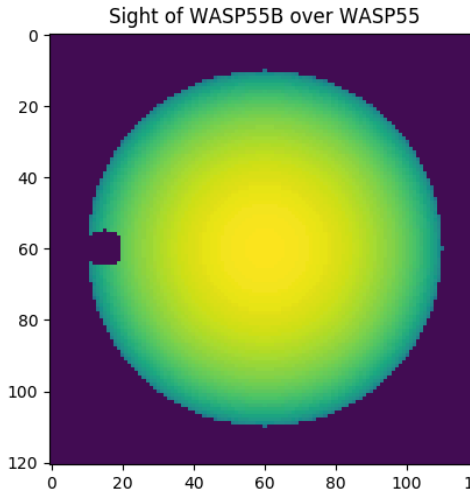


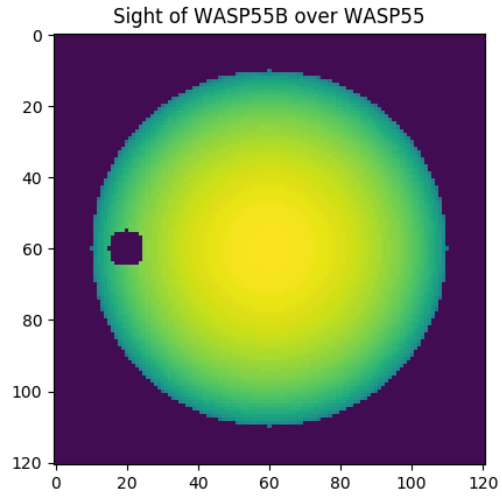


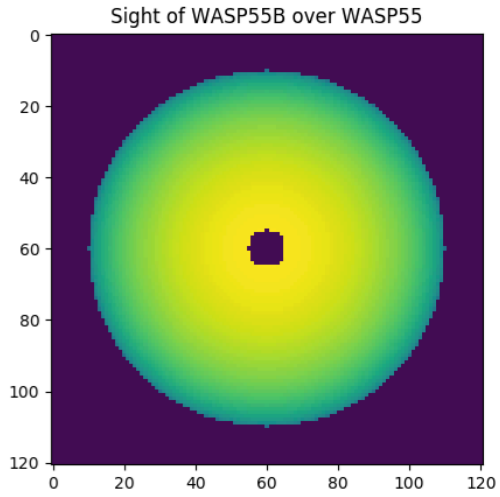


More Results

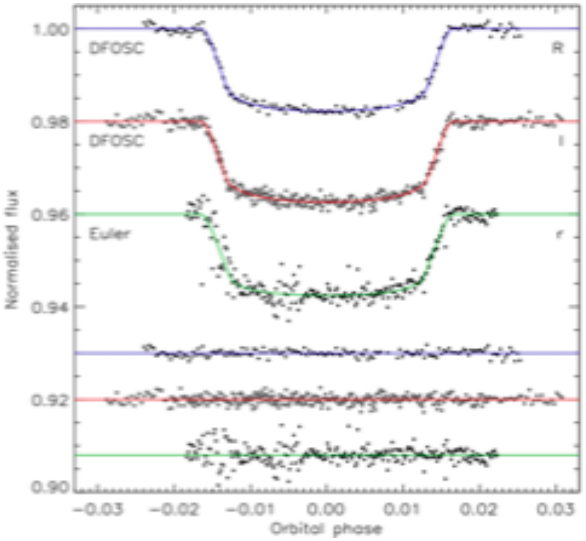
Transition of WASP-55 b across WASP-55 at center.



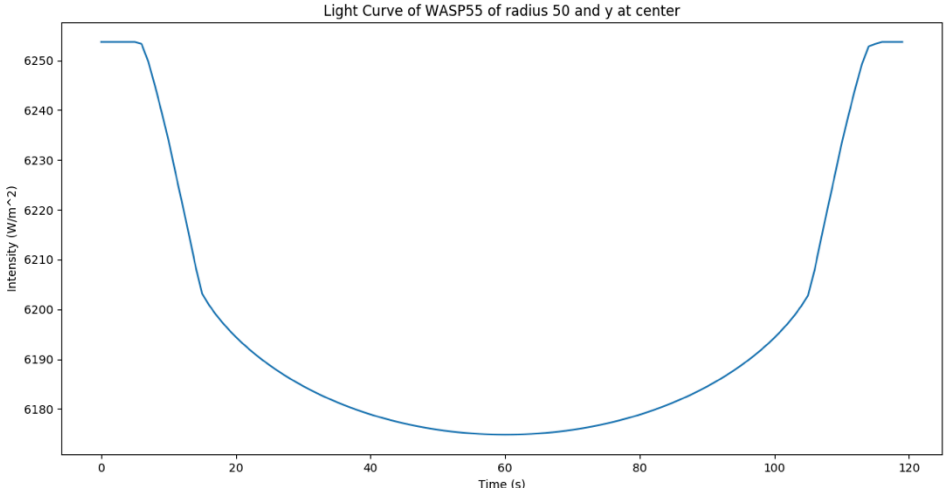


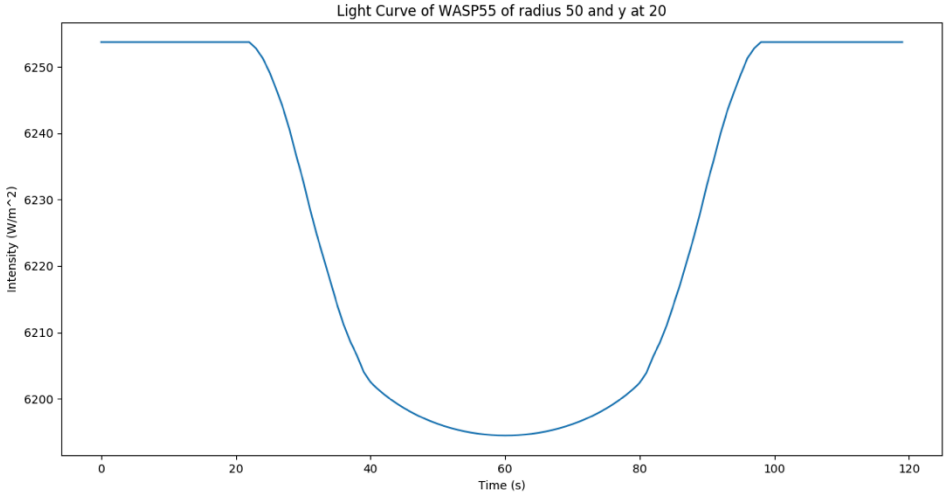


Form of expected Light Curve



Source:
https://academic-oup-com.ezproxy1.lib.asu.edu/mnras/article-lookup/doi/10.1093/mnras/stw279





Summary

Accomplishments from the project:

- Development of algorithm that efficiently calculates the limb-darkening effect and light curves associated
- Light curves simulated are in line with those from previous research done by other research group.
- Algorithm which will position a planet over a matrix and move it.

References

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