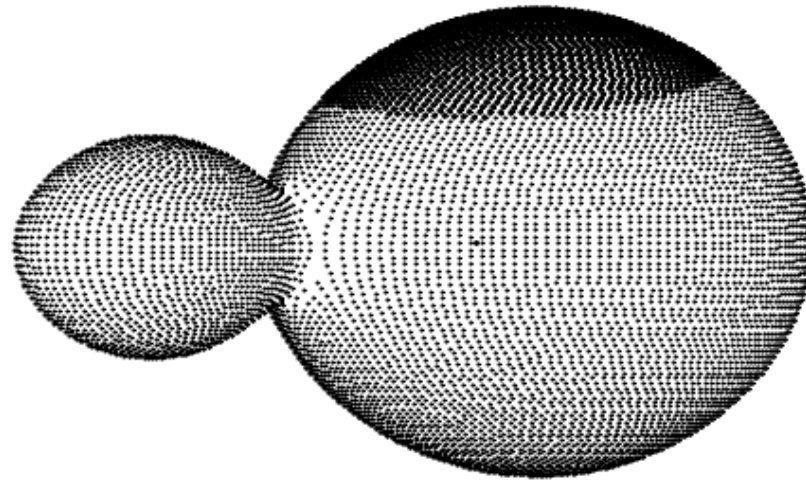


Magnetic activity in contact binaries

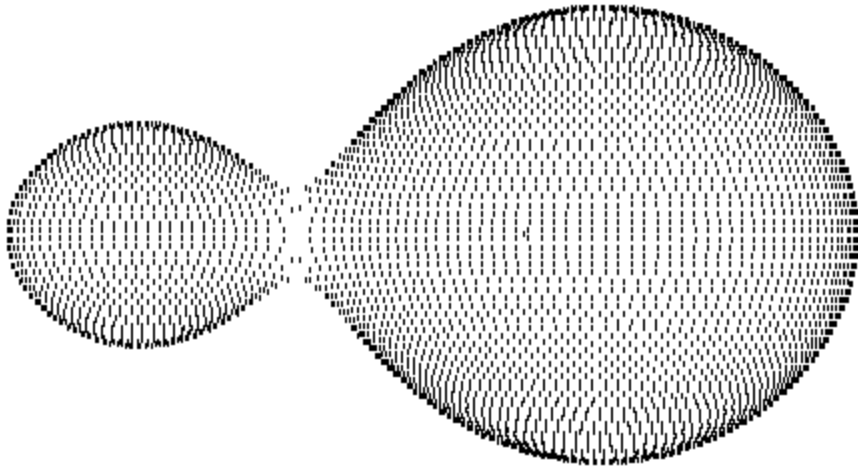


Bartłomiej Dębski

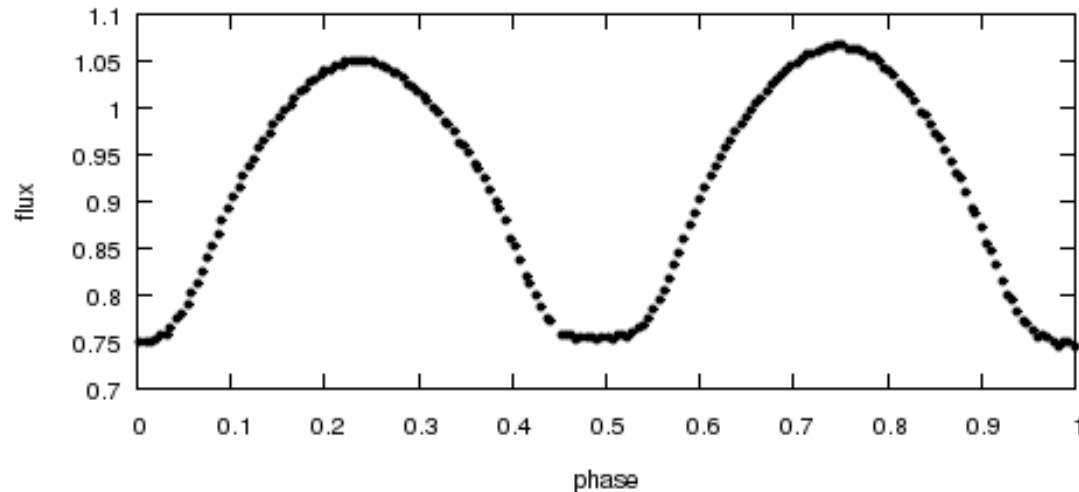
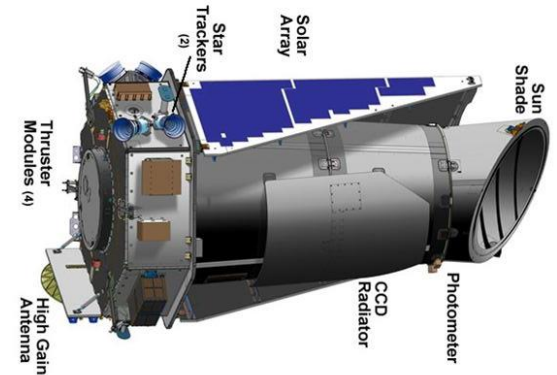
Astronomical Observatory of the Jagiellonian University
Krakow, Poland

