The Radii of Main Sequence M Dwarfs

Sam Morrell, Tim Naylor
Email: smorrell@astro.exeter.ac.uk

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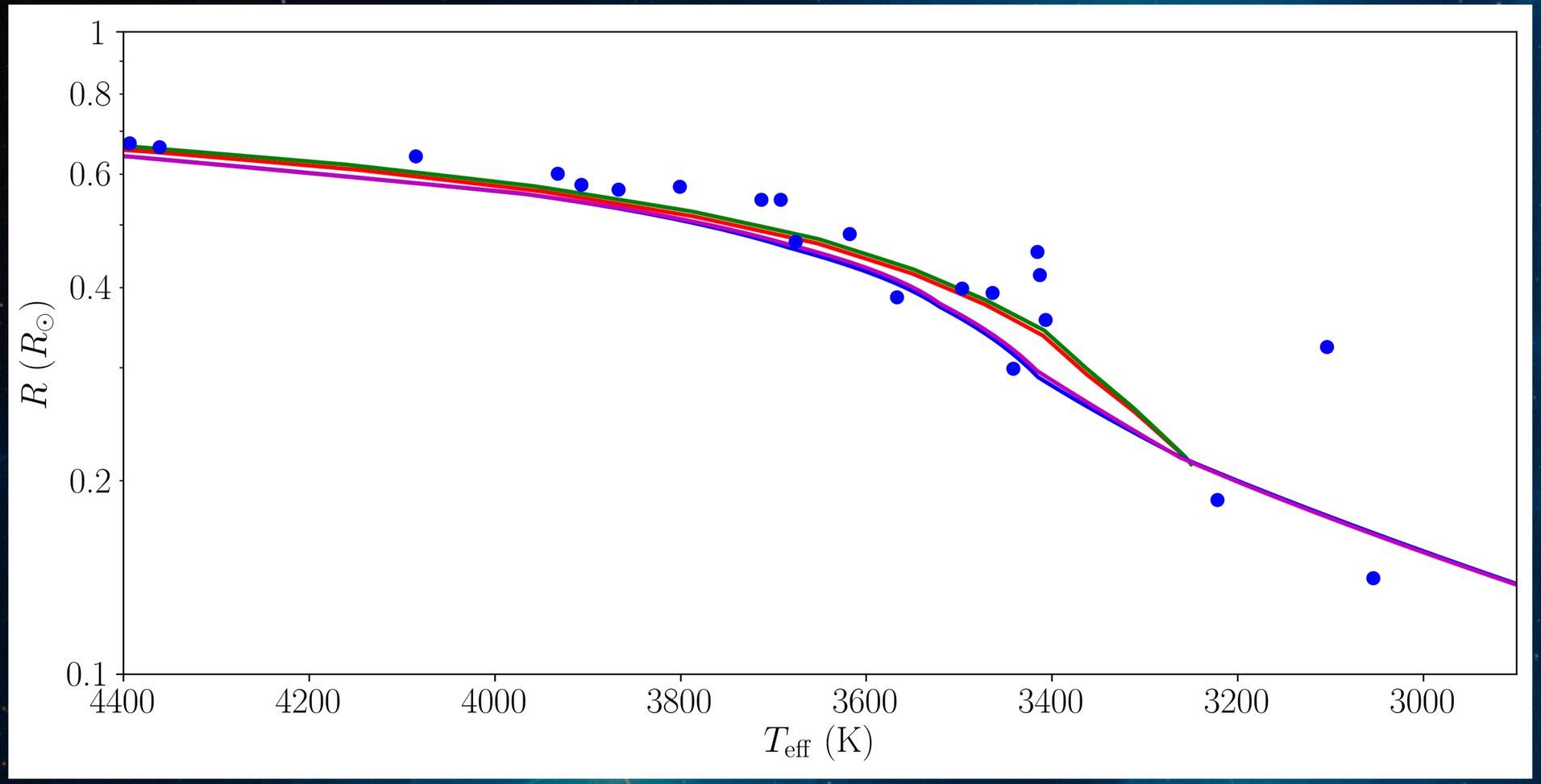
Interferometric Radii



Baraffe et al. 2015 – 1Gyr

Baraffe et al. 2015 – 4Gyr

Dotter et al. 2008 – 1Gyr

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Interferometric

Baraffe et al. (2015)
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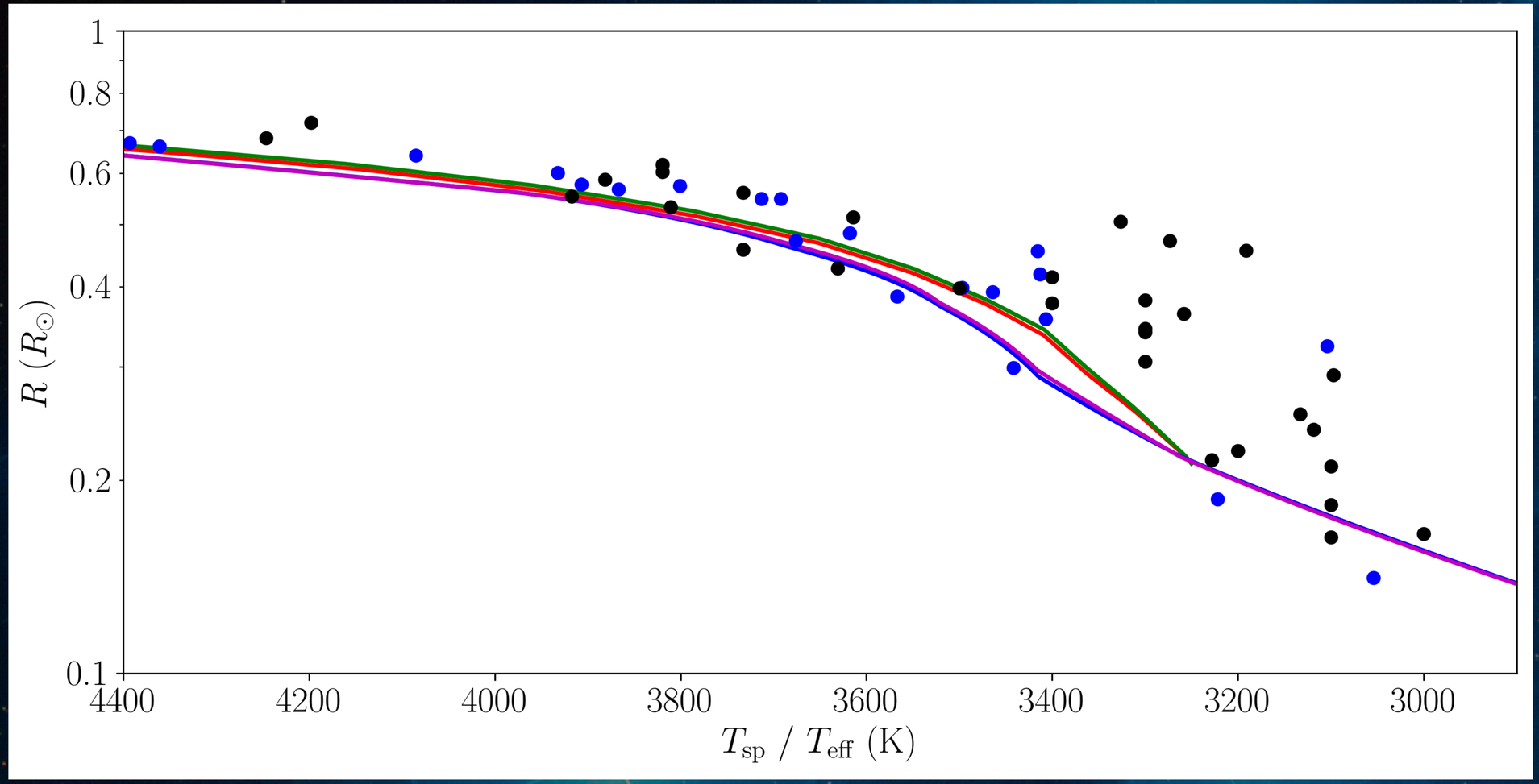
Boyajian et al. (2012)

