Towards an Automated Processing of Gaia Eclipsing Binaries

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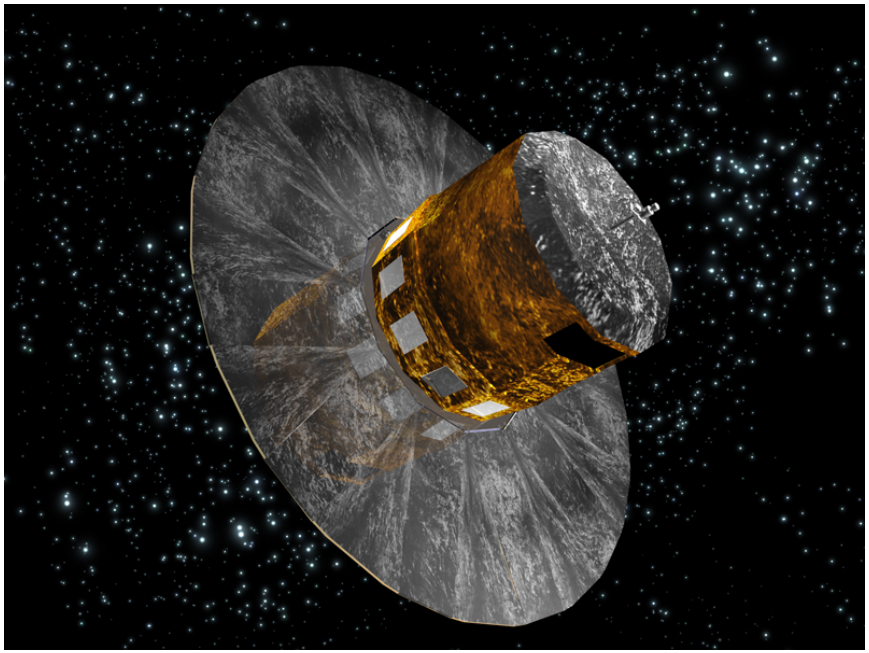
"Orbital Couples", October 10-12, Paris, France

gaia

Gaia DPAC
Data Processing & Analysis Consortium

The Gaia Mission



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- Gaia is a scanning mission:
  - no pointing, no change in schedule
  - 30-200 photometric transits per object ($\sim$70 on average)
- Multicolor (G, RP, BP) photometry for $\sim 10^9$ objects down to $\sim$20 mag
- Spectroscopy for $\sim 10^8$ objects down to $\sim$17 mag
- Pipeline expected to identify $\sim 10^8$ variable objects
- $\sim 10^5 - 10^6$ of these objects expected to be eclipsing binaries

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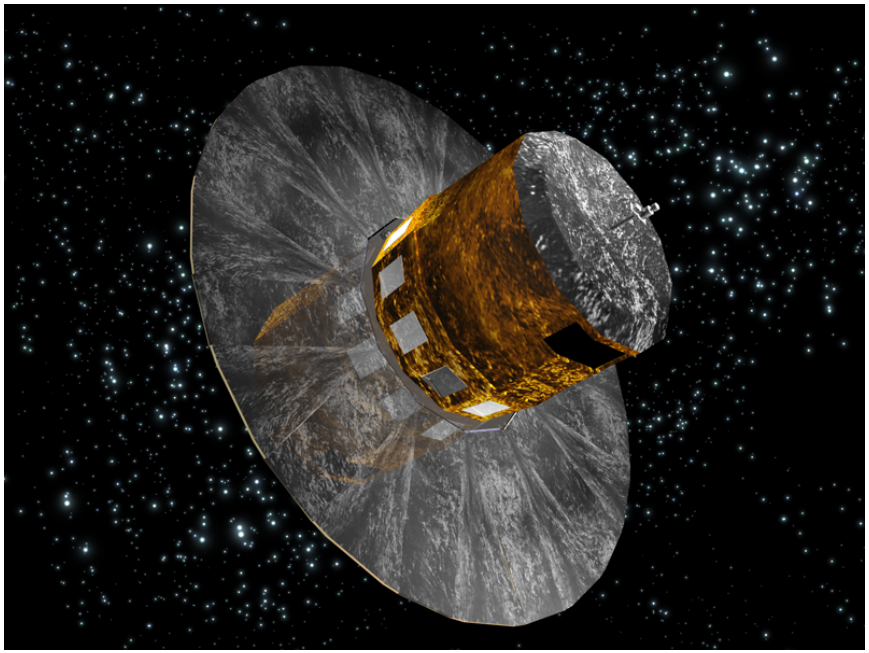

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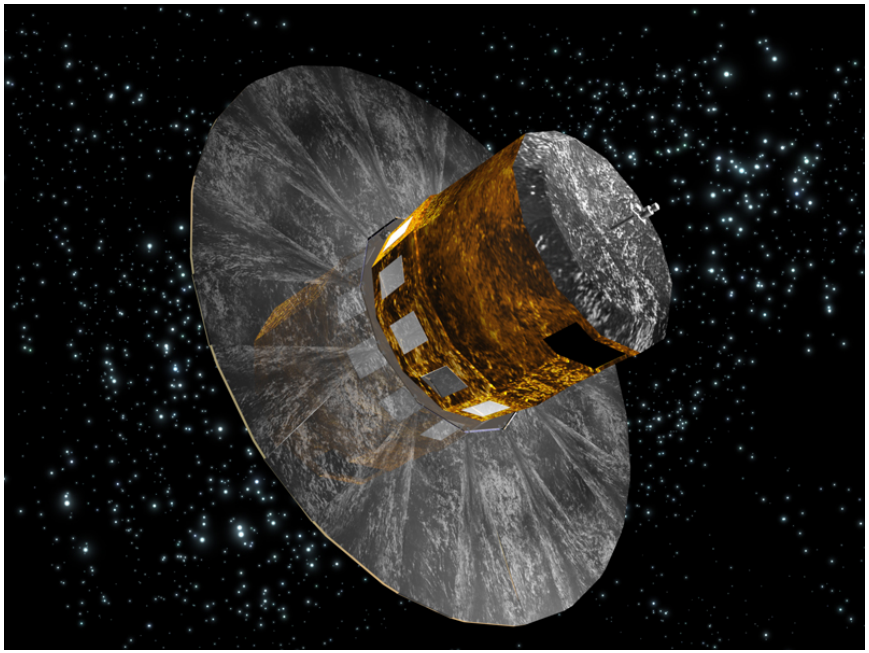

