

Just accepted in MNRAS!!!

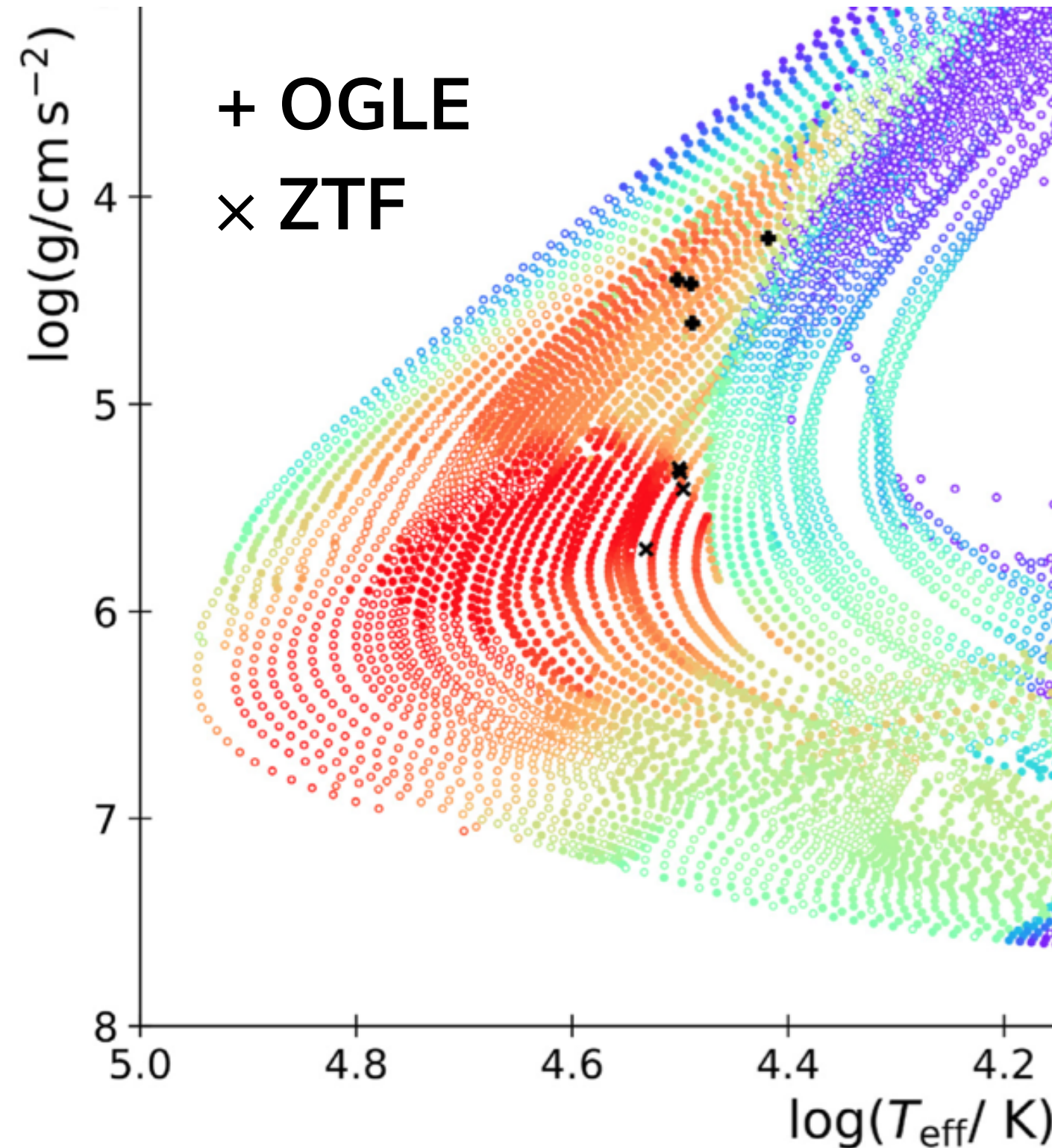
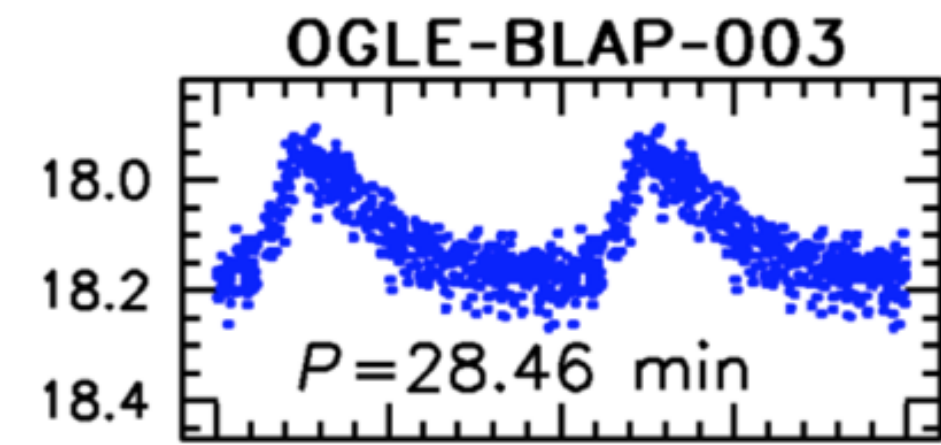