Detached Eclipsing Binaries



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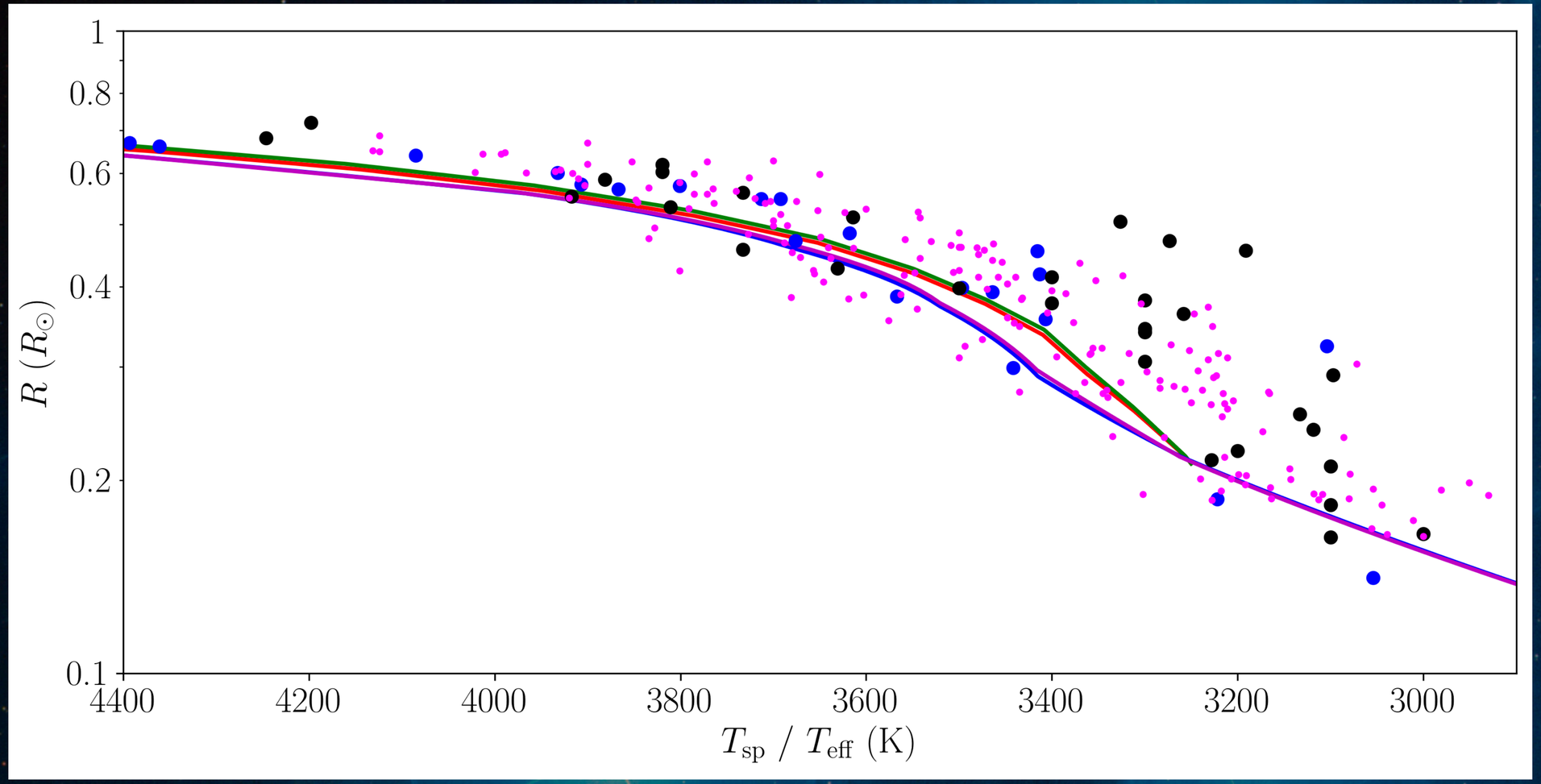
$L_{SED} + T_{SP}$



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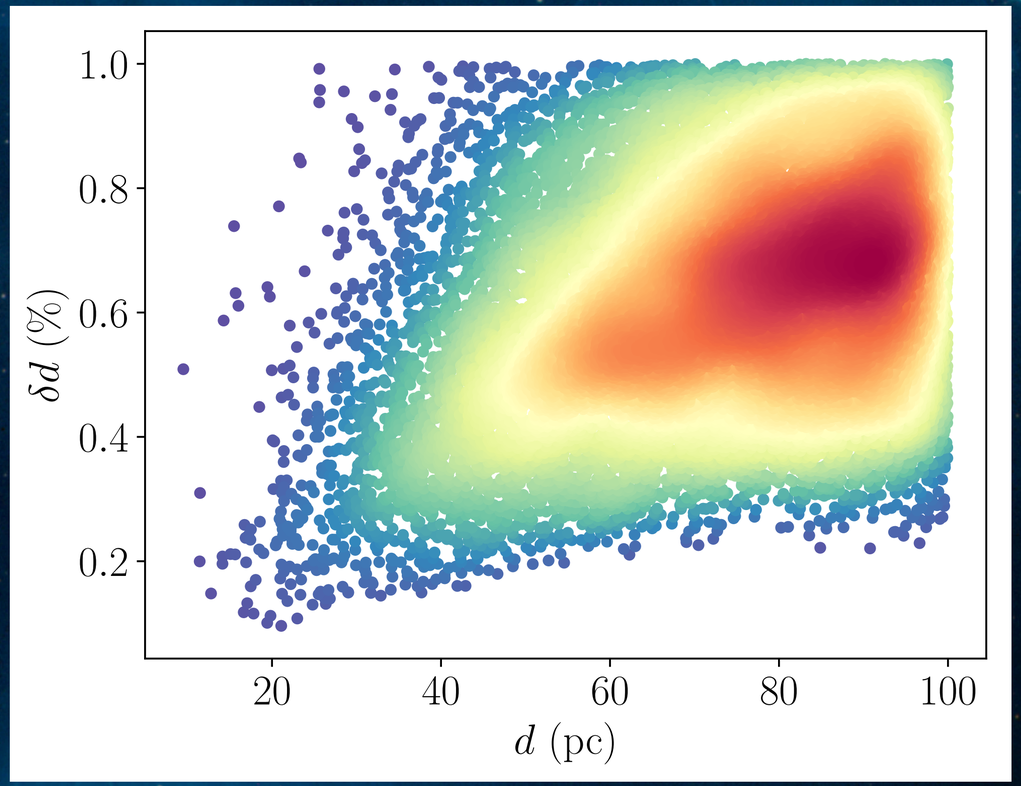
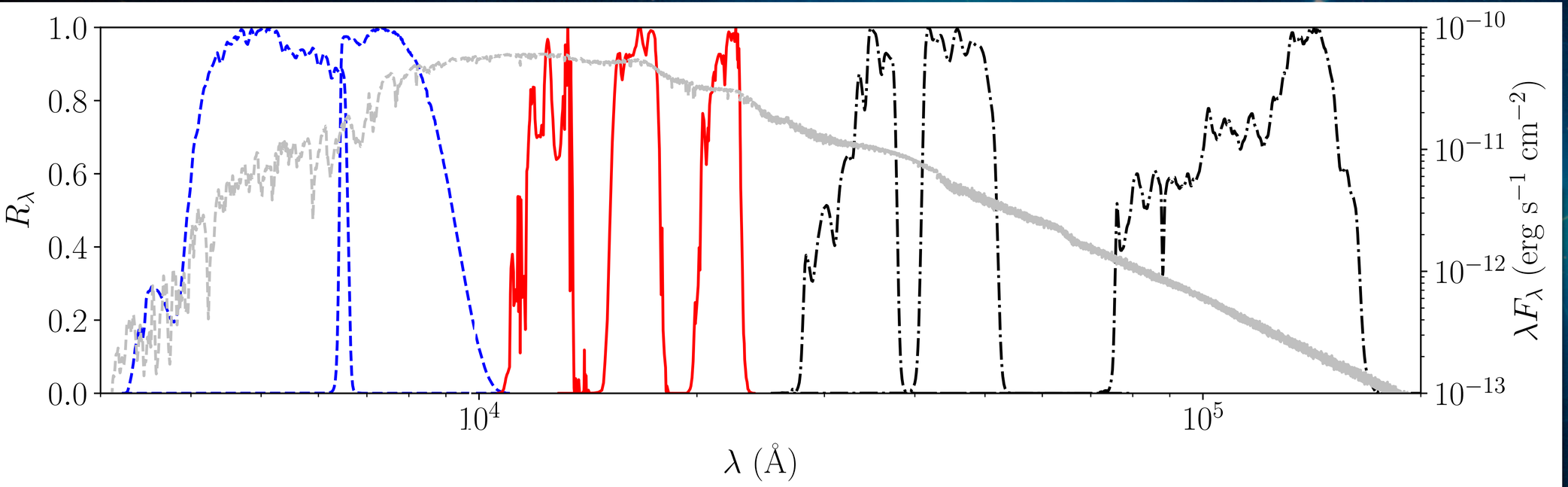
Distances