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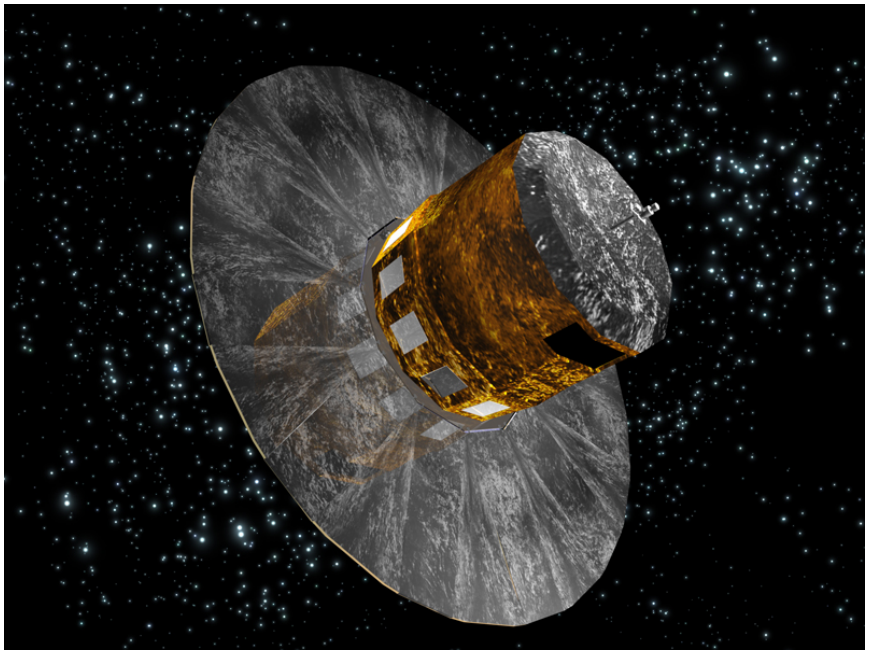

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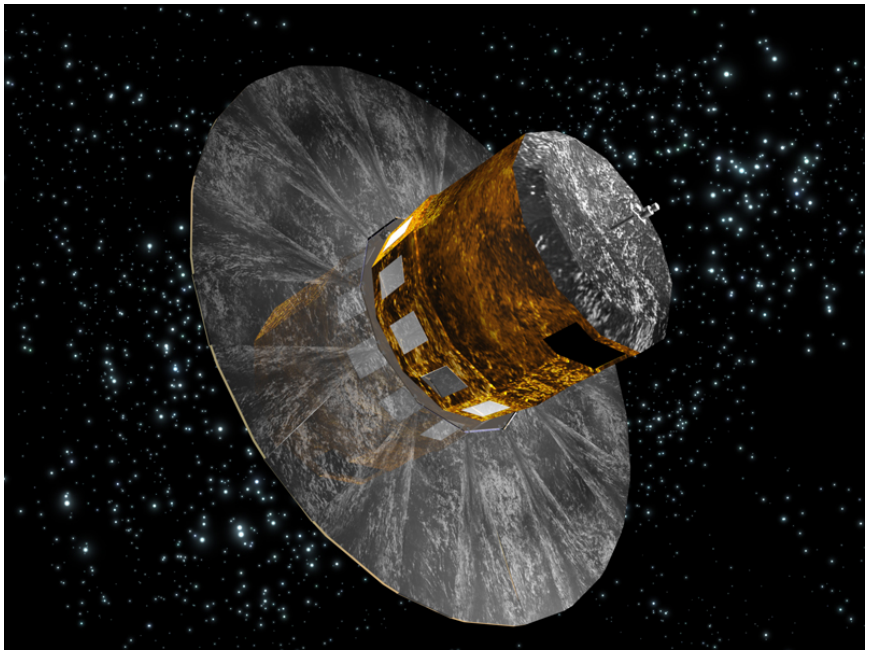