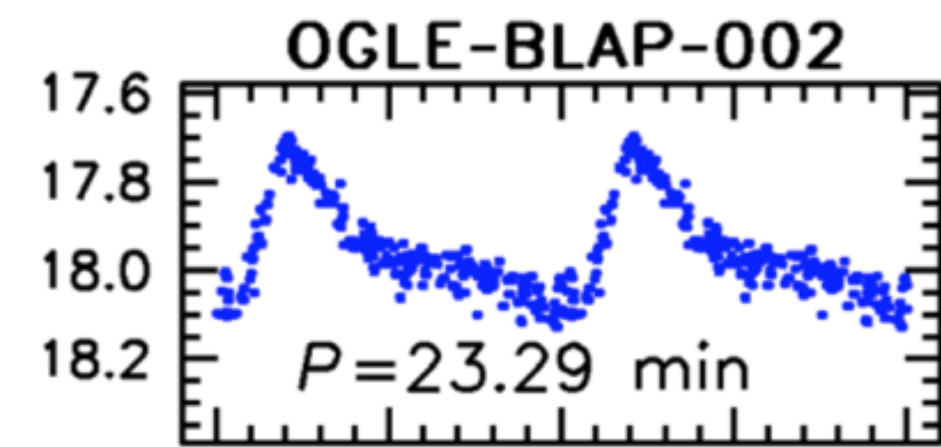
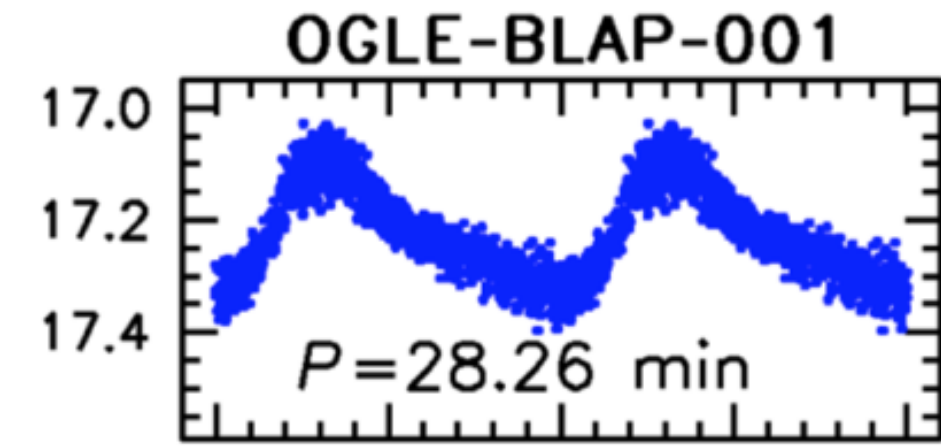
Preprint available here:  
(arXiv in coming days)