- This experiment is now possible, thanks to the Gaia DR2 parallaxes.
- We use the geometric distances of Bailer-Jones et al. (2018), as they do a Bayesian treatment using reasonable priors and correctly deal with asymmetries in uncertainties.



Photometry



Gaia DR2

- $G_{BP} - G_{RP} > 1.5$

2MASS

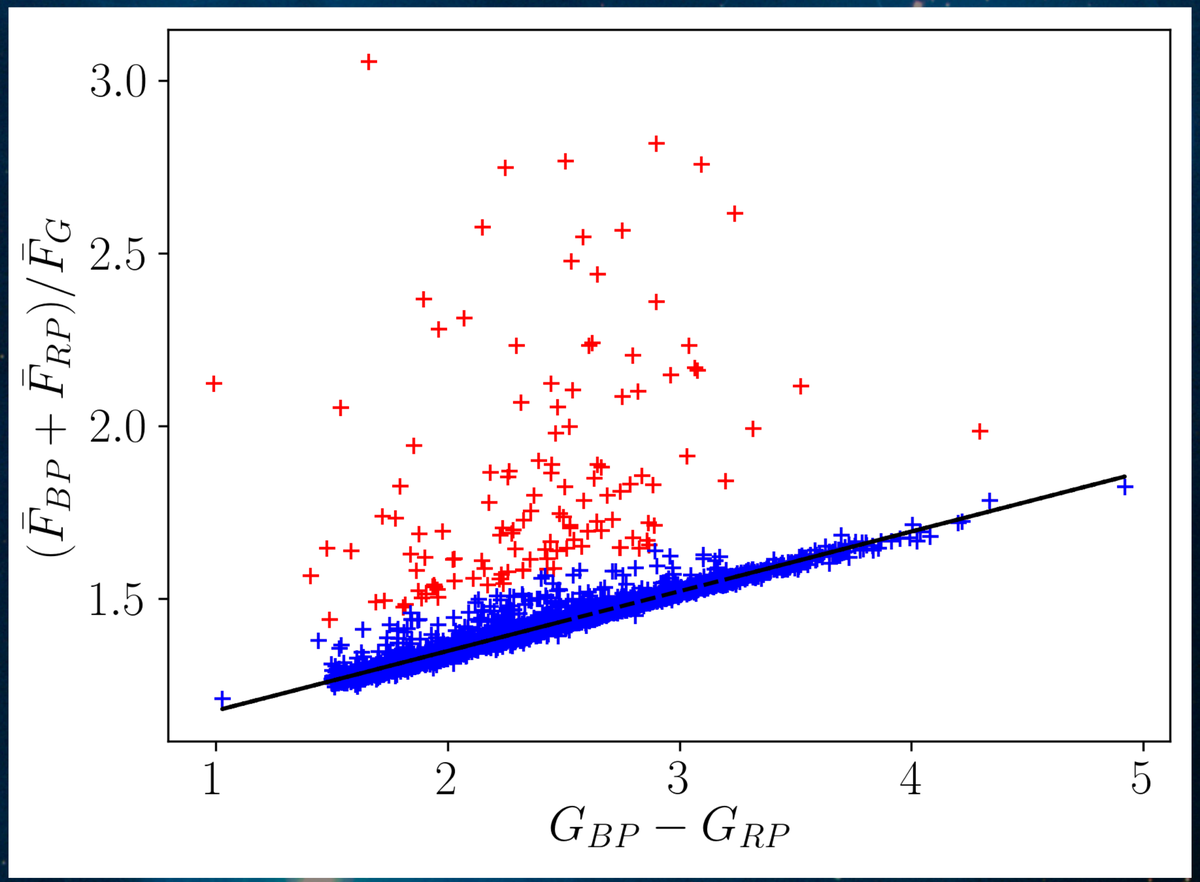
- $SNR_J \geq 10$
- $SNR_H \geq 10$
- $SNR_{Ks} \geq 10$

AllWISE

- Contamination Free
- Point Source
- $\delta W3 < 5\%$
- $SNR_{W1} > 3$
- $SNR_{W2} > 3$
- $SNR_{W3} > 3$