Contact binaries: LC & data source

$q = 0.20$ $f = 30.0\%$ $\text{phase} = .75$



Star spots = manifestation of the stellar magnetic field



CATALOG SEARCH PAPERS CHARTER HELP

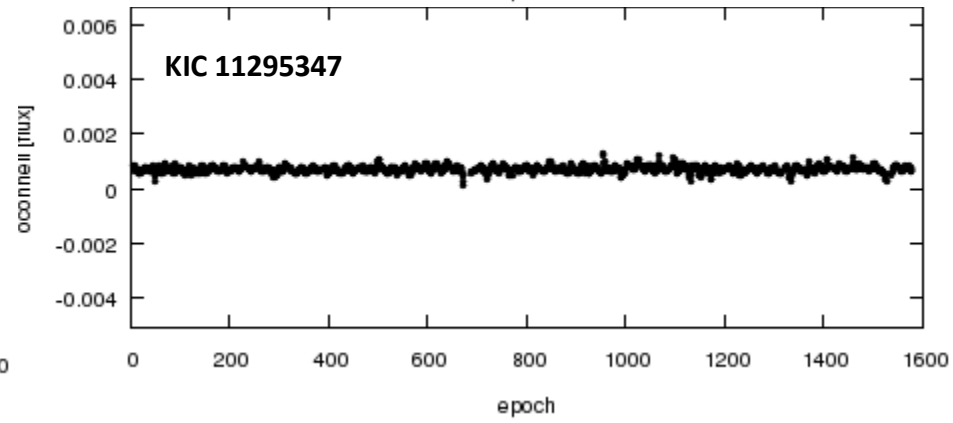
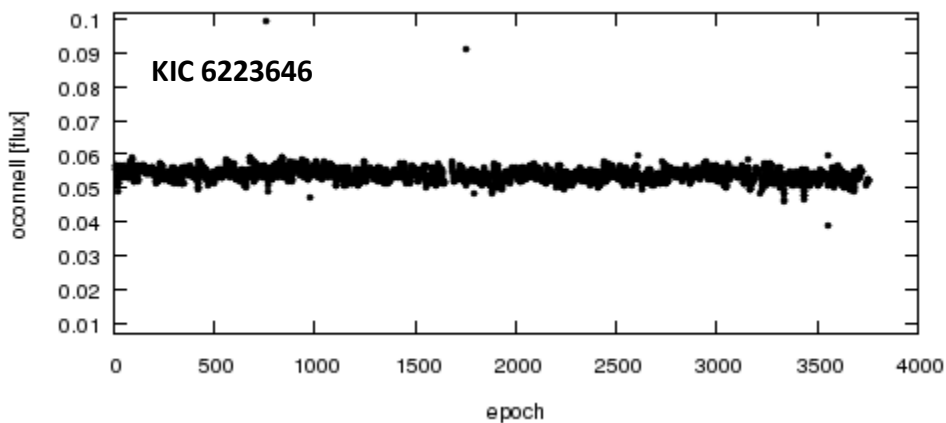
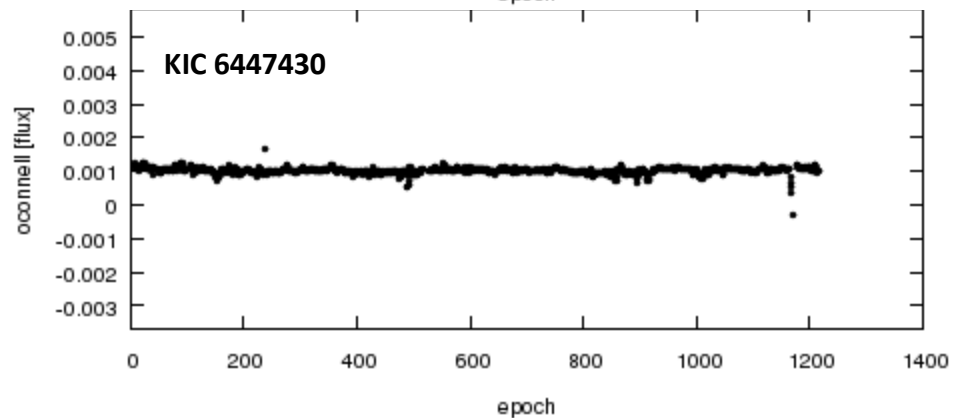
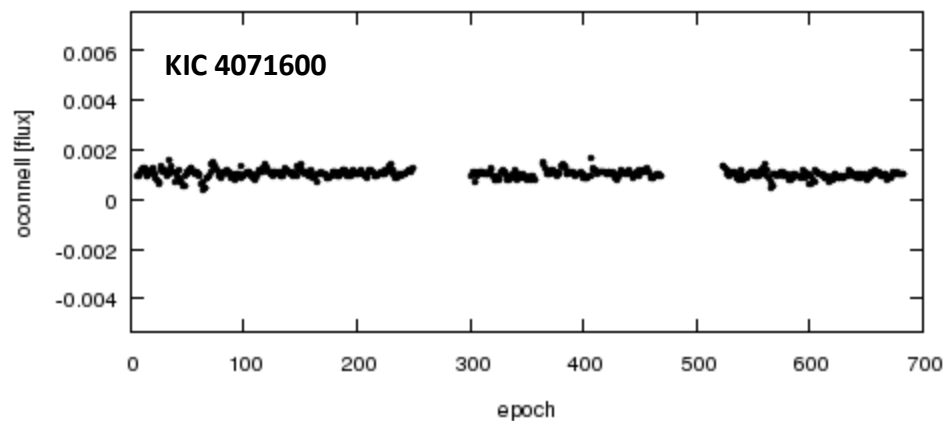
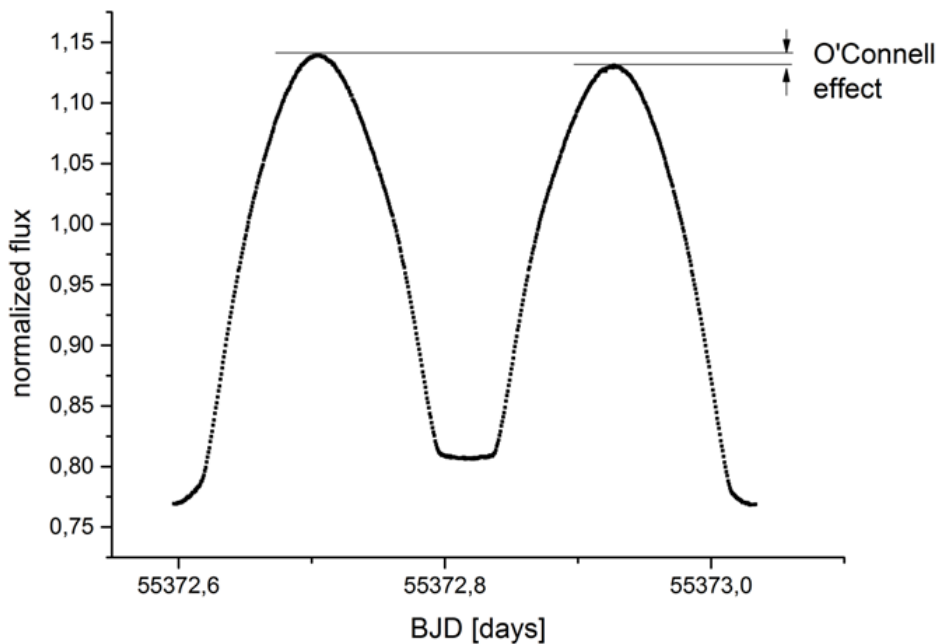