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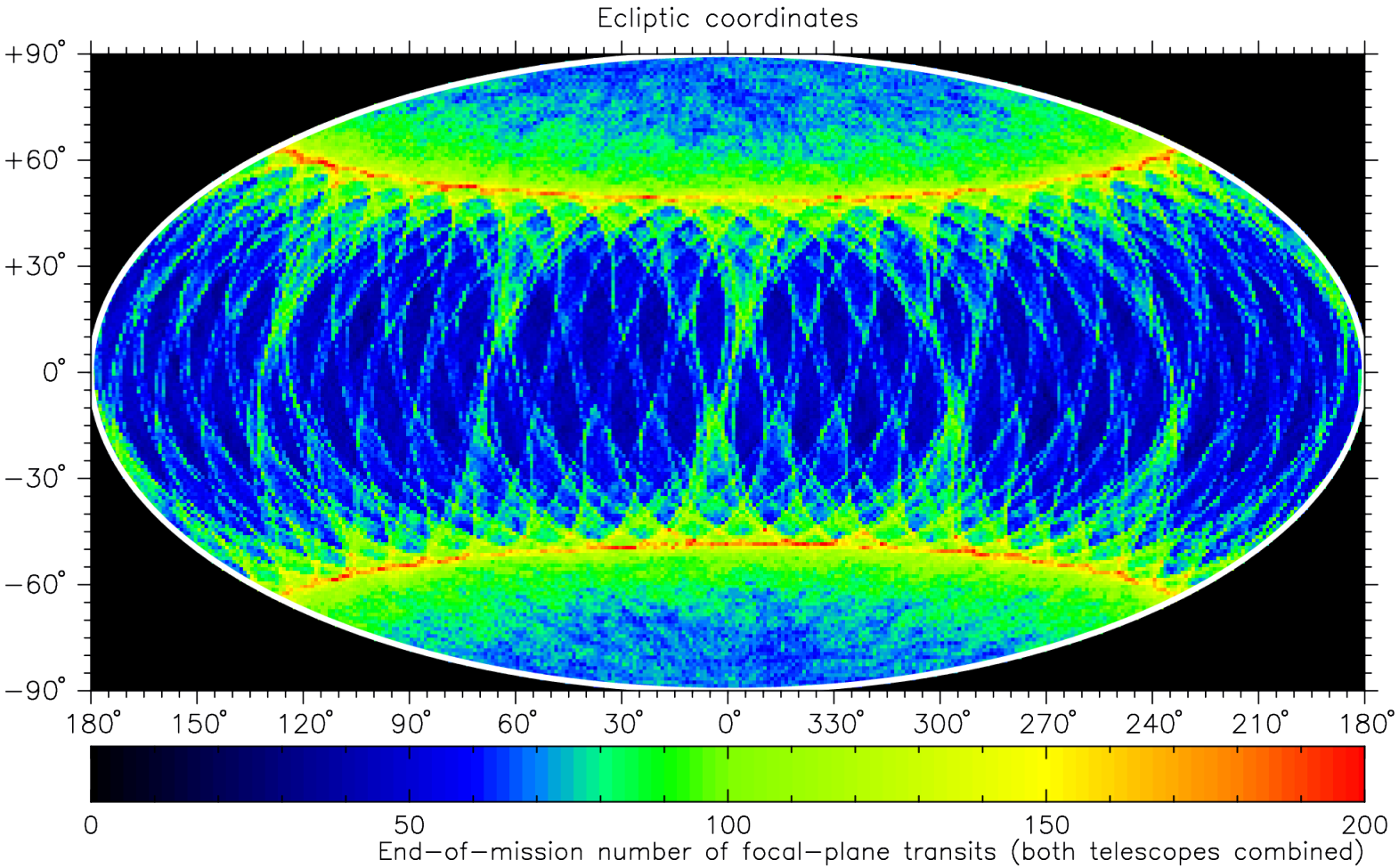
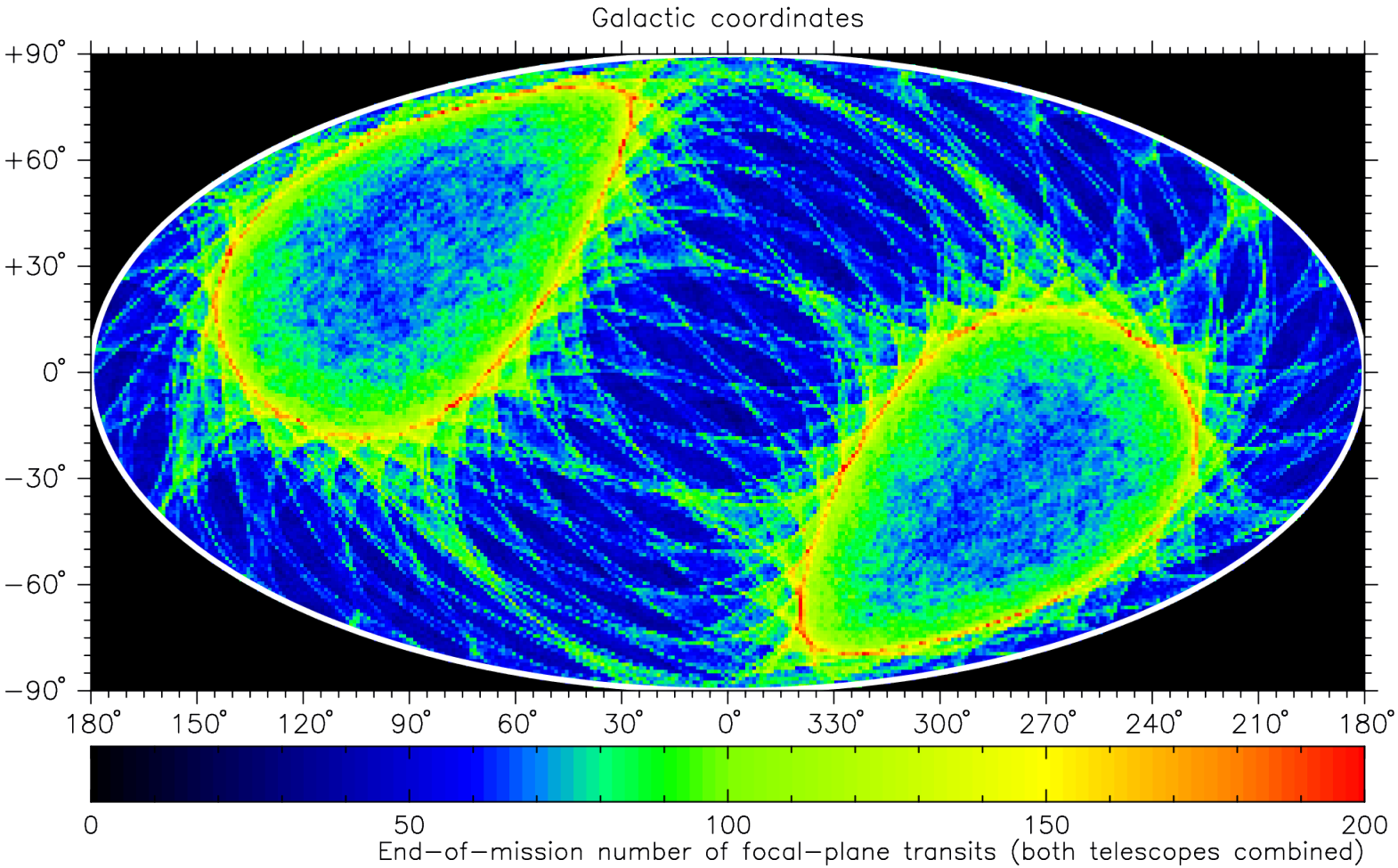
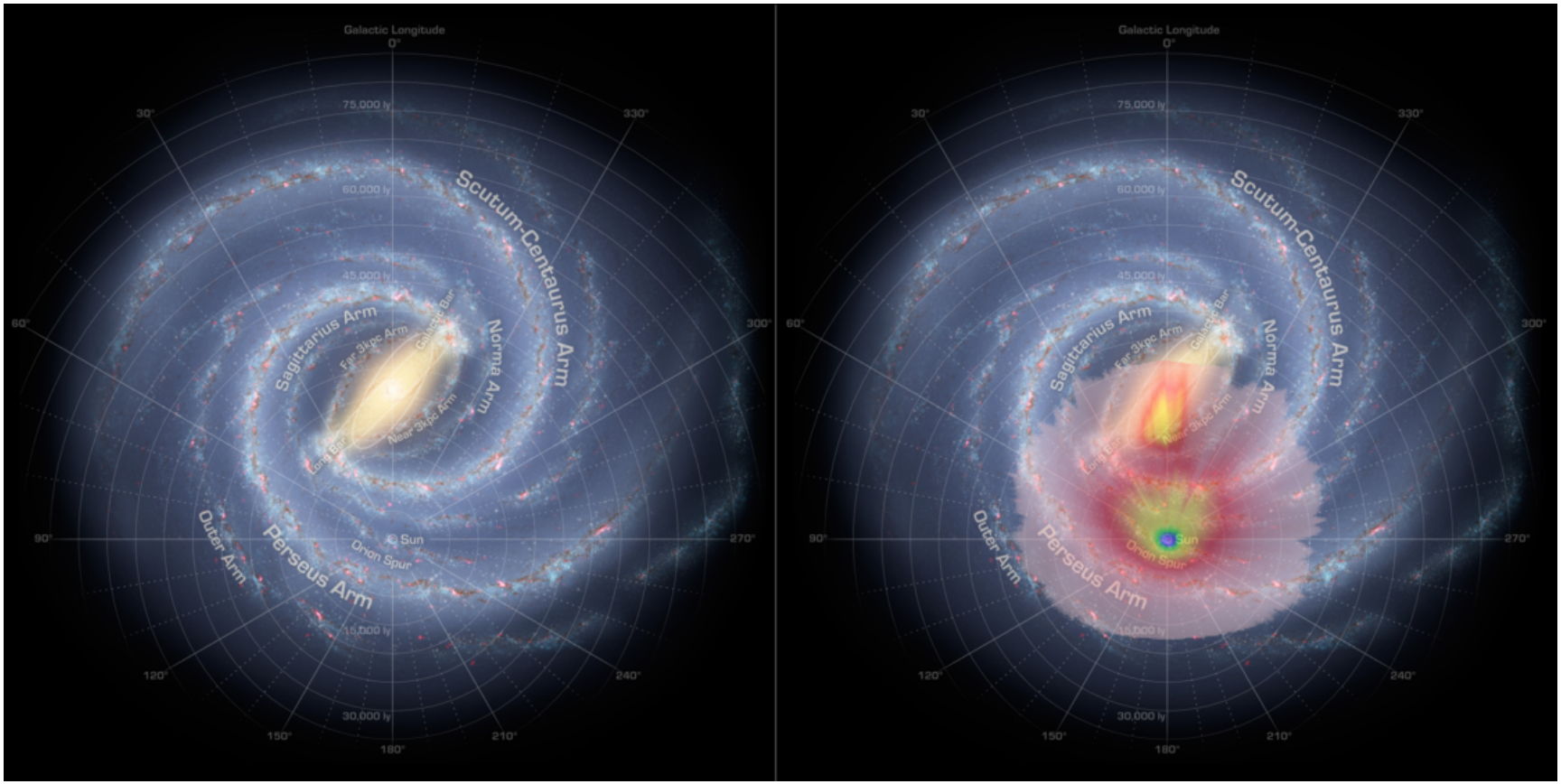
Gaia sky coverage – Ecliptic coordinates



