

Eclipsing binaries and astrophysical false positives in the PLATO fields



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Abstract

We perform binary population synthesis calculations linked to a comprehensive Galactic extinction model to determine the number and type of eclipsing binaries expected in a given field of view with a given magnitude limit. We present selected, preliminary results on fields that are representative of the central, most sensitive region of the PLATO field.

Our technique has two principal applications:

- (1) Estimating the number and nature of astrophysical false positive exoplanet transit detections.
- (2) Constraining the formation history of binary systems by comparing the synthesised signal with a census from an actually observed field.

Binary population synthesis approach

We use the BiSEPS and population codes as described by Willems et al (2006):

- Employs a stellar and binary evolution scheme as in Hurley et al (2000, 2002).
- Convolves initial distributions of newly forming binaries with Galactic star formation history to map out the present-day binary population.
- Integrates over the stellar number density distribution, taking into account the comprehensive extinction model by Hakkila et al (1997).
- Allows one to determine the total number and characteristics of systems in a given magnitude range per unit area as a function of Galactic longitude and latitude.

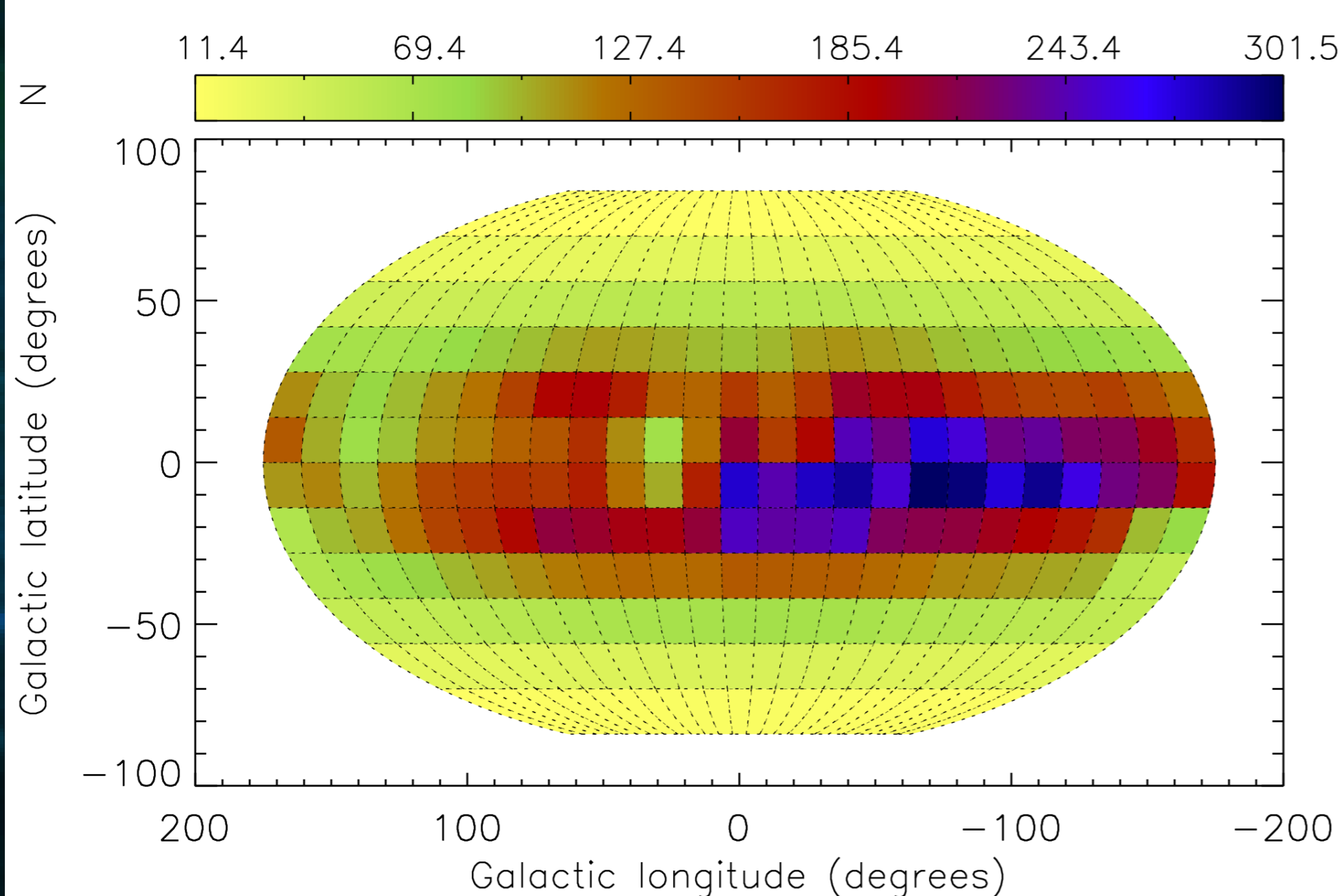


Figure 1: Binaries displaying total eclipses with a transit depth, $\Delta F/F \geq 10^{-4}$