Kepler Eclipsing Binary Catalog

The previous version of the catalog (V2) can be downloaded from keplerebs.villanova.edu

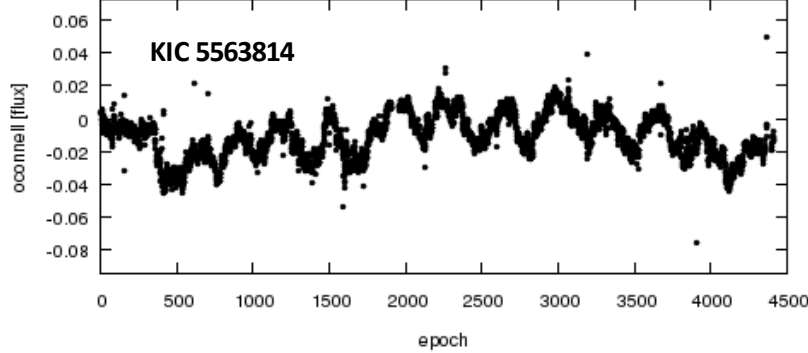
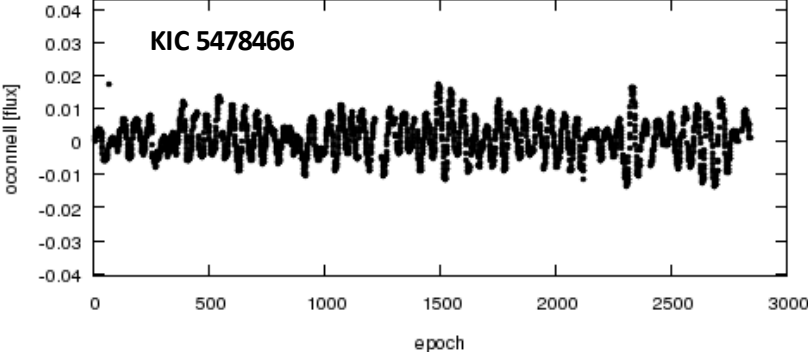
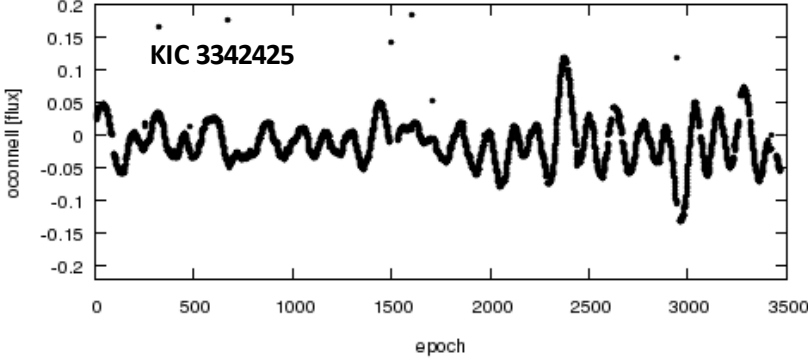
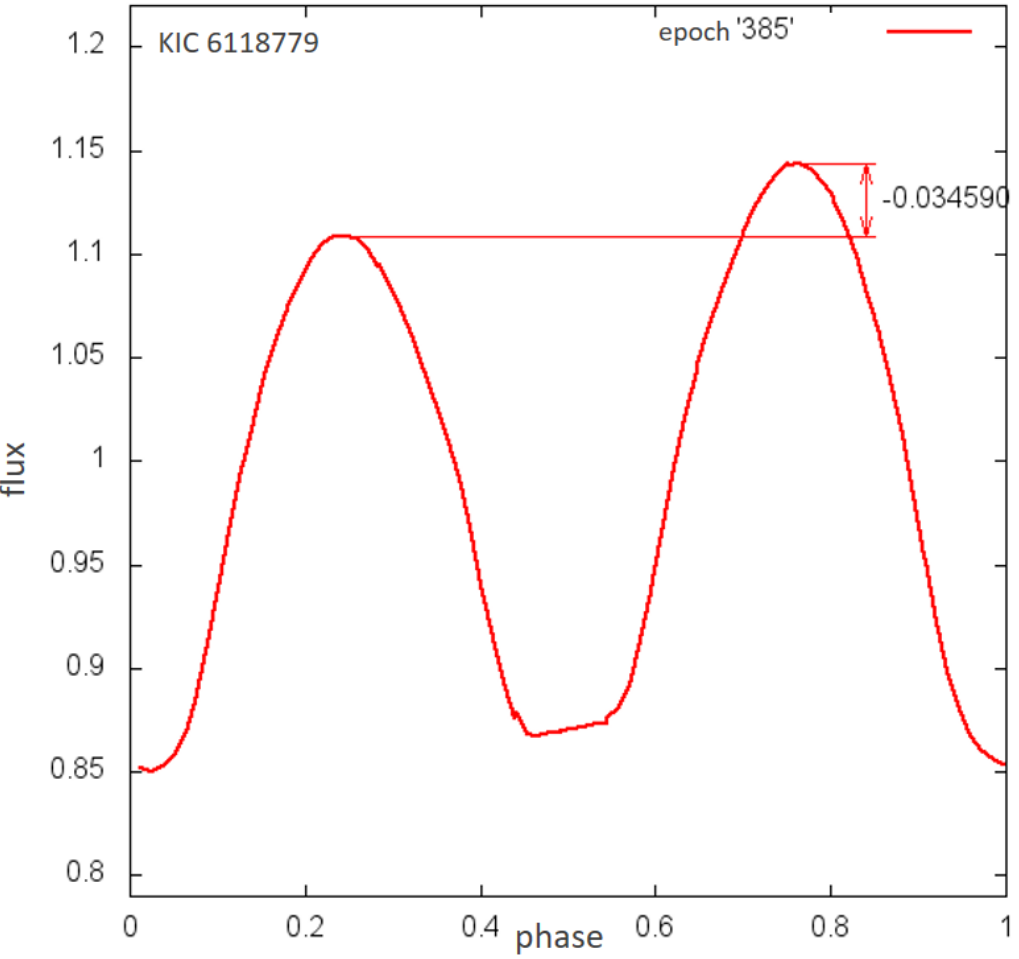
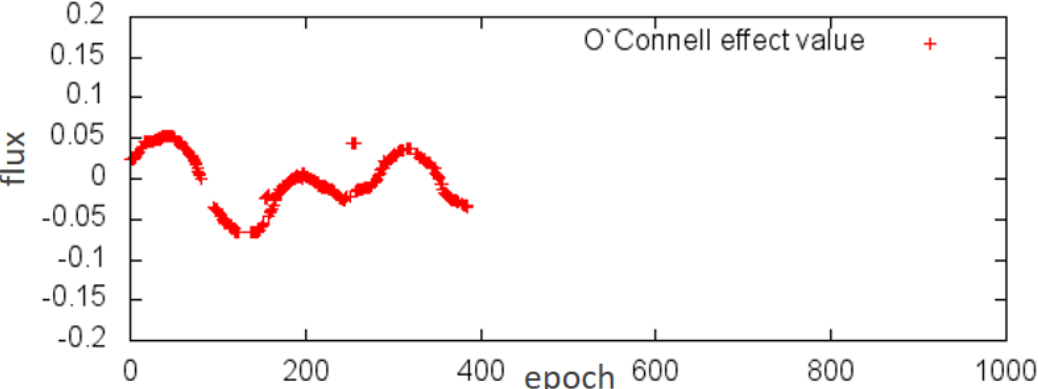
File: comma-separated values Download Catalog or search for