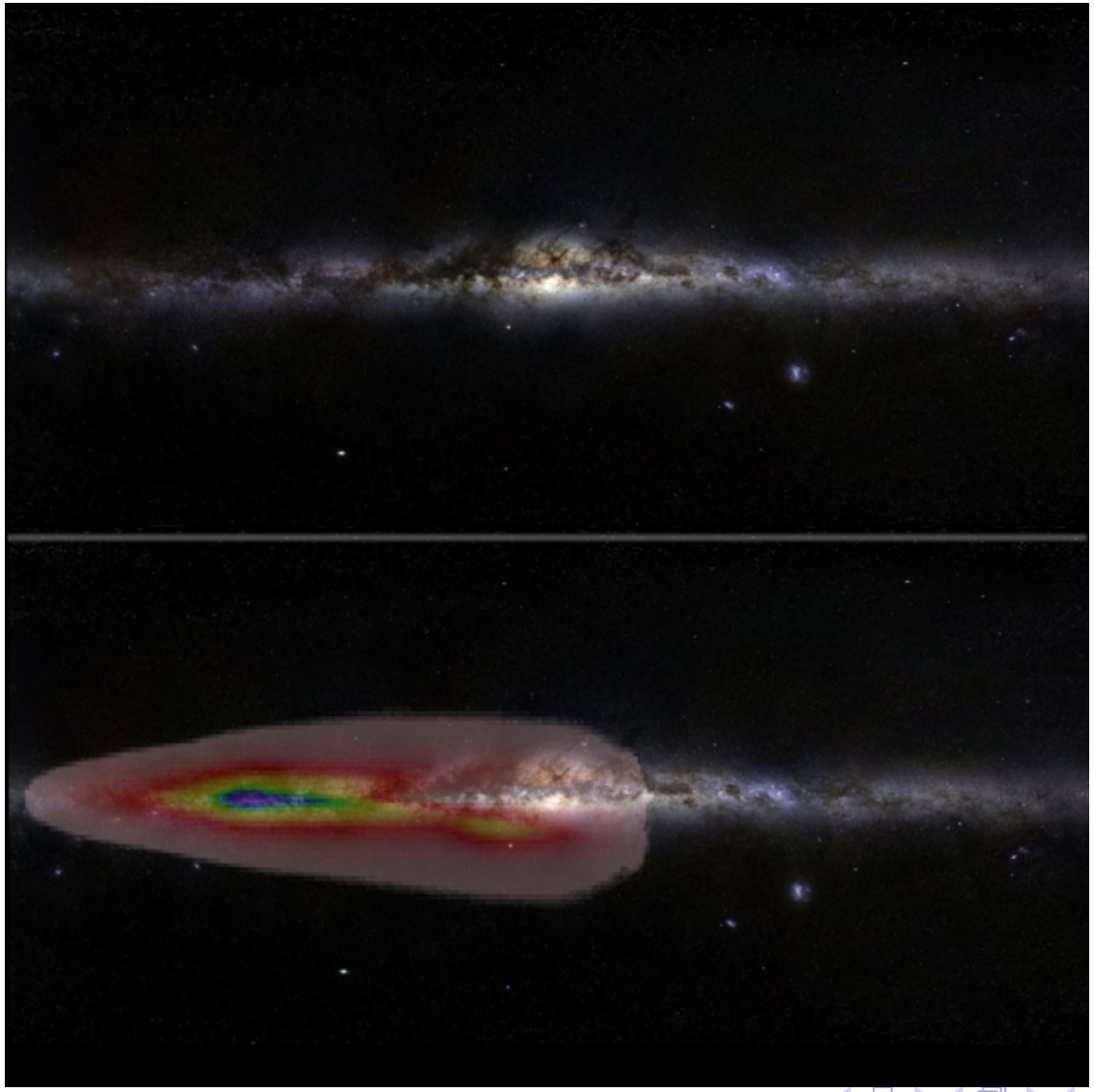
Gaia sky coverage – Galactic coordinates



