INVESTIGATIONS INTO THE ORIGINS OF THE O’CONNELL EFFECT IN ECLIPSING BINARY STAR SYSTEMS

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What is an Eclipsing Binary?

• Two stars orbiting each other

• Inclination of the orbital plane close to our line of sight

• Periodic Eclipses

• Variable Brightness
Symmetry suggests that the flux received from both out-of-eclipse configurations should be equal.
Many systems have unequal maxima, which suggest some asymmetry in the system.

This asymmetry in the out-of-eclipse maxima is called the O’Connell effect.
The O’Connell effect is either positive or negative

$\Delta m = \text{Max II} - \text{Max I}$ (Positive)

Max I brighter than Max II

$\Delta m = \text{Max II} - \text{Max I}$ (Negative)

Max II brighter than Max I

Data taken by N.J. Wilsey at Truman Observatory
Starspots are most commonly invoked to explain the O’Connell effect
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Many starspot models have spots covering 30%-50% of the surface area, which is hard to explain.
Impacts of a gas stream flowing from one component to the other might also explain the O’Connell effect.
We hope to help identify the origins of the O'Connell effect through a multi-pronged approach

Observations of O’Connell effect systems

Looking for trends in population studies
We have acquired multi-filtered light curves for several O’Connell effect binary systems
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V502 Ophiuchi, July 2010, Truman Observatory
There appears to be no correlation between the size of the O’Connell effect and orbital period changes for SW Lacertae.
There appears to be no correlation between the size of the O’Connell effect and orbital period changes for CN Andromedae.
There appears to be no correlation between the size of the O’Connell effect and orbital period changes in V502 Ophiuchi.
Large photometric surveys provide a rich source of data for stellar population studies

• We examined thousands of eclipsing binary light curves from the Second Optical Gravitational Lensing Experiment (OGLE II) in search of the O’Connell effect

Large Magellanic Cloud (LMC)
• 2681 eclipsing binaries
• 101(3.77%) O’Connell effect systems

Small Magellanic Cloud (SMC)
• 1401 eclipsing binaries
• 62(4.42%) O’Connell effect systems

www.ogle.astrouw.edu.pl
We have found higher percentage of the O’Connell systems in the region of red giant stars.
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We have found a possible correlation between the sign of the O’Connell effect and the star temperature

Δm vs. B - V Color Index for LMC
We have found a possible correlation between the sign of the O’Connell effect and the star temperature.
Conclusions

Observation at Truman Observatory

- Multi-filtered light curves of V502 Oph, SW Lac and CN And
- No correlation observed in the size of O’Connell effect and change in the orbital period of the systems

Population study of EBs in OGLE-II

- Higher percentage of the O’Connell effect systems in the region of red giant stars
- At higher temperature, more positive O’Connell effect systems found