Probabilistic Modelling of *Gaia* DR2 Systematics

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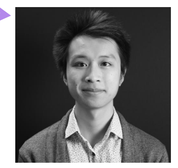

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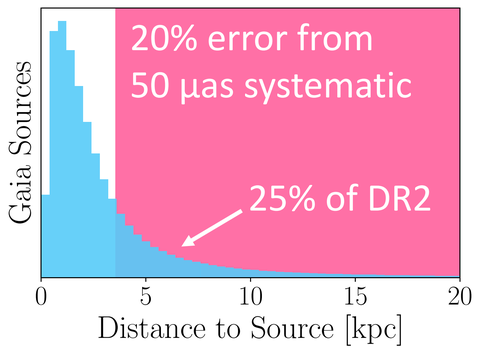
The *Gaia* Satellite

- Data Release 2 includes parallax measurements for > 1.3 BILLION sources
- Studies suggest a significant systematic offset of 30-50 μas in all Gaia parallaxes

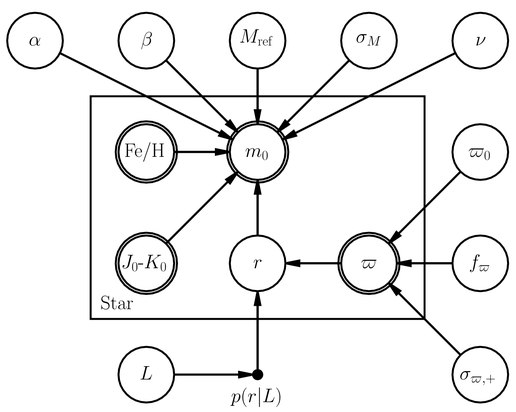


Red Clump Modelling

- We construct hierarchical probabilistic models for the zero point parallax ϖ_0
- Red clump star apparent magnitudes (m) are related to observed parallax (ϖ) through the distances to each star

$$m - M = 5\log(r) - 5$$

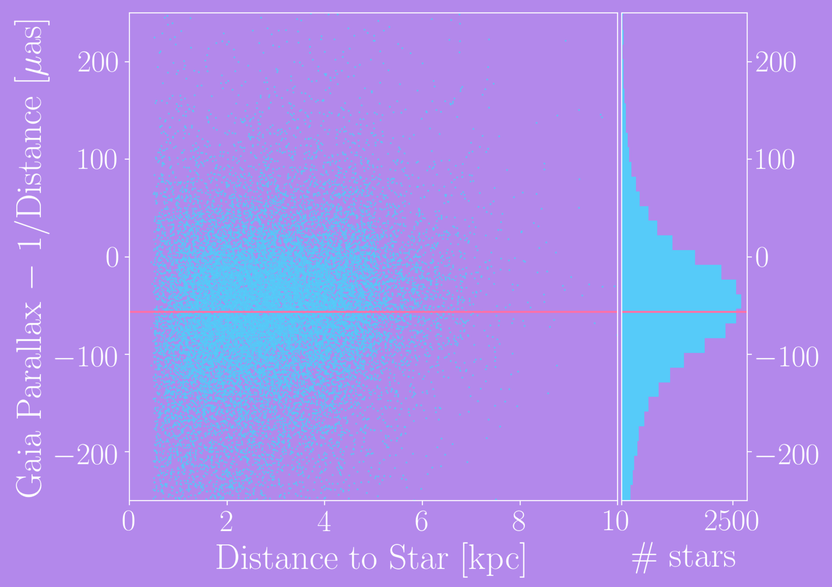
$$\text{Parallax} = 1/r + \varpi_0$$



- Red clump luminosity is modelled with linear metallicity and colour dependence and following a Student's t-distribution

Gaia Zero Point Parallax

- The *Gaia* zero point parallax is inferred to be ϖ_0 = -49 ± 1 μas with the full sample
- Accurate distances from *Gaia* offer insight to stellar modelling and distance scales
  - Concrete local distance anchors would solidify local Hubble constant (H_0) measurements
- Manuscript in prep., and planned for submission later this summer

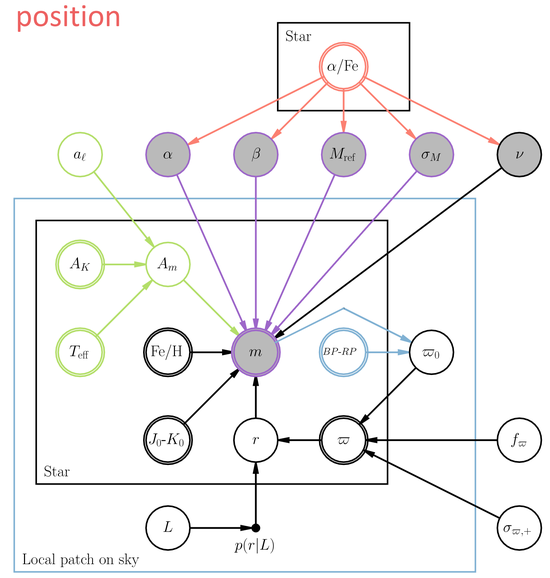


Probabilistic measurements of distances to red clump stars reveals a **systematic offset** of **-49 ± 1 μas** in Gaia DR2 parallaxes.

Learn More!

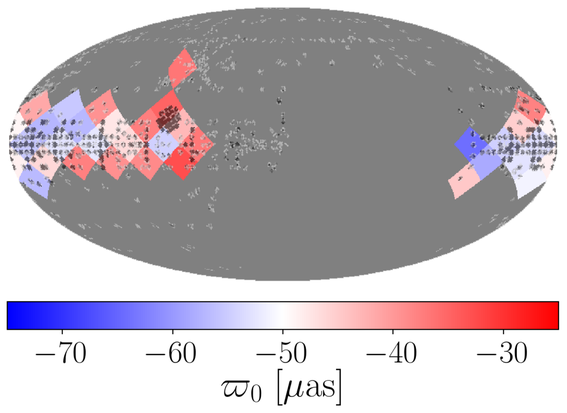
Extended Modelling

- Can model zero point dependence on observed magnitude, colour, and sky position



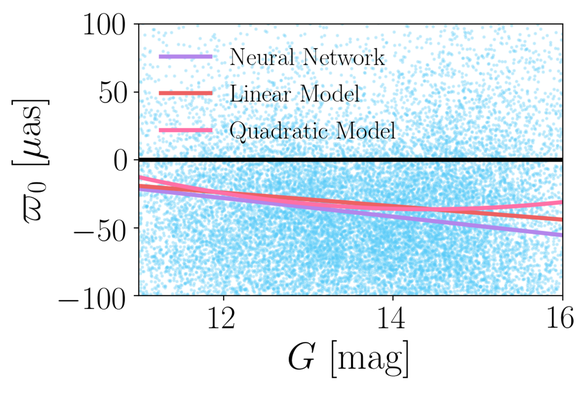
Sky Position Dependence

- The zero point's variation along the Galactic disk can be analyzed by dividing the sky into patches with the most stars



Apparent Magnitude Dependence

- Hierarchical modelling infers a slight dependence of the zero point parallax on the observed *Gaia* G band magnitude



References
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