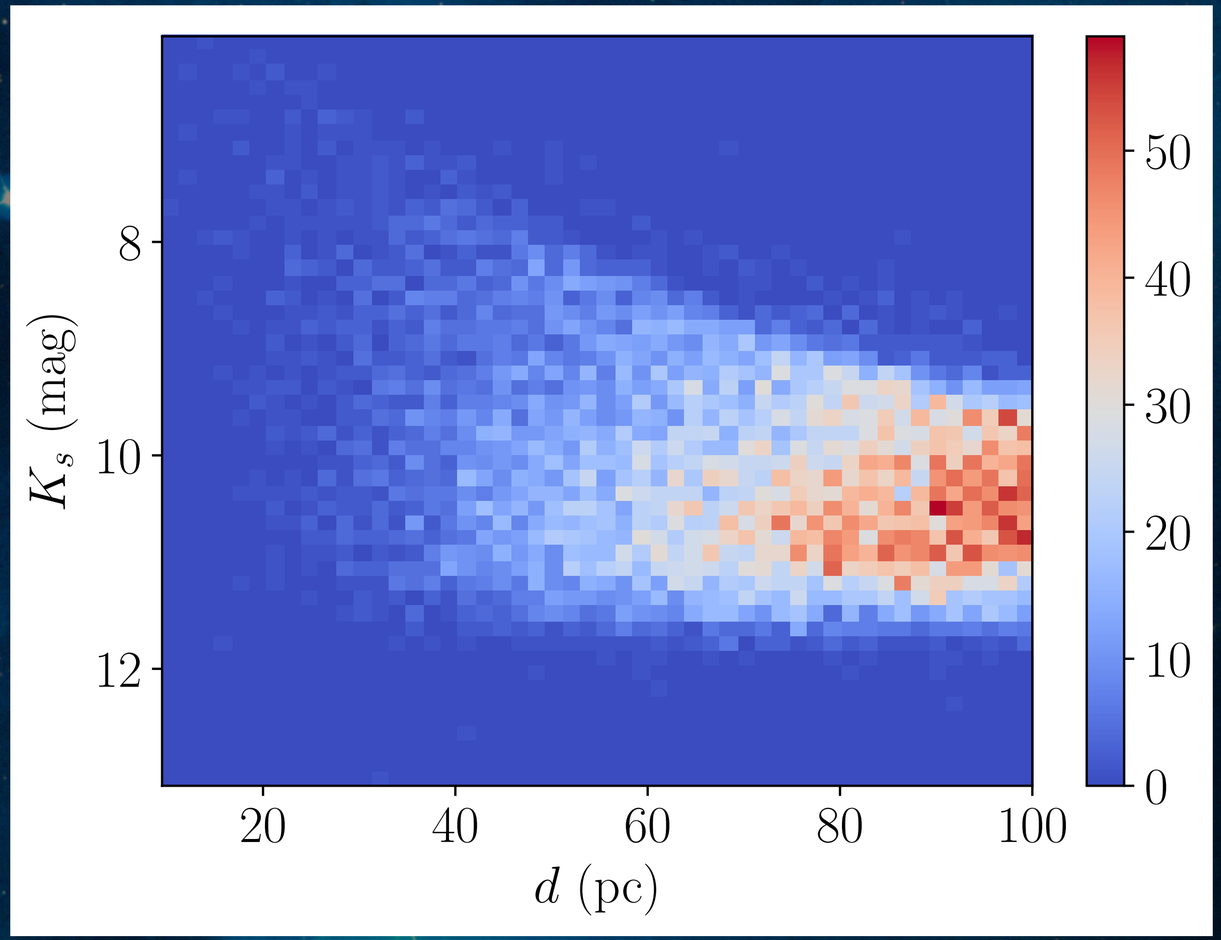
Flagging

- Further to stringent cuts on source catalogues. We assemble flags using Gaia data to further constrain the sample.
- We follow the methodology of Evans et al. (2018).
- We flag poor photometry using the by sigma clipping in the flux excess ratio space (right).
- We also account poor astrometry by flagging those with large values of astrometric χ^2.