WARWICK  
THE UNIVERSITY OF WARWICK

# Detecting Blue Large-Amplitude Pulsators (BLAPs) with VRO LSST

Conor Byrne, Elizabeth Stanway (Warwick) & Jan Eldridge (Auckland)  
NAM 2021 / Bath / 21 July

# Blue Large-Amplitude Pulsators (BLAPs)



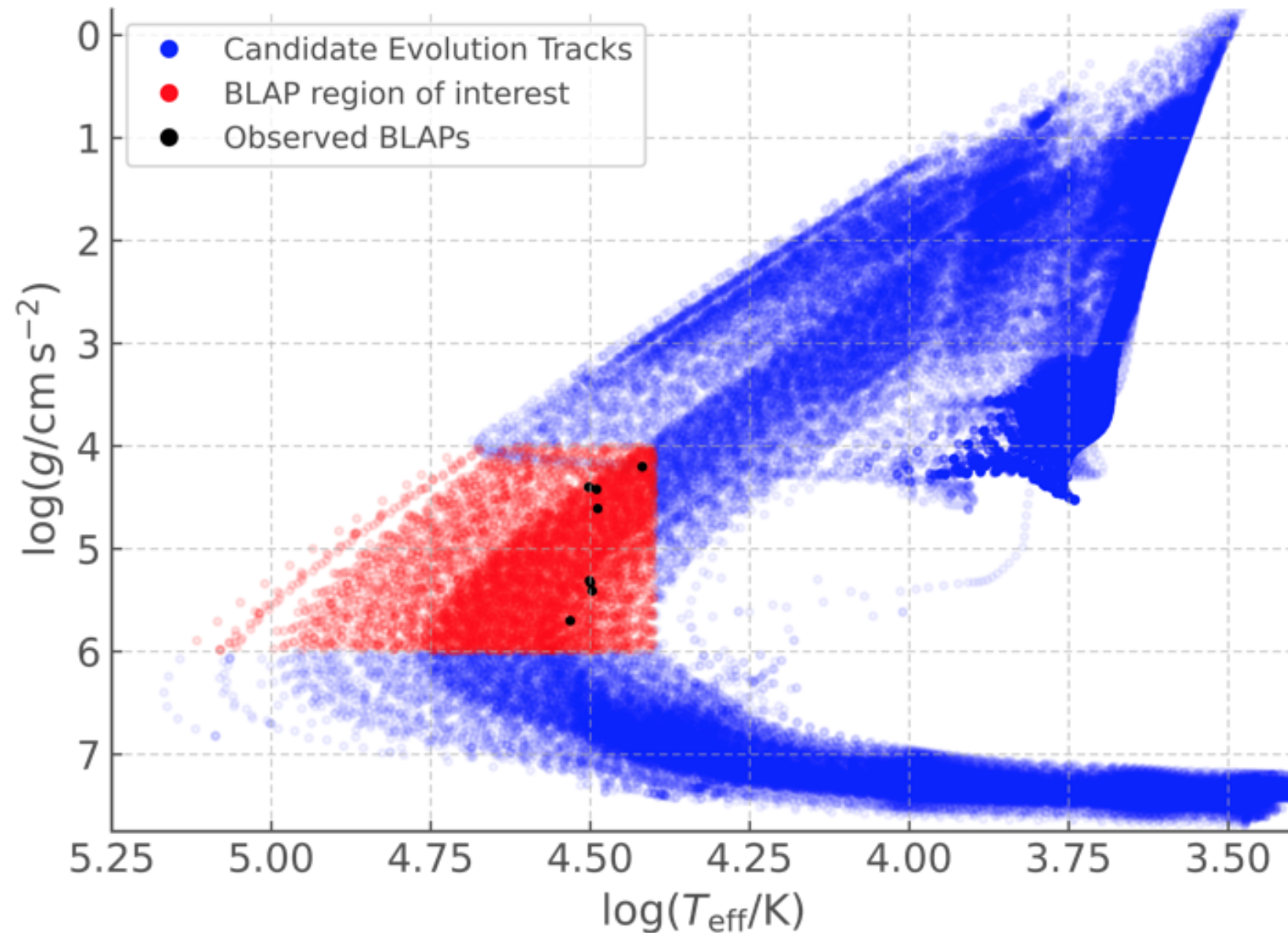
These will be detected by wide-area all-sky surveys such as VRO LSST

# Binary Population and Spectral Synthesis (BPASS)

- BPASS Version 2.2.1 (Stanway & Eldridge 2018)
- Include detailed stellar evolution models of single and binary stars, including the consequences of mass transfer
- Stellar population is synthesised with stars from 0.1 to 300 solar masses with a variety of IMFs and a binary parameter distribution from Moe & Di Stefano (2017)
- Examining the detailed stellar models enables identification of stars with structures comparable to BLAPs
- Applying BPASS to BLAPs is a useful test of its capabilities in a low mass regime