KIC / EPIC / KOI: Quick Search

Light curve deformation: the O'Connell Effect

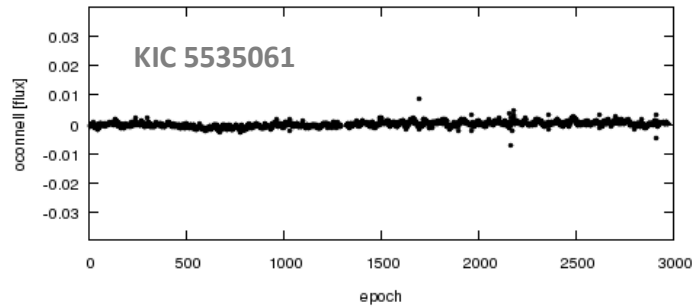


Evolution of the O'Connell Effect

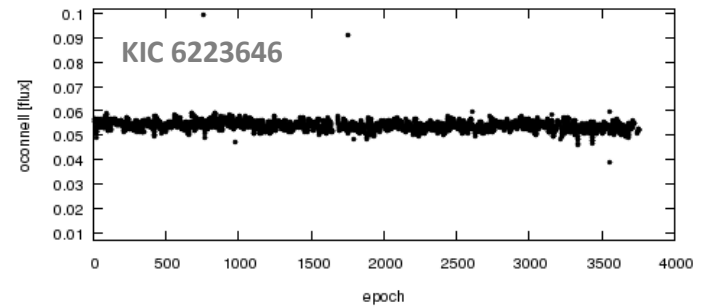


Phenomenological classification of the O'Connell Effect

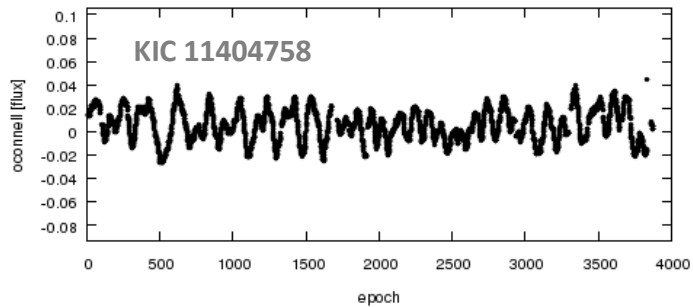
No O'Connell Effect



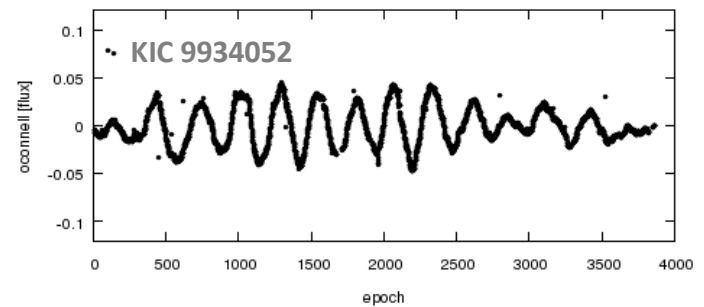
Stable, non-changing O'Connell Effect



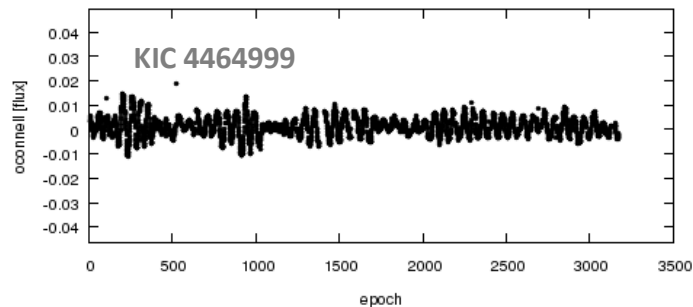
Signal of transition between spots