Gaia Catalog Coverage: View from Galactic Pole



Gaia Catalog Coverage: View from Galactic Equator



Doing Eclipsing Binaries with Gaia

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  - Christos Siopis (DU436 manager)
  - Brandon Tingley (now at IAC)
  - Gilles Sadowski (physicist, computer scientist)
  - Associate members

- Why bother with eclipsing binaries?
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  - One of few ways to determine stellar masses (as well as other stellar parameters)
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    - Software performance requirements
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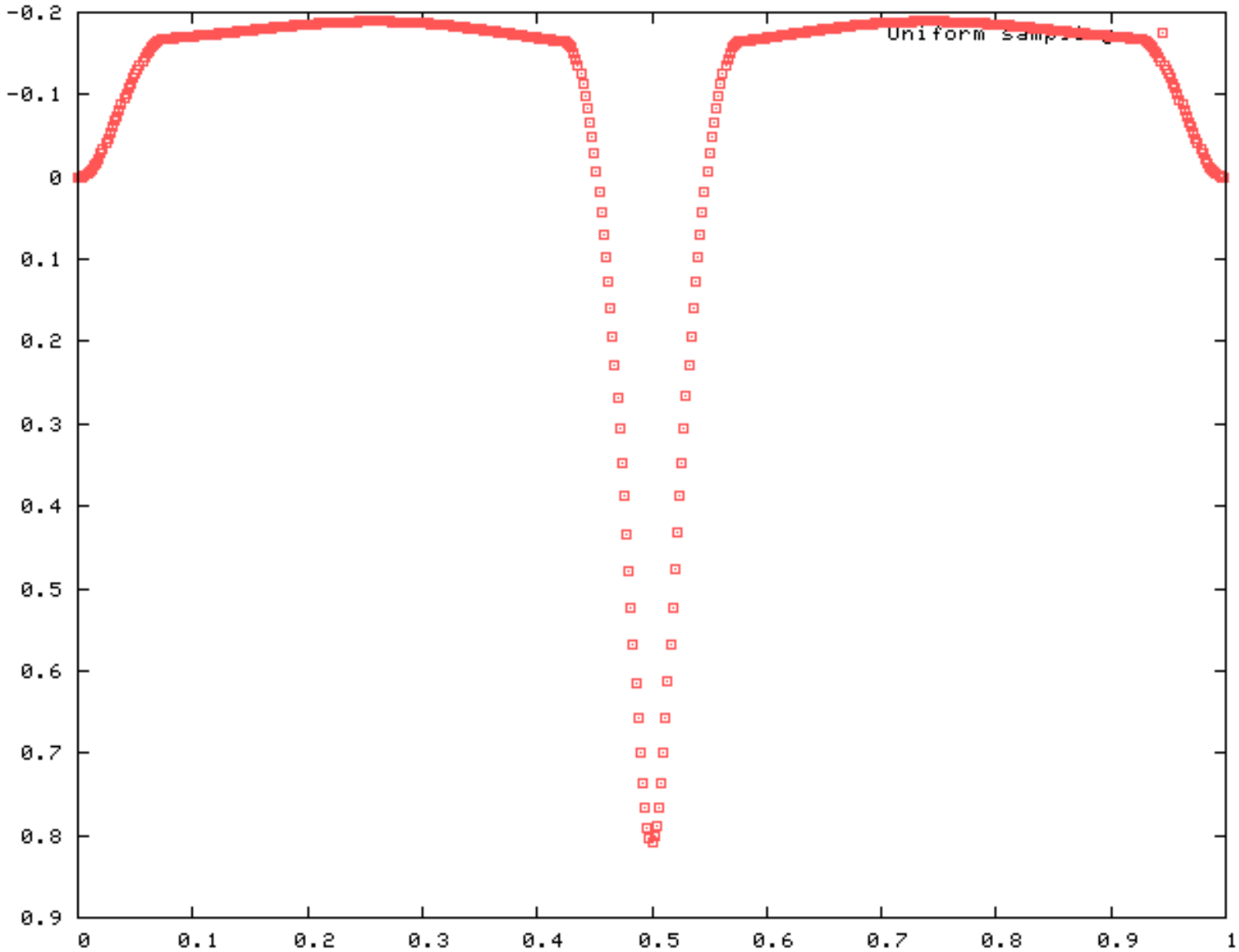
EB and Gaia Scanning Law