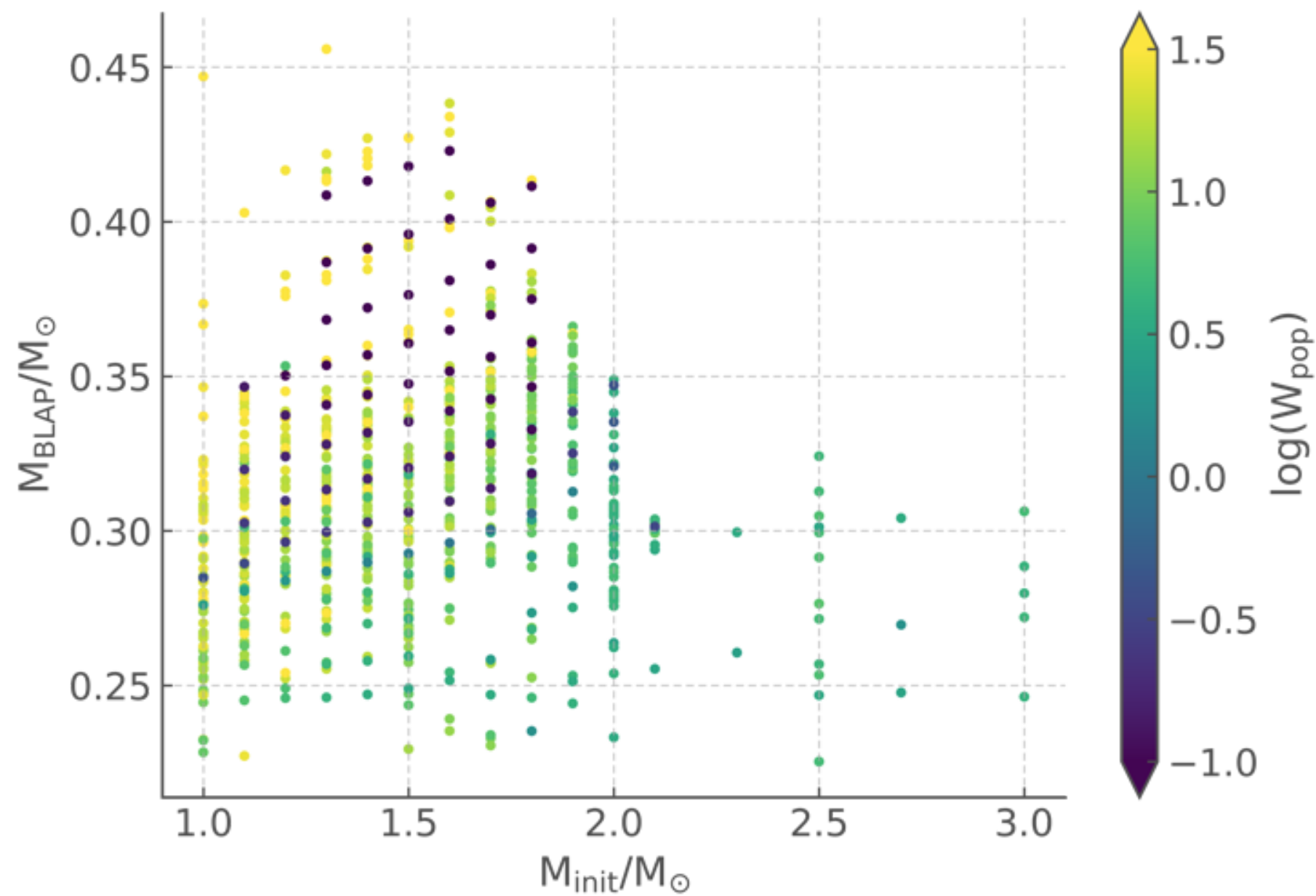


# Model selection



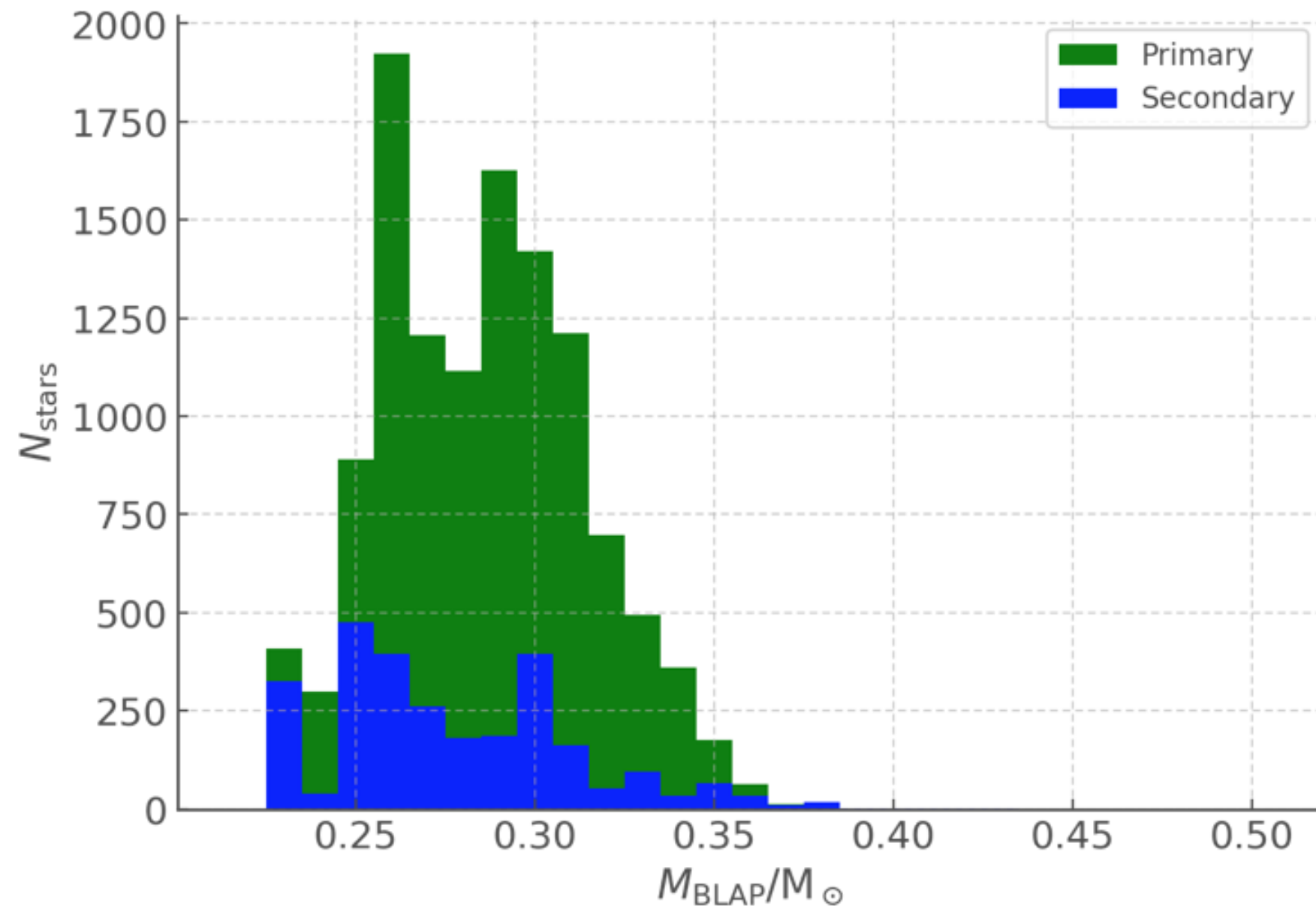
- Apply Selection Criteria
  - Temperature and Gravity
  - Stellar Mass
  - Age
  - Stellar Structure
- 754 Stellar models identified
  - All selected models come from binary systems
  - Most are primary stars (MS companions) but there are also secondary stars (with compact companions) in the sample

# Weighting of the population



- Lower initial masses are preferred
  - IMF used is broken power-law (Kroupa 2001)
- More massive BLAPs systems more heavily weighted
  - Require mass transfer lower on RGB to get lower mass pre-WDs
- Most progenitors have initial masses between 1  $M_{\odot}$  and 2  $M_{\odot}$ 
  - BLAP masses vary between 0.23  $M_{\odot}$  and 0.45  $M_{\odot}$