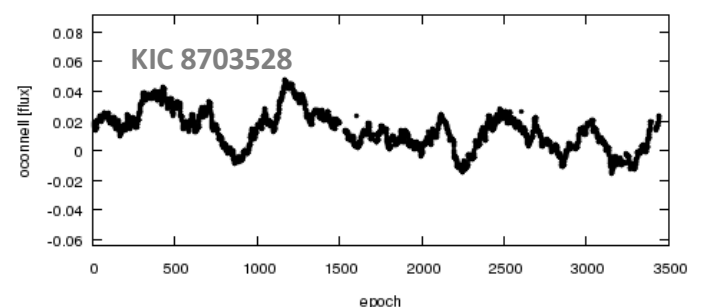
Regular variations



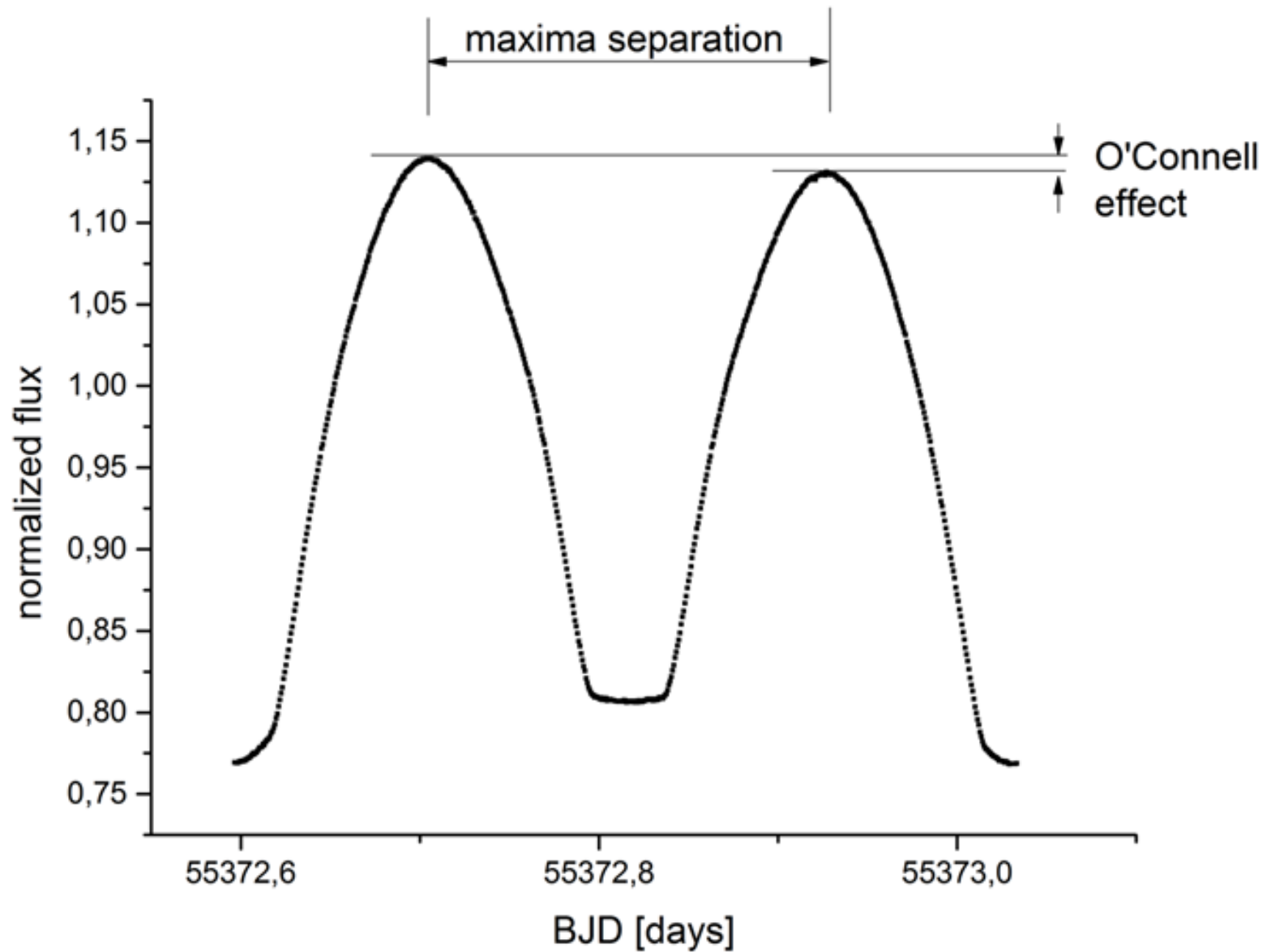
Cycles of activity



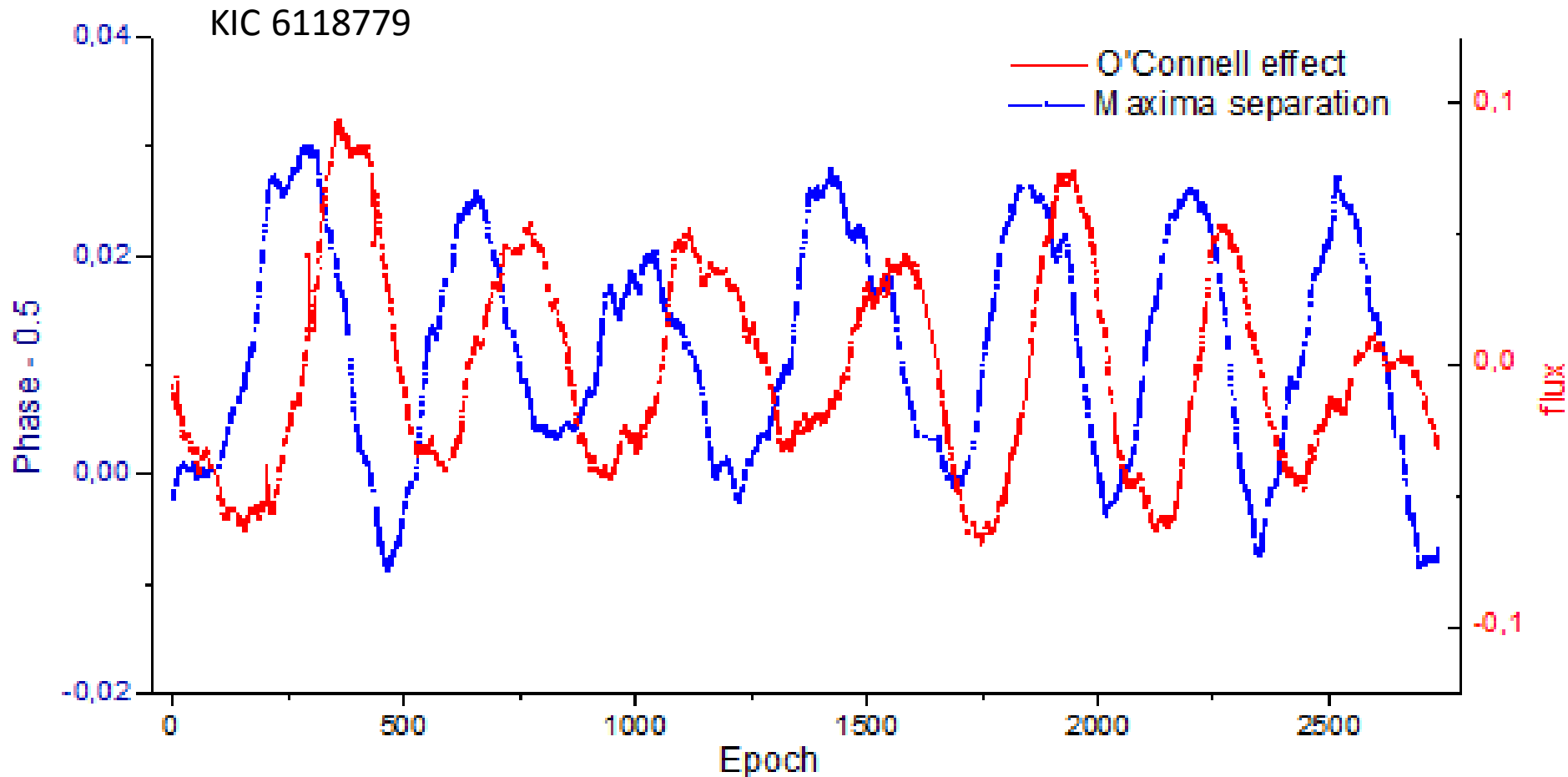
Random variations



Separation of the brightness maxima

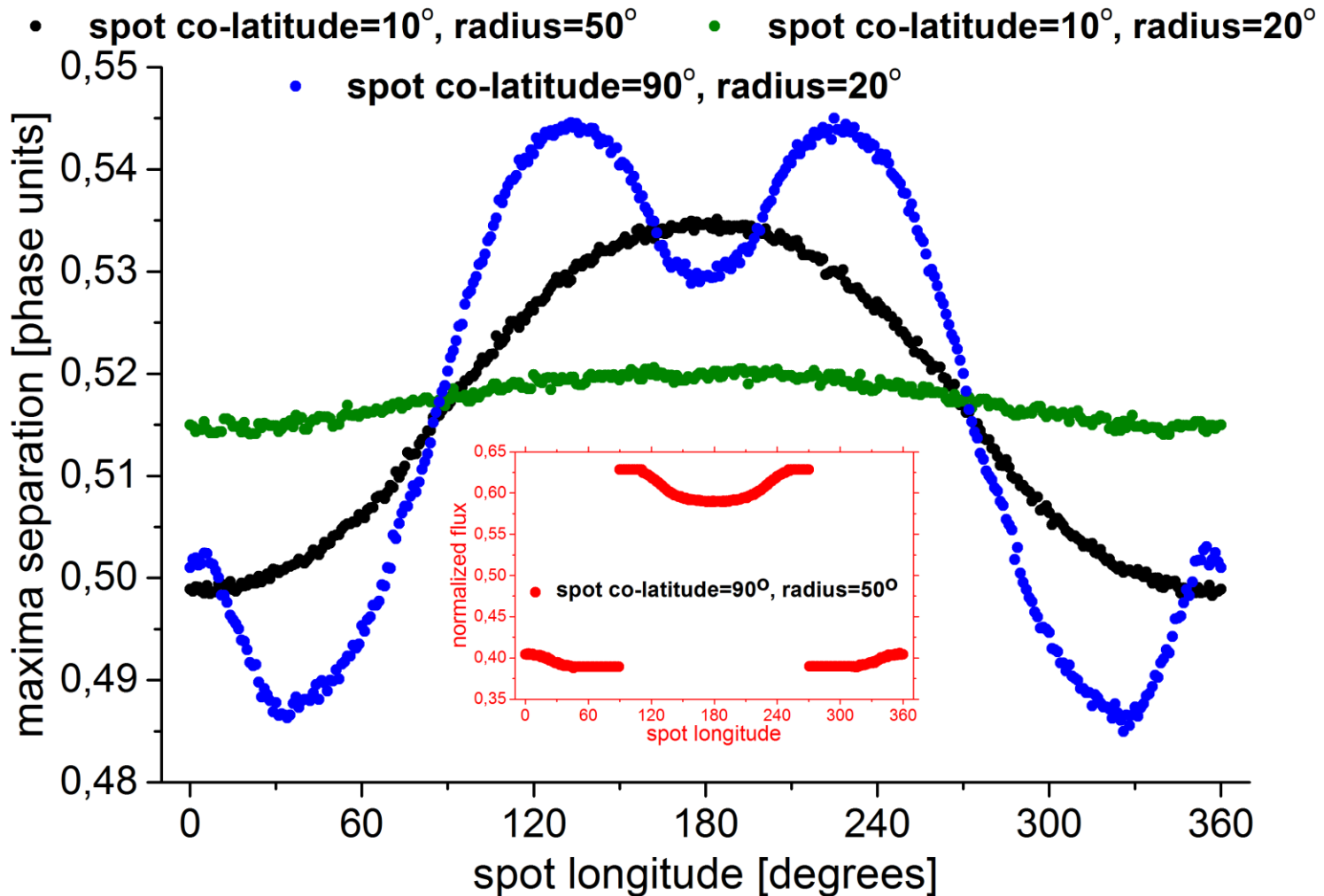


Separation of the brightness maxima

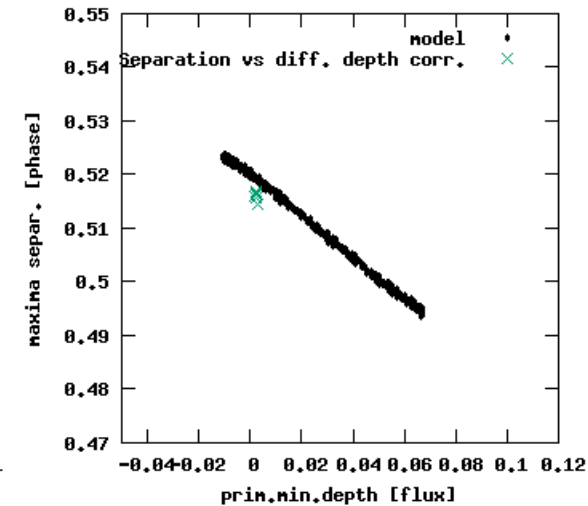
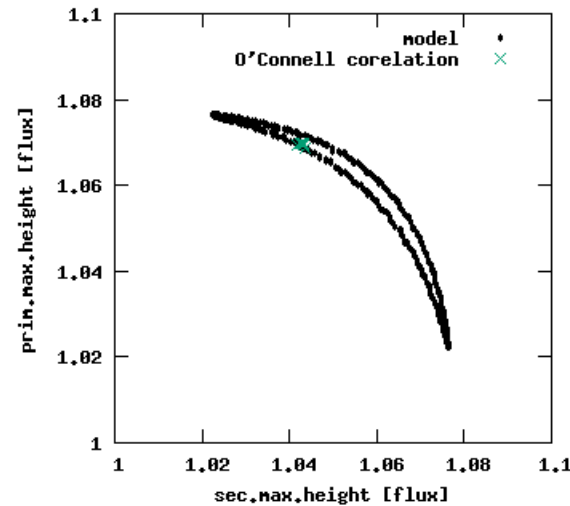
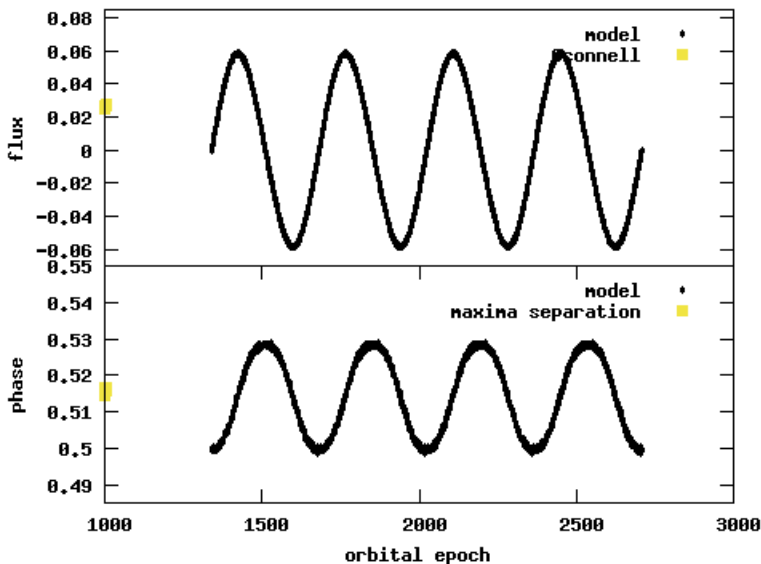
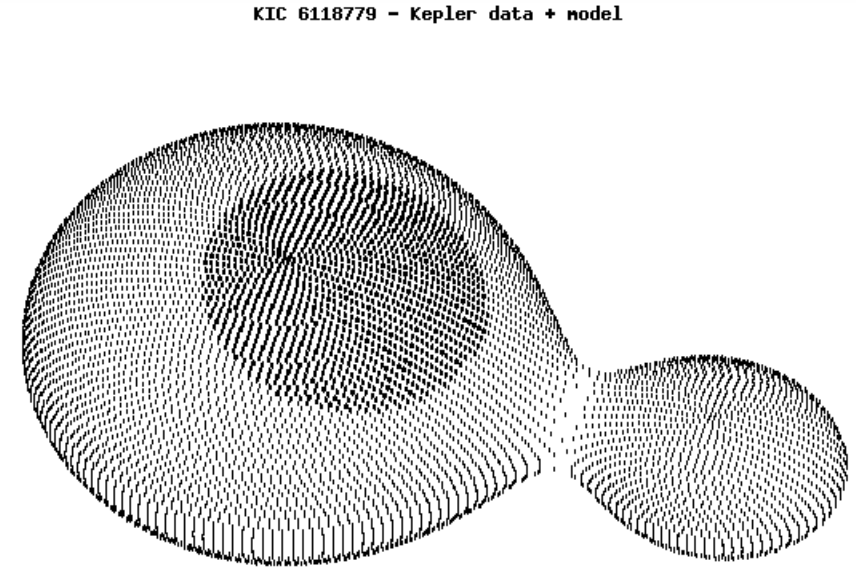
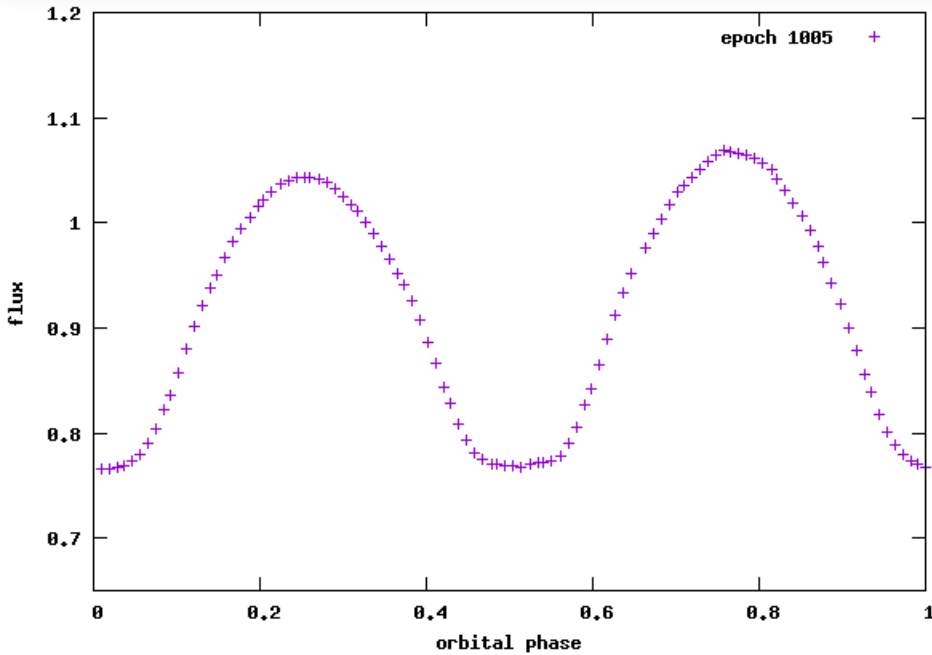