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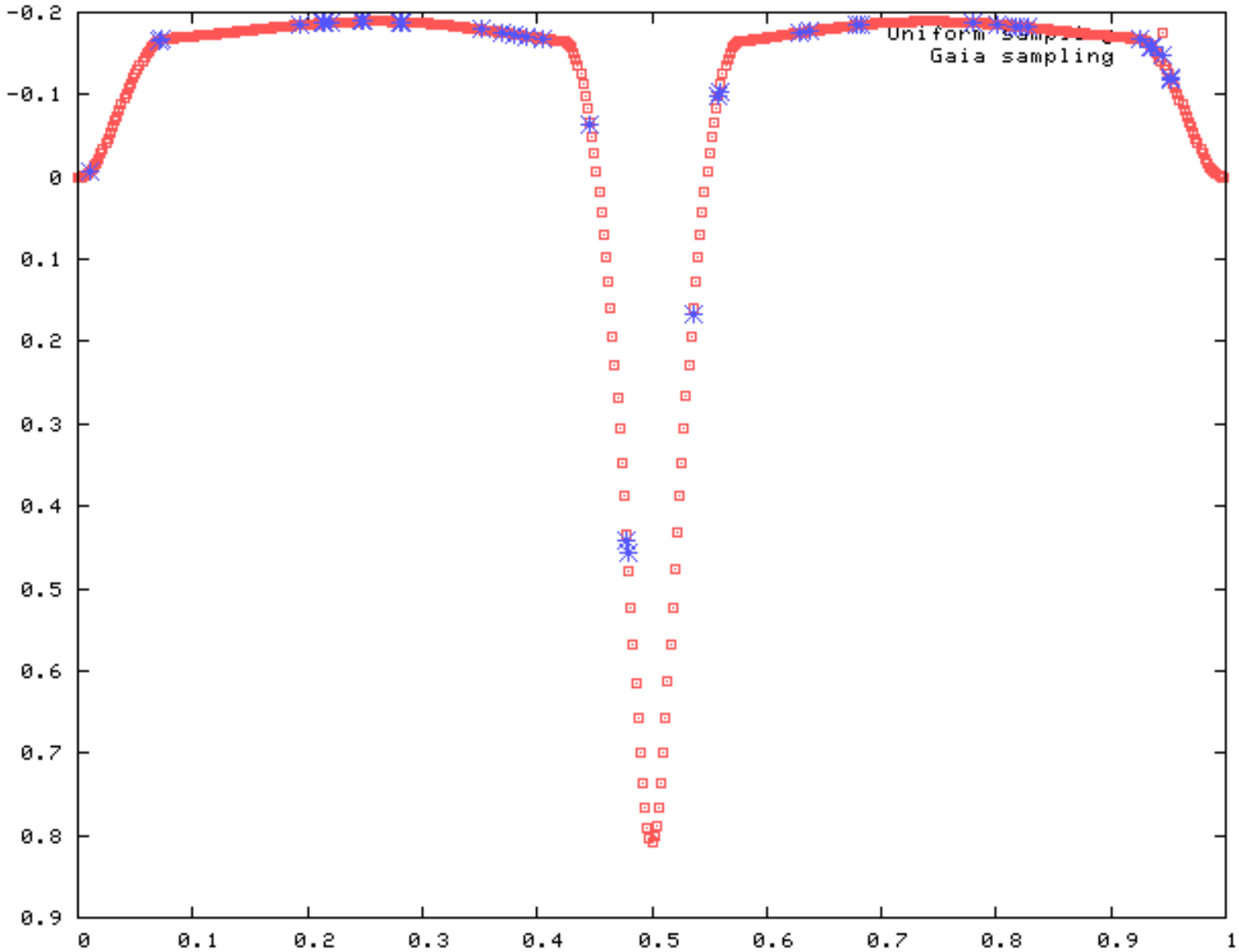