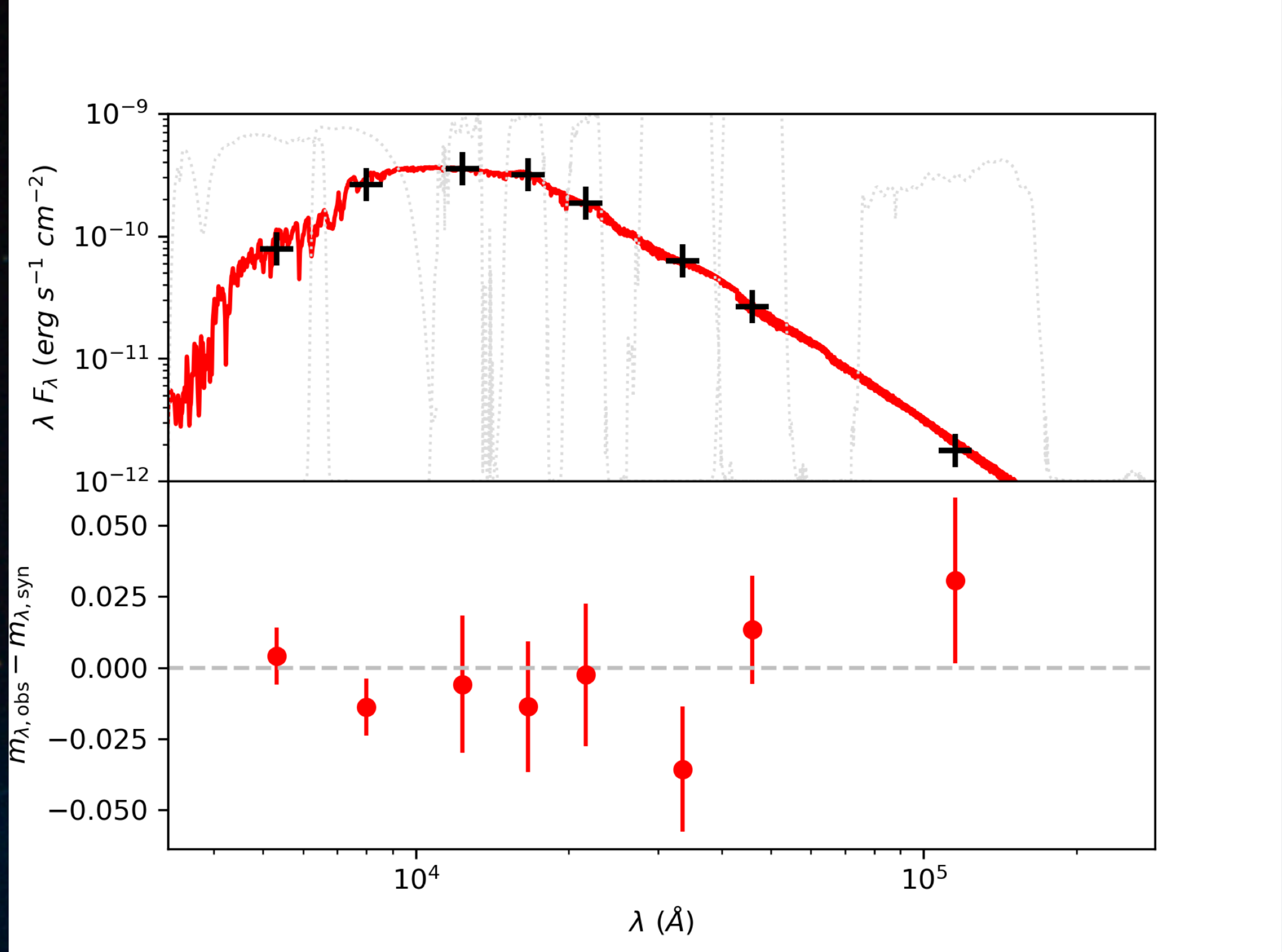


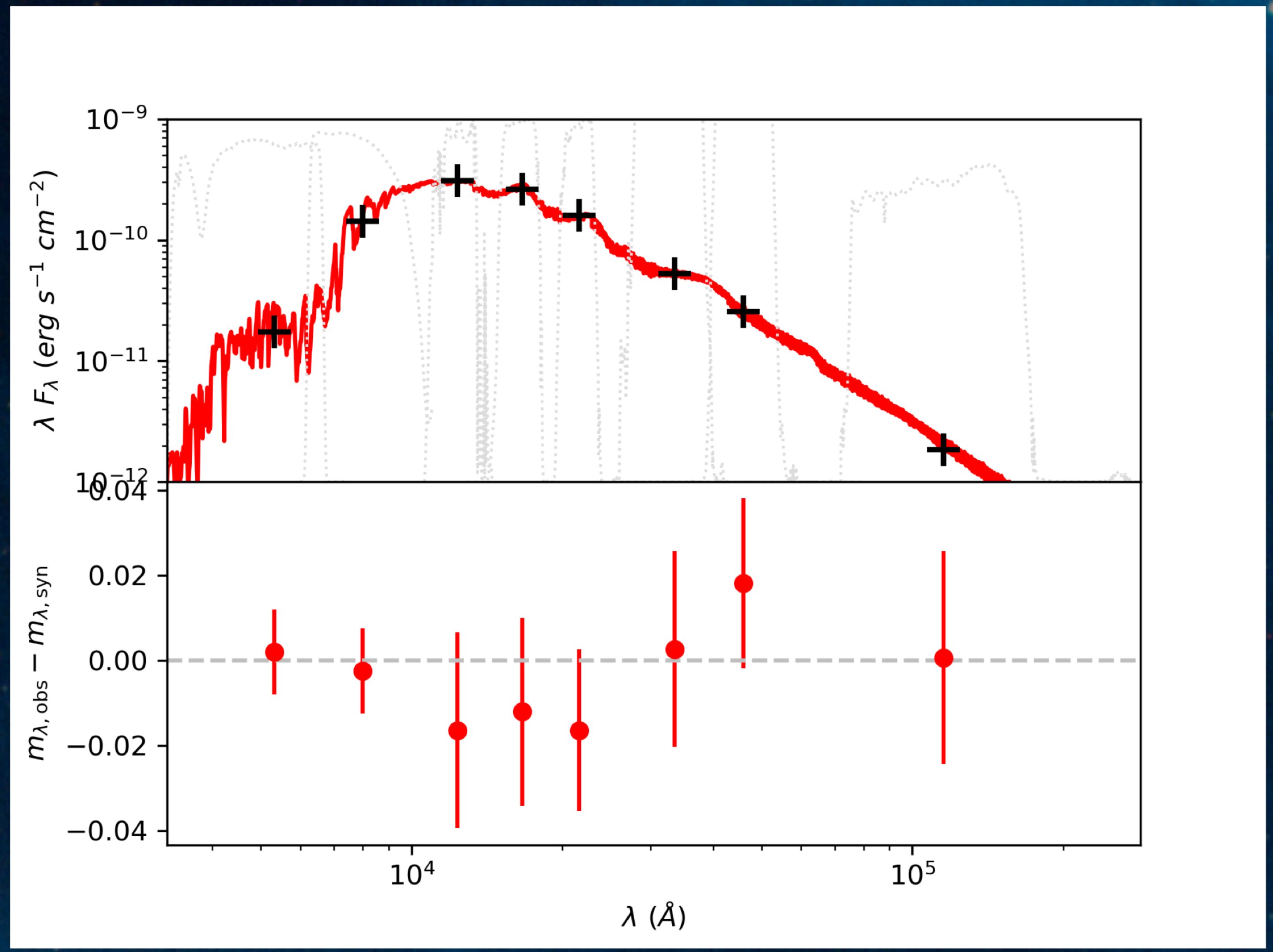
Final Input Catalogue

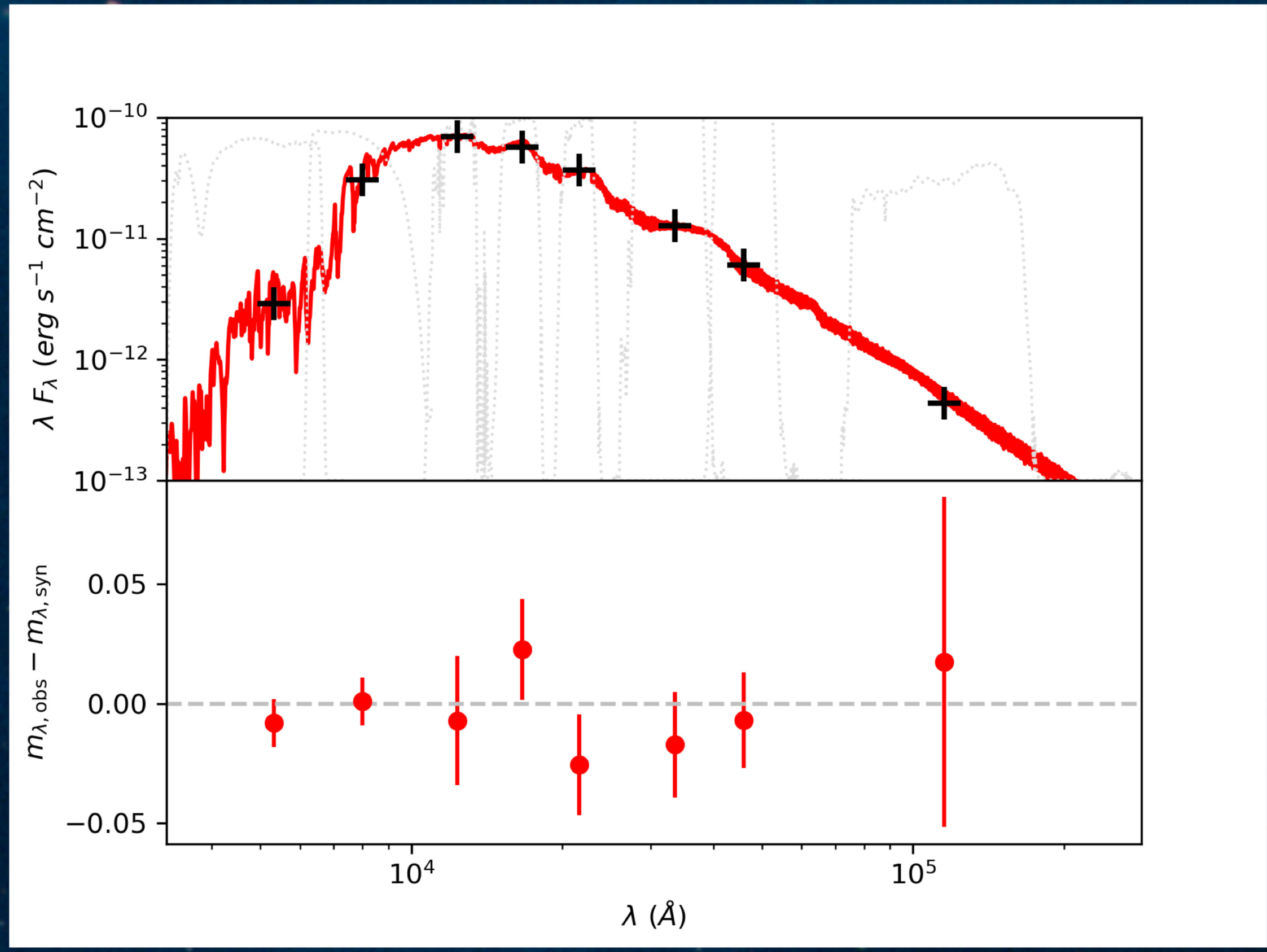
- Robust distances with uncertainties <1%.
- Stringent cuts on photometry to ensure reliability.
- Post processing flags to further cut down the sample.
- When removing flagged stars, the final catalogue totals 15,350 stars.