Separation of the brightness maxima

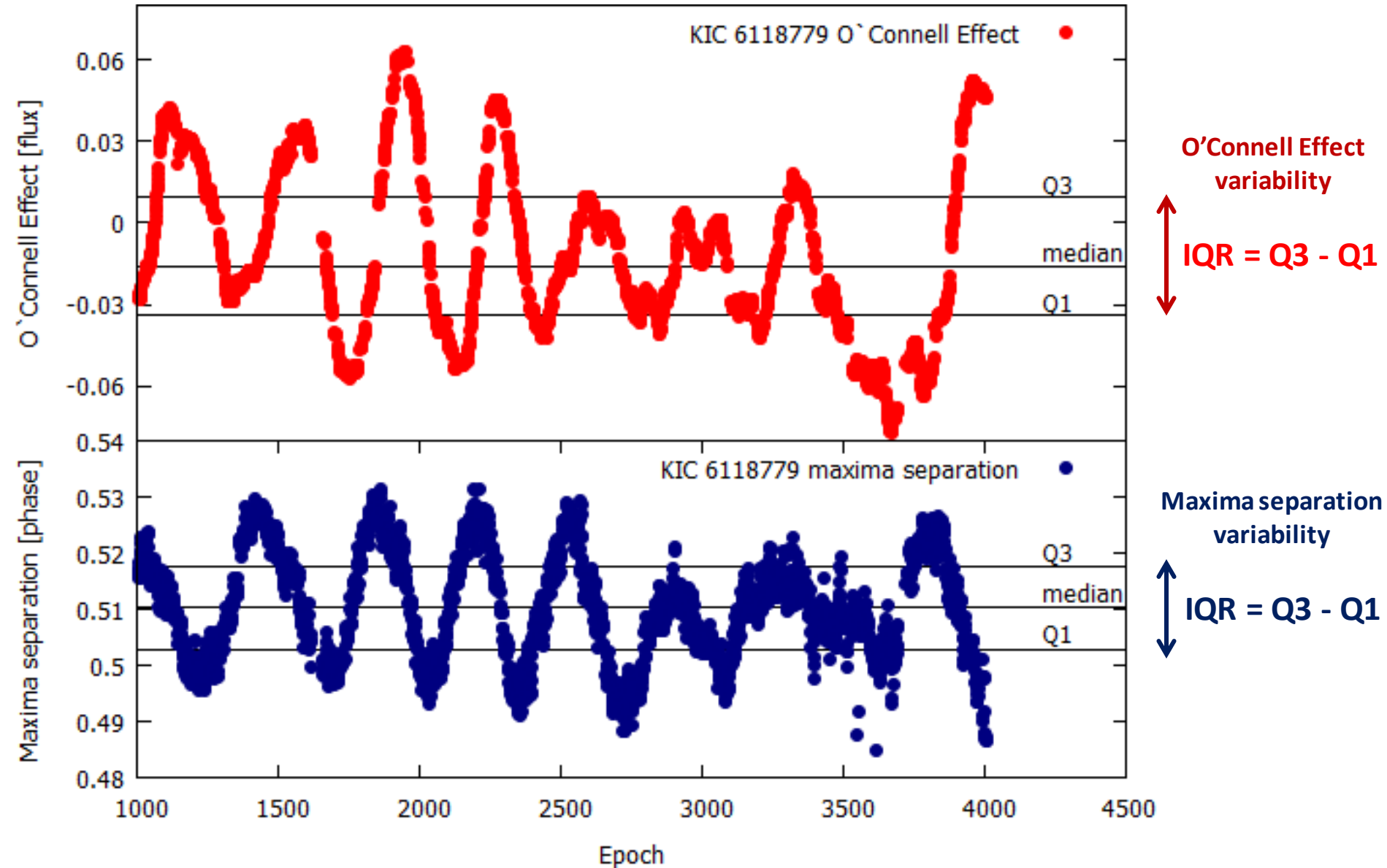
Simulated evolution of the maxima separation under the migration of a different kinds of star spots



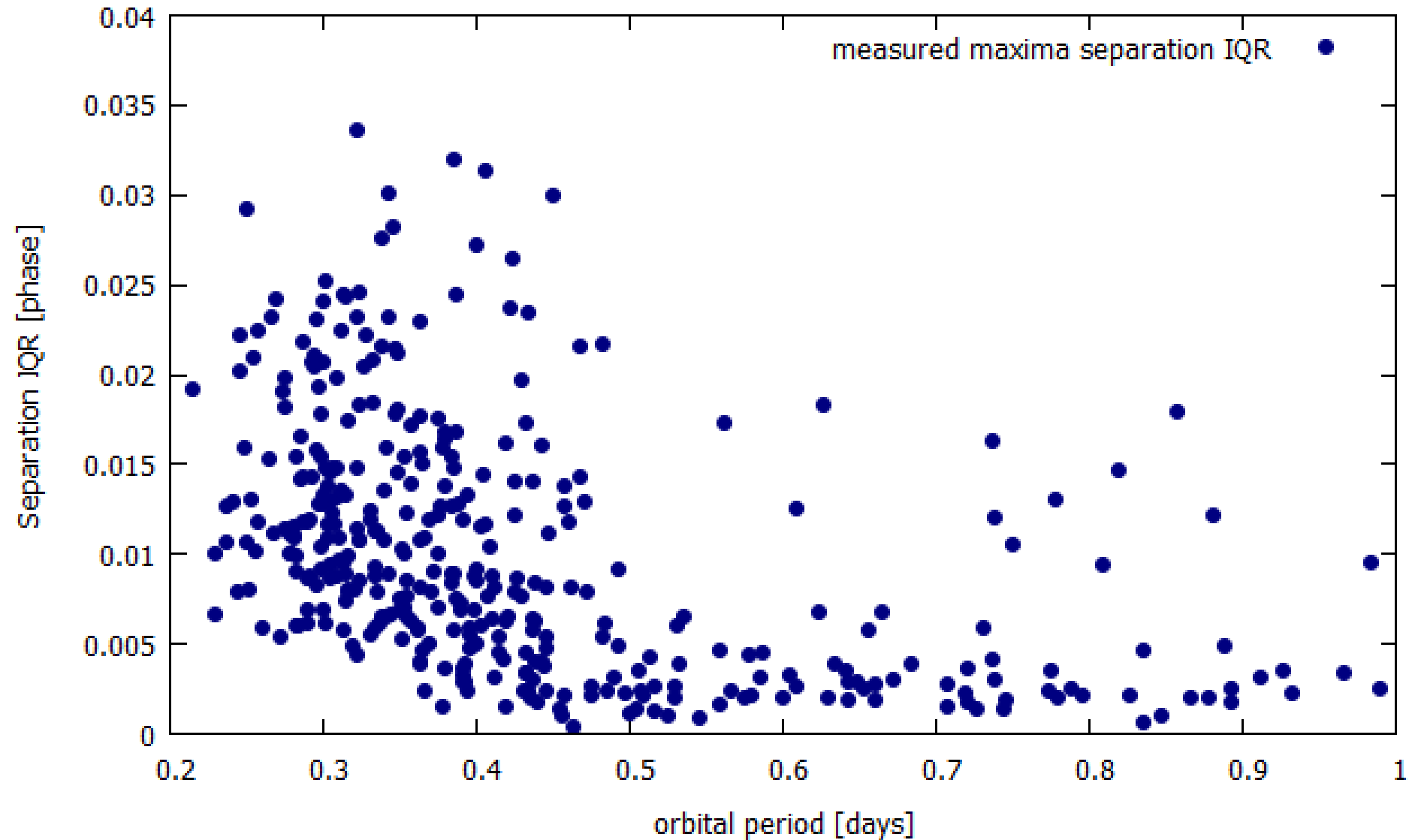
KIC 6118779 – contact binary with a migrating polar spot