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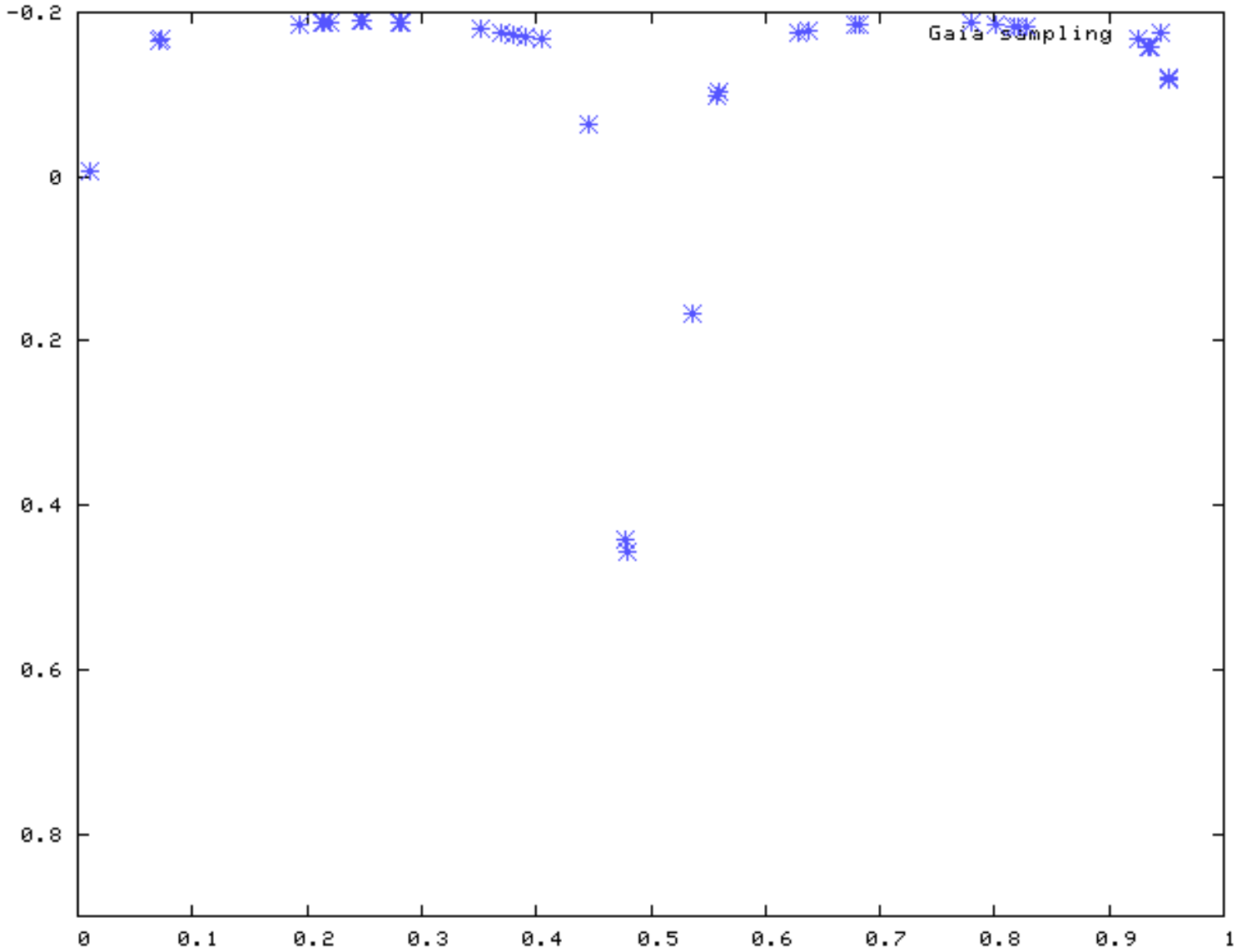

Estimation of Physical Parameters

- EB Model Generator: Given a set of epochs $\{t_i\}$ and physical parameters $\mathbf{p}$, generate EB physical model $\mathcal{M}(t_i; \mathbf{p})$
  - Full Roche-lobe modeling:
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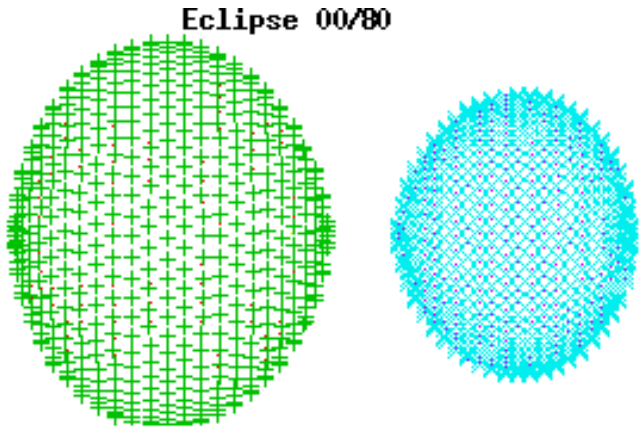