SED Fitting

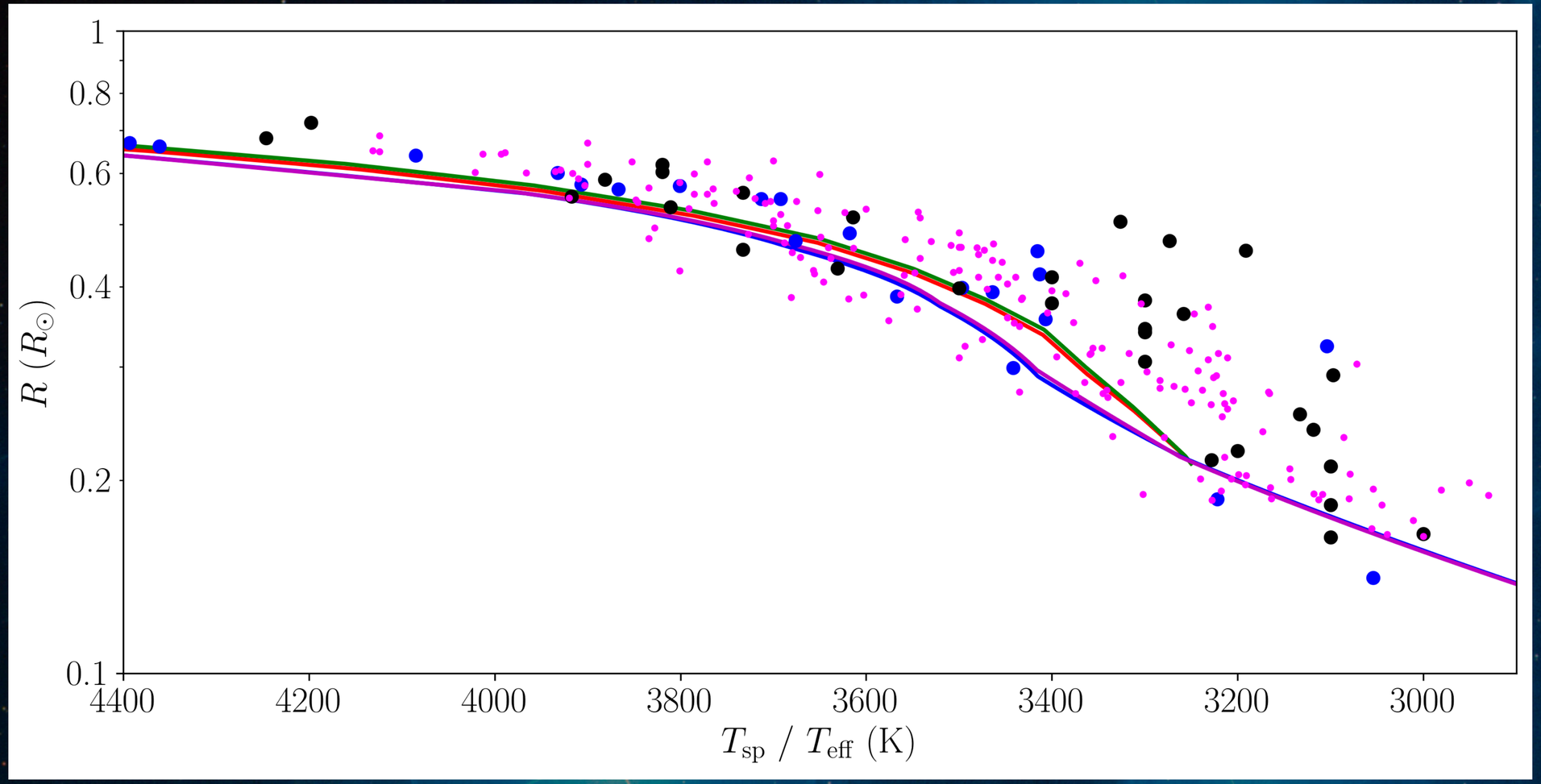






- The bands that we adopt allow us to fit in the optical with Gaia DR2 photometry, the blackbody peak with 2MASS and the Rayleigh-Jeans tail with AllWISE.

$L_{SED} + T_{SP}$



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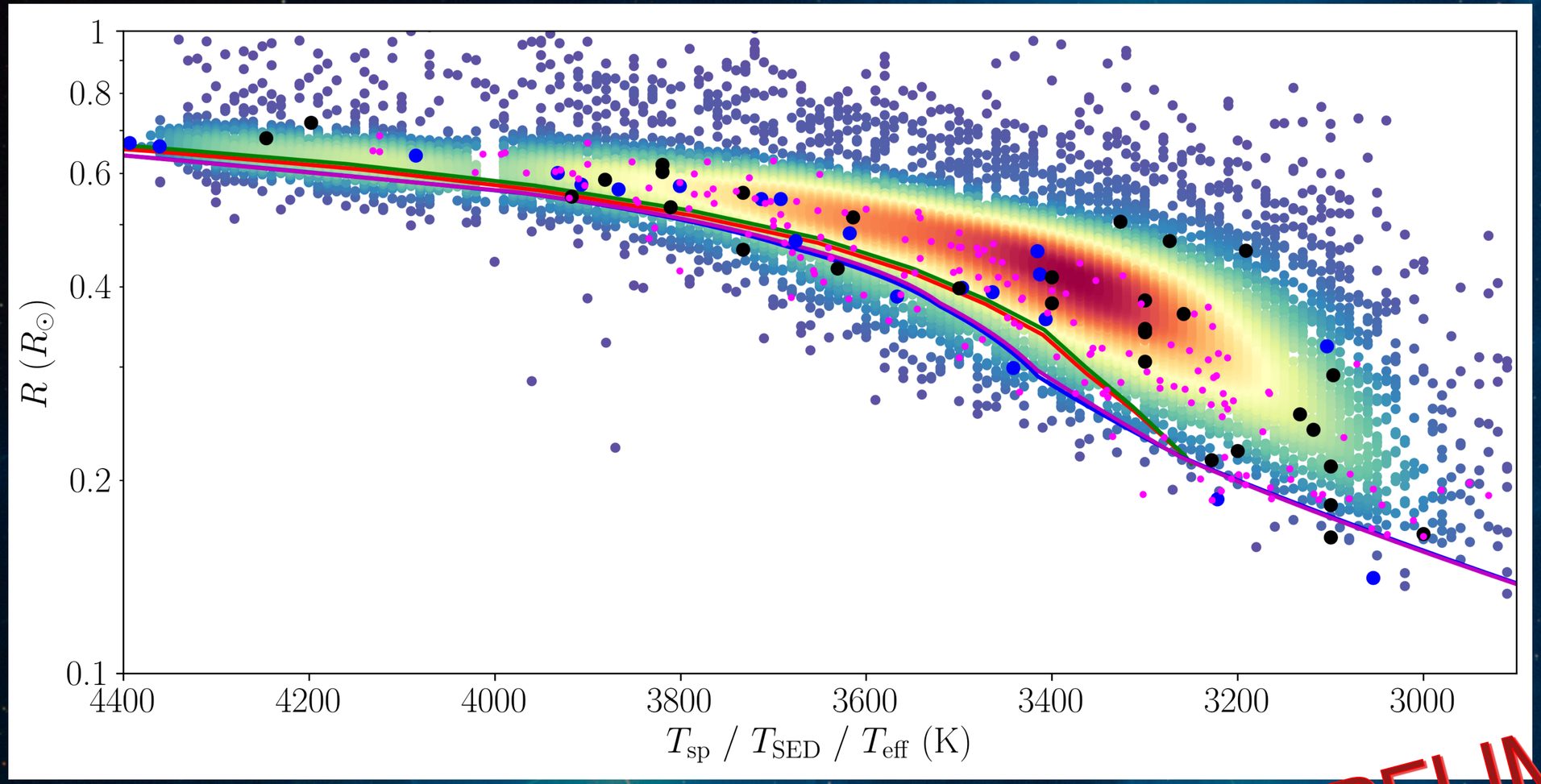
Our Sample



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Morrell & Naylor (in prep)