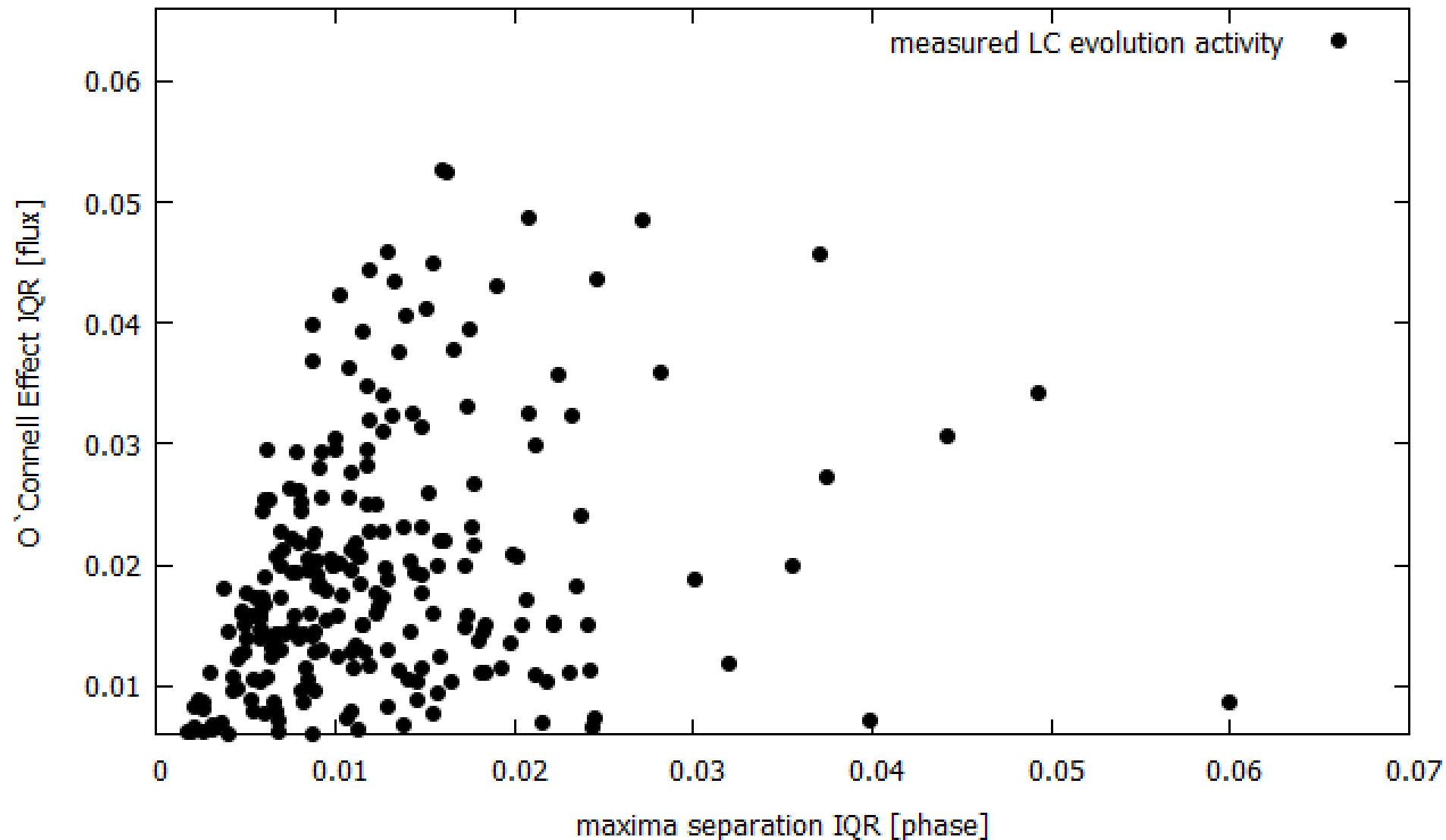
Measurement of the parameters variation magnitude



Measurement of the variation magnitude - statistical study



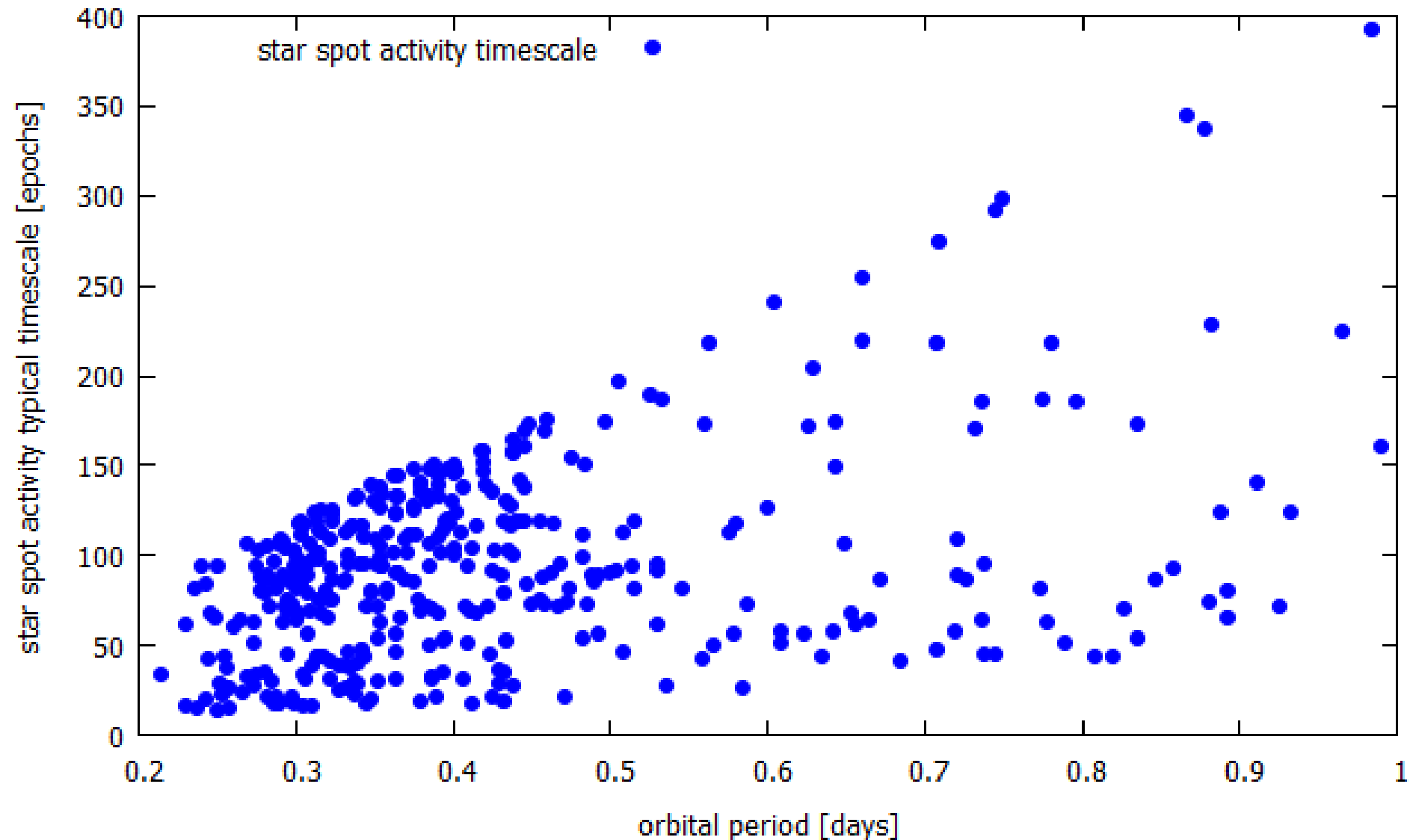
Measurement of the variation magnitude - statistical study