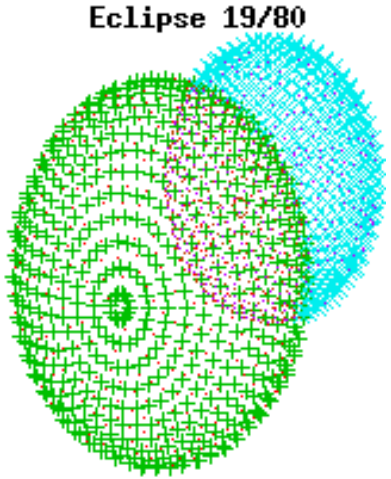

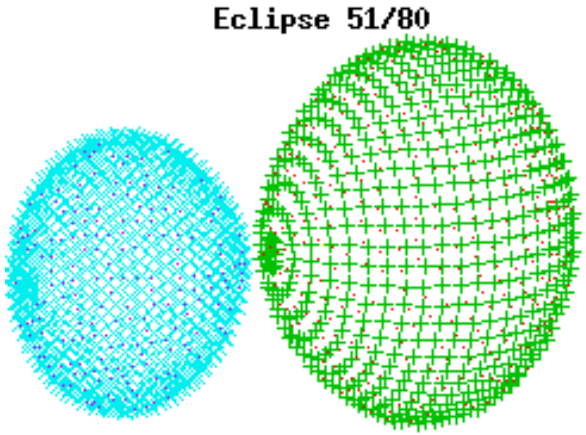

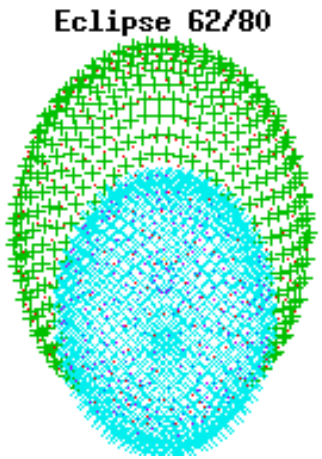

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$$\text{Find} \quad \mathbf{p}: \quad \min ||\mathcal{M}(t_i; \mathbf{p}) - \mathcal{O}(t_i)||$$

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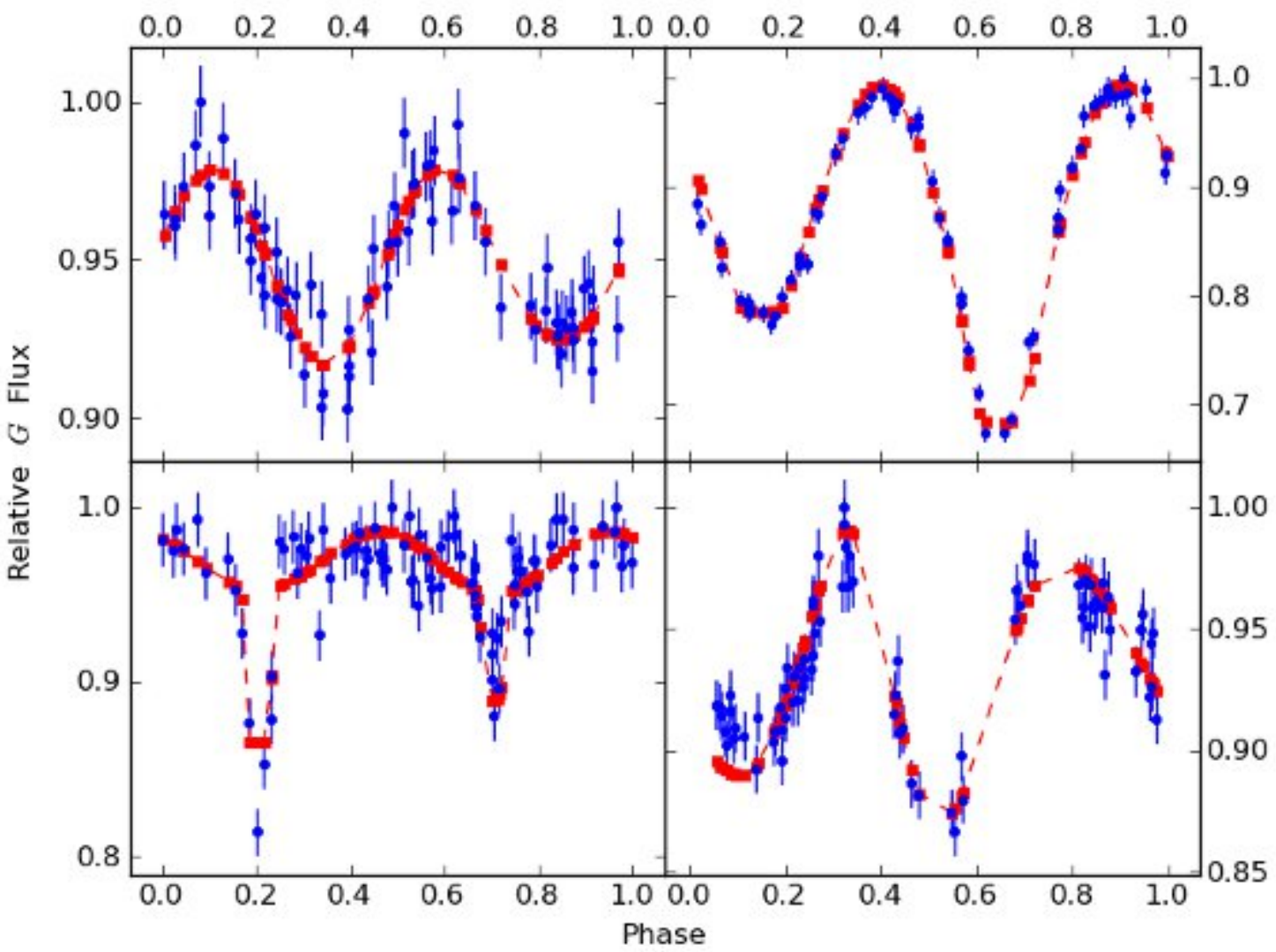

Remaining Work

- Simulator: Validation against, *e.g.*, Wilson-Devinney code
- Optimizer: Still lots of work on the fitting procedure!
- Testing using EB light-curve data sets from the literature
- Error estimation
- Provide useful output to EB community: How to best exploit a large number of EBs with
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