# Properties of the population

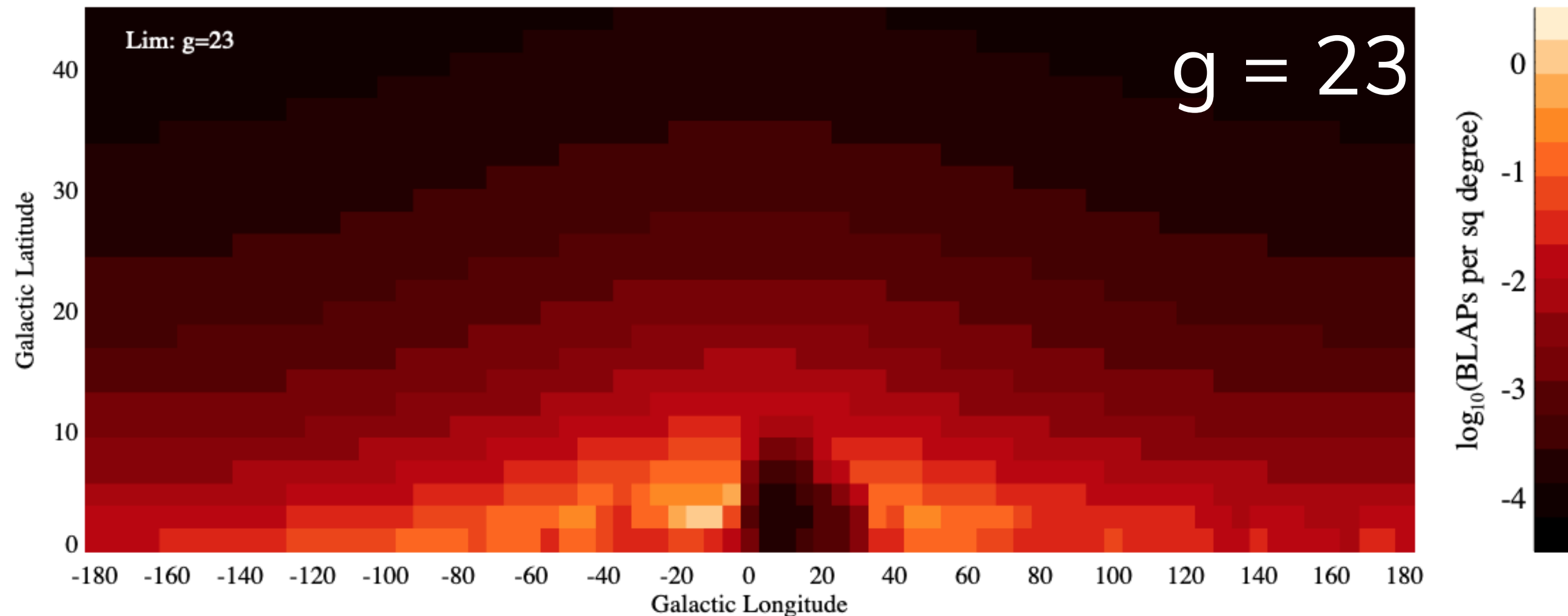


Mass Distribution

- Assume a constant star formation rate of  $3 M_{\odot}/\text{yr}$
- Combine each model's age, lifetime in the region and population weighting to determine the current population
- Total of 11,931 BLAPs in the Milky Way
- Two peaks in the mass distribution
  - 0.26  $M_{\odot}$  (ZTF BLAPs)
  - 0.29  $M_{\odot}$  (OGLE)
- Larger samples from VRO LSST will be able to confirm bimodality

# Estimating sky surface density

- Create a toy model of MW and distribute BLAPs as a thin disk population
- Include dust extinction (Amôres & Lépine 2005)
- Assume an absolute g-band magnitude of 4.0 (Ramsay 2018)



# Conclusions

- Mass distribution of BLAPs/low-mass pre-WDs shows 2 peaks
  - The gap between the two observed groups has some physical basis
- Population statistics estimate 12,000 BLAPs in the Milky Way
  - Most of these have low mass MS companions, which may be challenging to detect
- Most likely to be found close to the Galactic Plane
  - Sky coverage of VRO LSST will still allow significant number of detections out of the plane
- Thanks for your attention!

Paper: <https://tinyurl.com/blaps-bpass>

Conor.Byrne@warwick.ac.uk