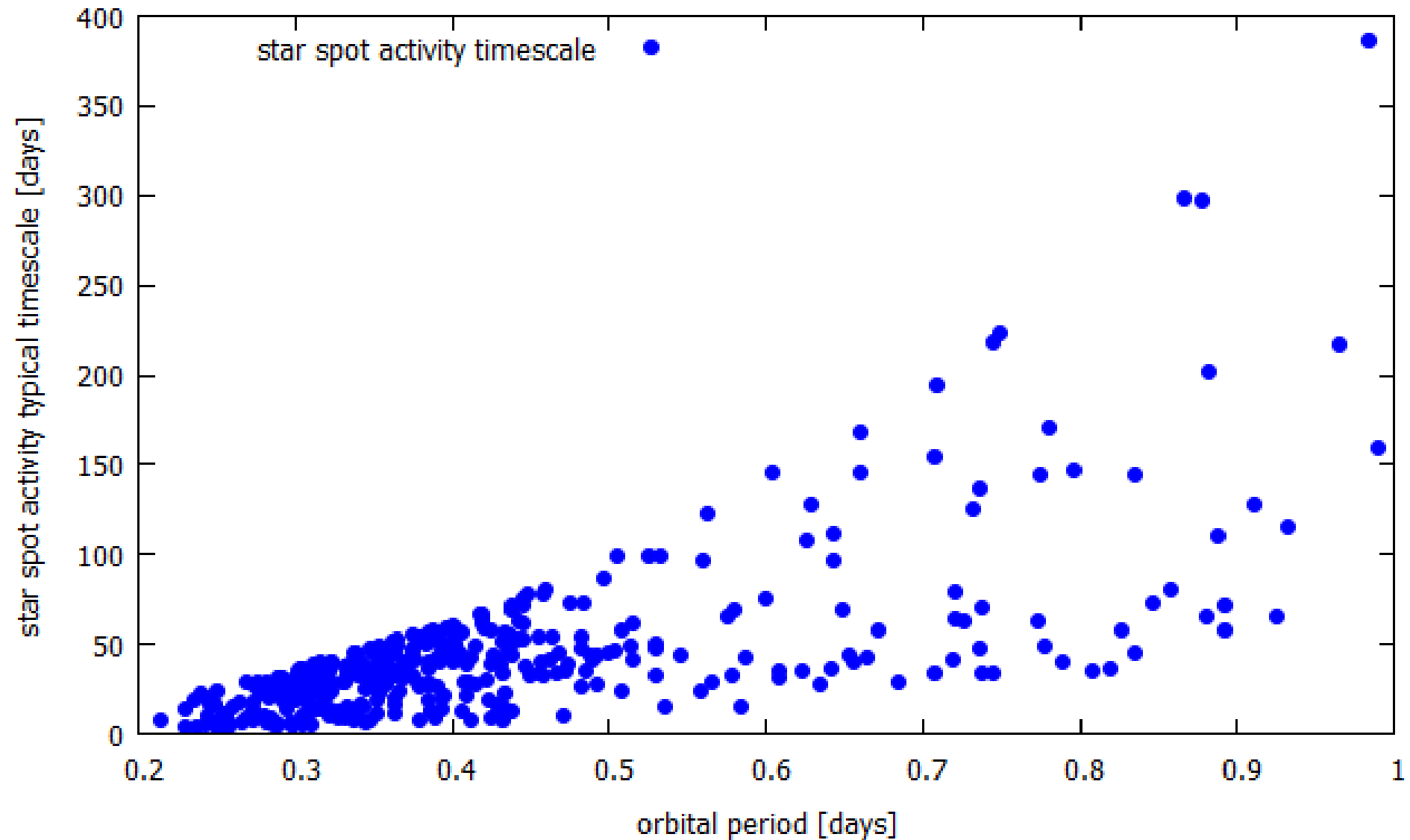
The hidden variability

- **Maxima separation** evolution can serve as a signature of an activity not visible in the O`Connell Effect, such as:
 - Stationary, non-migrating, evolving polar spot (Candidates found, e.g. KIC 5535061)
 - No O`Connell Effect
 - Small changes in the maxima separation
 - Simultaneous changes in the maxima height
 - (Thermal) pulsations of the binary neck (Candidates found, e.g. KIC 5376552)
 - No O`Connell Effect
 - Considerable changes in the maxima separation
 - Large variation of the primary minimum depth
 - Global temperature changes of one of the binary components
 - Changes in the maxima separation
 - Changes in the minima depth
 - No changes in the O`Connell Effect

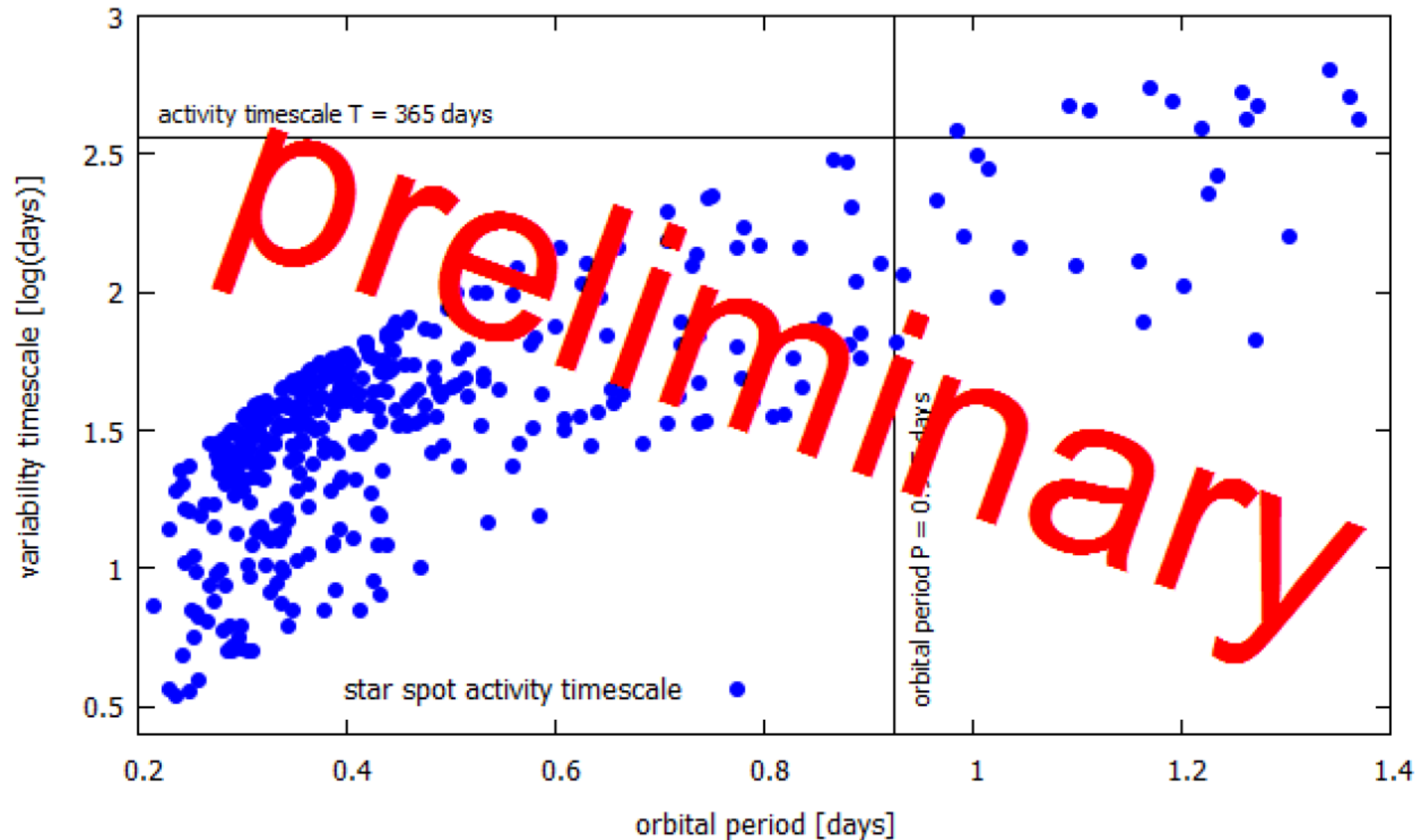
Typical timescale of the activity



Typical timescale of the activity



Typical timescale of the activity



Summary

- The **O'Connell Effect** serves as a basic signature of a star spot presence, e.g.:
 - Stationary, non-migrating spots
 - Various cases of migrating spots
- **Maxima separation** can be used for detecting the activity 'hidden' from the O'Connell Effect, such as:
 - Stationary (evolving) polar spots
 - Pulsations of the binary neck
 - Global temperature changes

With the knowledge of the maxima separation evolution and changes in the O'Connell Effect, it is possible to constrain the latitude of star spots in contact binaries to the stellar pole and rule out small equatorial spots.