PRELIMINARY

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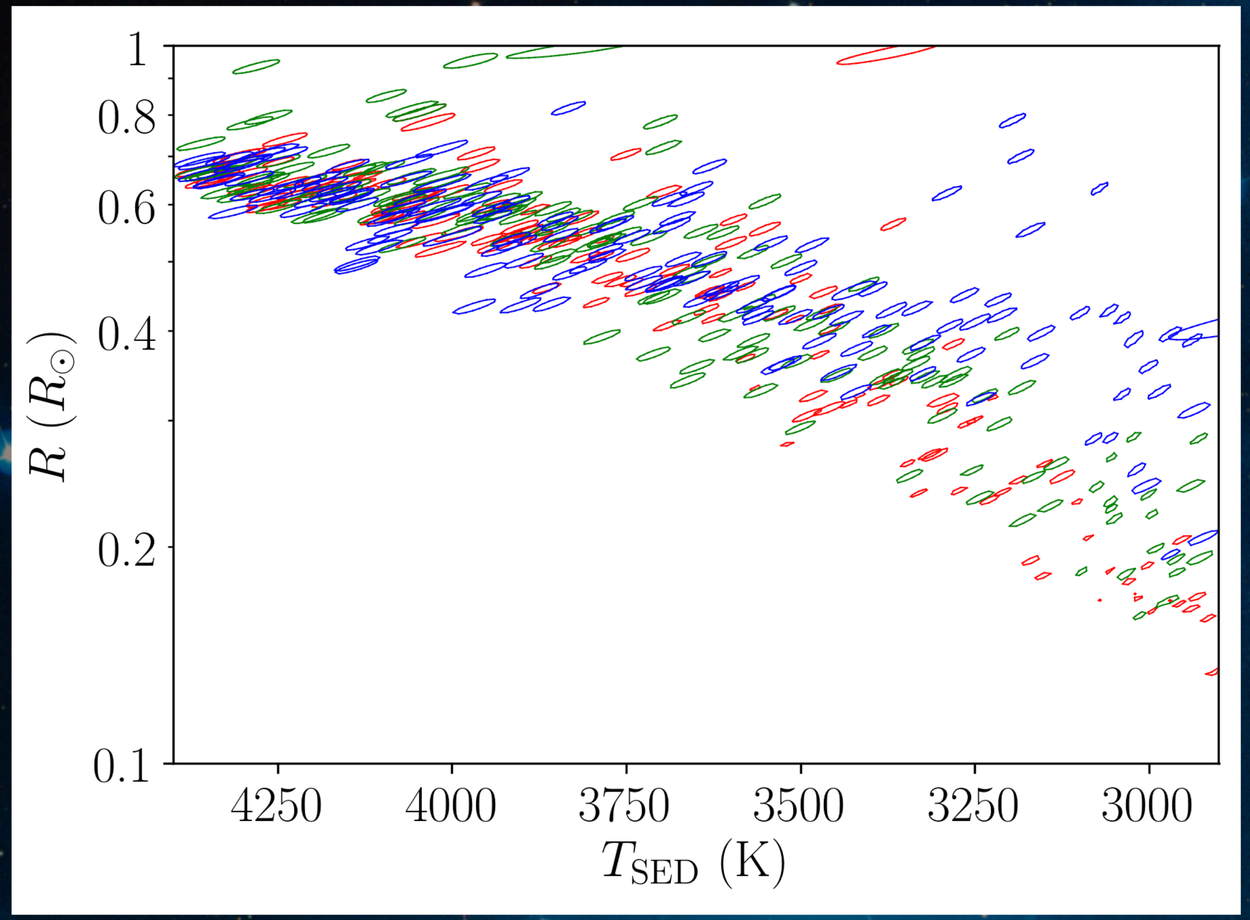
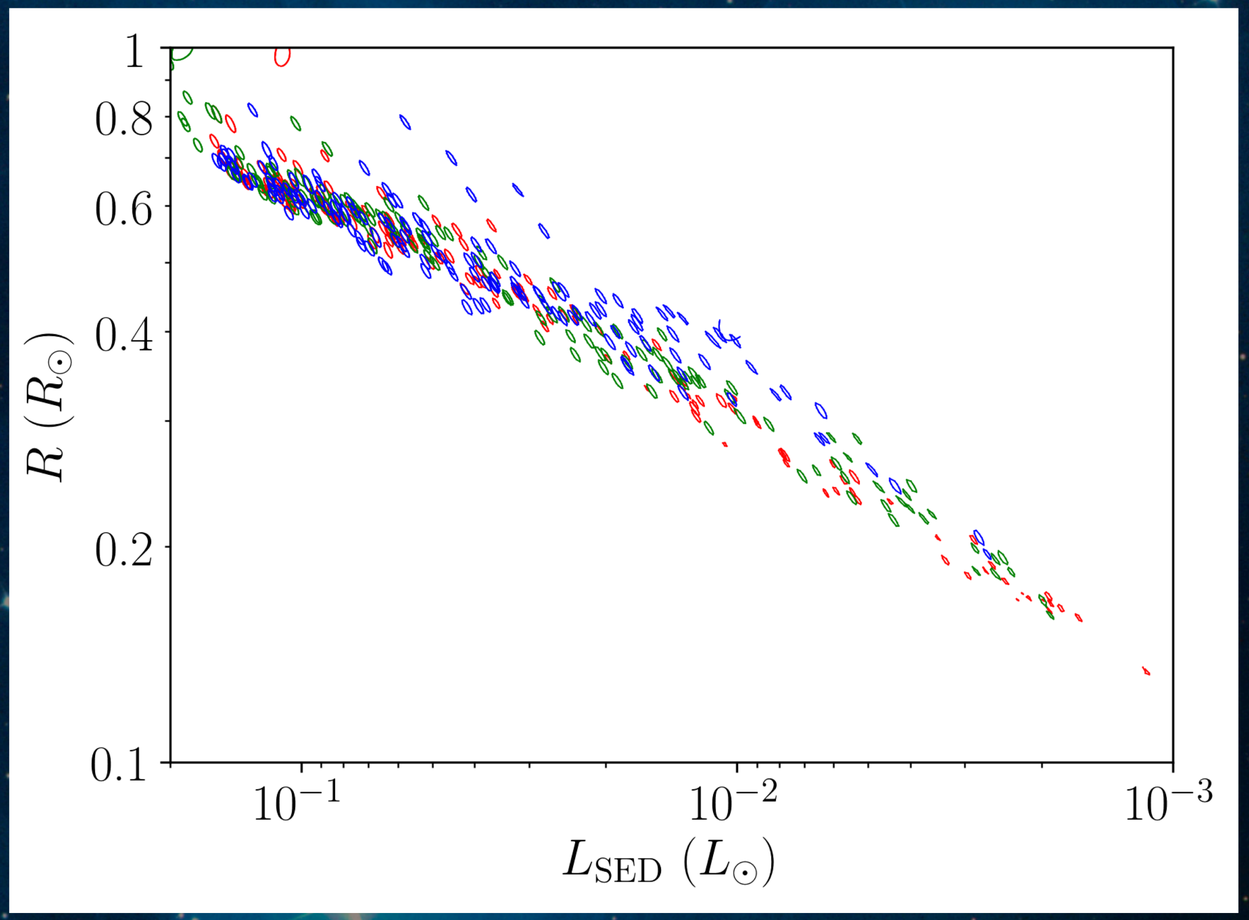
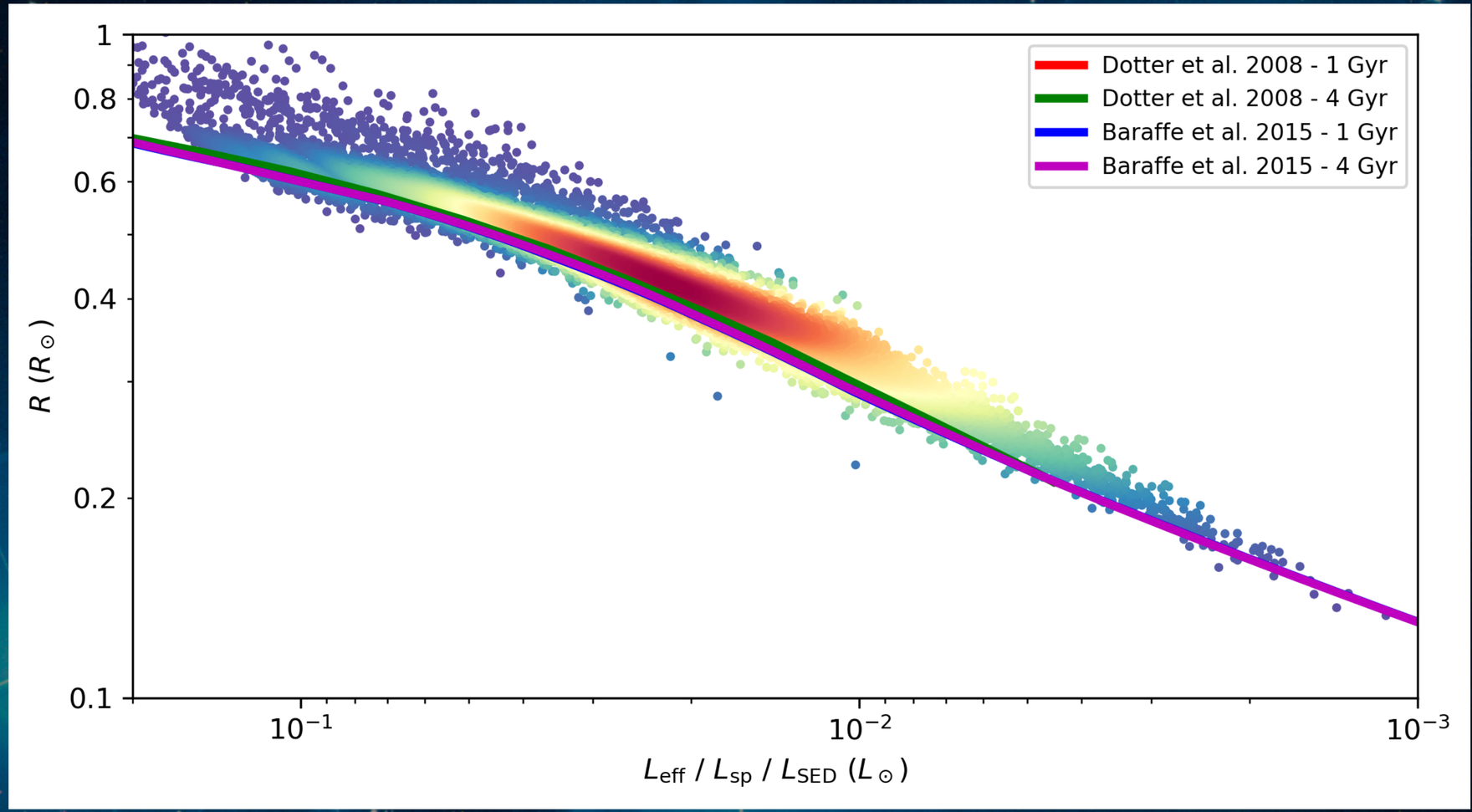
Correlation in the R – T_{SED} R – L_{SED} Plane





Radius Distribution

- By plotting in the luminosity – radius plane, we avoid correlations between the axes, showing the true extent of the radius distribution.
- Radii of early main sequence M dwarfs are inflated by an average of 10%.
- More importantly, the 10% scatter in radius means that an M dwarf sequence doesn't exist.