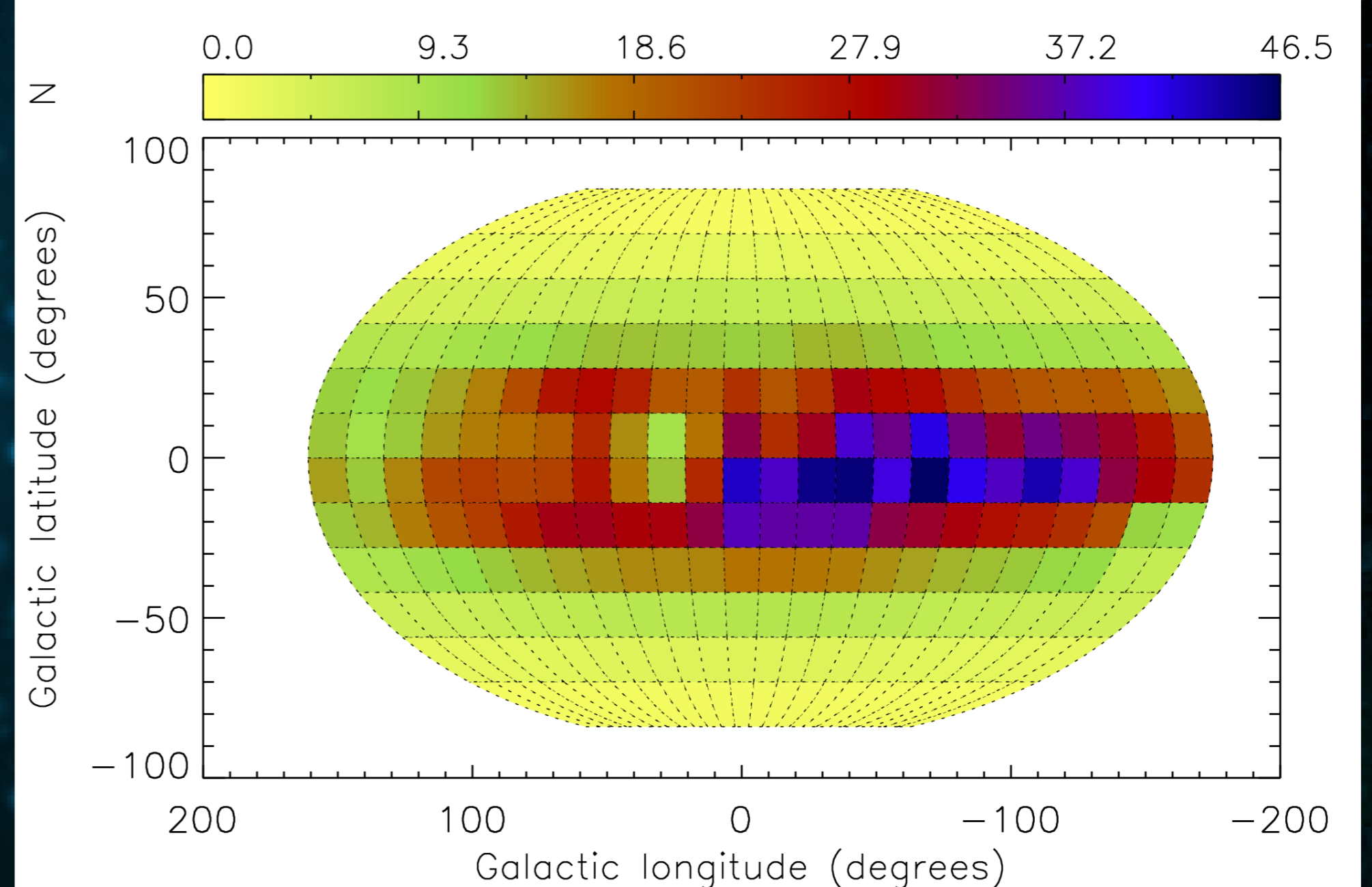


Figure 2: Binaries displaying total eclipses with a transit depth, $10^{-4} \leq \Delta F/F \leq 10^{-3}$

The figures give an example of the capabilities of our simulations. Shown are the Galactic distribution of eclipsing binaries:

- In $14^\circ \times 14^\circ$ fields, representative of the central region of the PLATO field of view.
- In the magnitude range $8 \leq m_v \leq 11$.
- For a flat initial mass ratio distribution.

Ongoing work

We are in the process of including

- Grazing eclipses
- Limb darkening
- Blending
- Properly represented PLATO fields

References

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