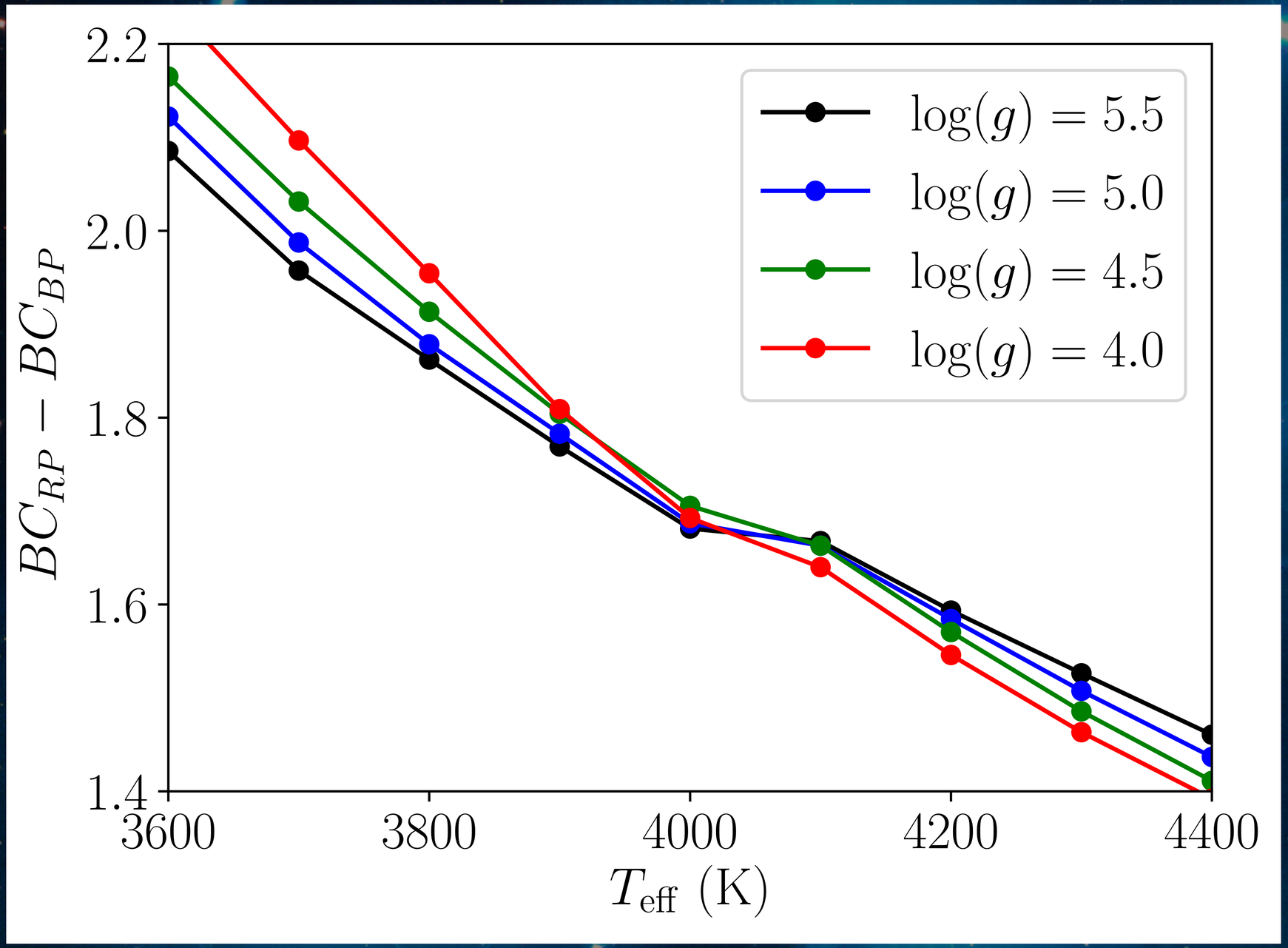


Conclusions

- There is an intrinsic physical scatter in M dwarf radii, meaning that **an M dwarf sequence doesn't exist**.
- We present an all-sky catalogue of over 15,000 main sequence, M dwarf stars with determinations of T_{SED} and R.
- Our T_{SED} appears cooler than the T_{sp} from Mann et al. (2015), which is also surprising given the good correlation Mann et al. found between T_{sp} and T_{eff}.
- Our paper is in preparation and will be submitted very soon.

Thank you for listening

Any questions?



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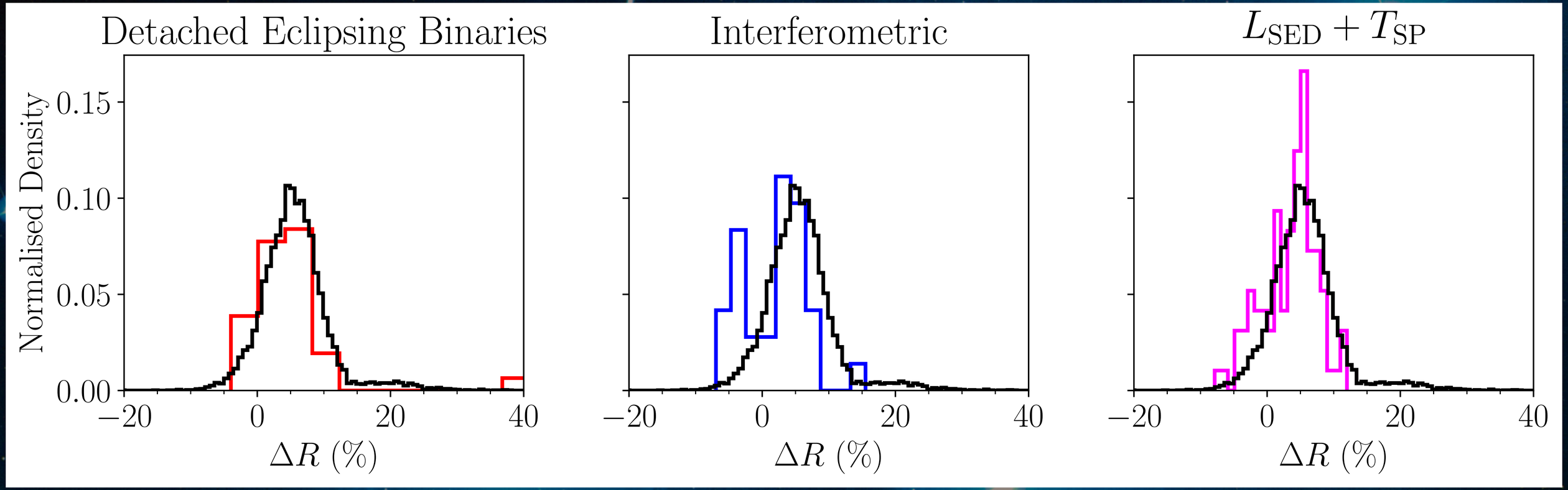
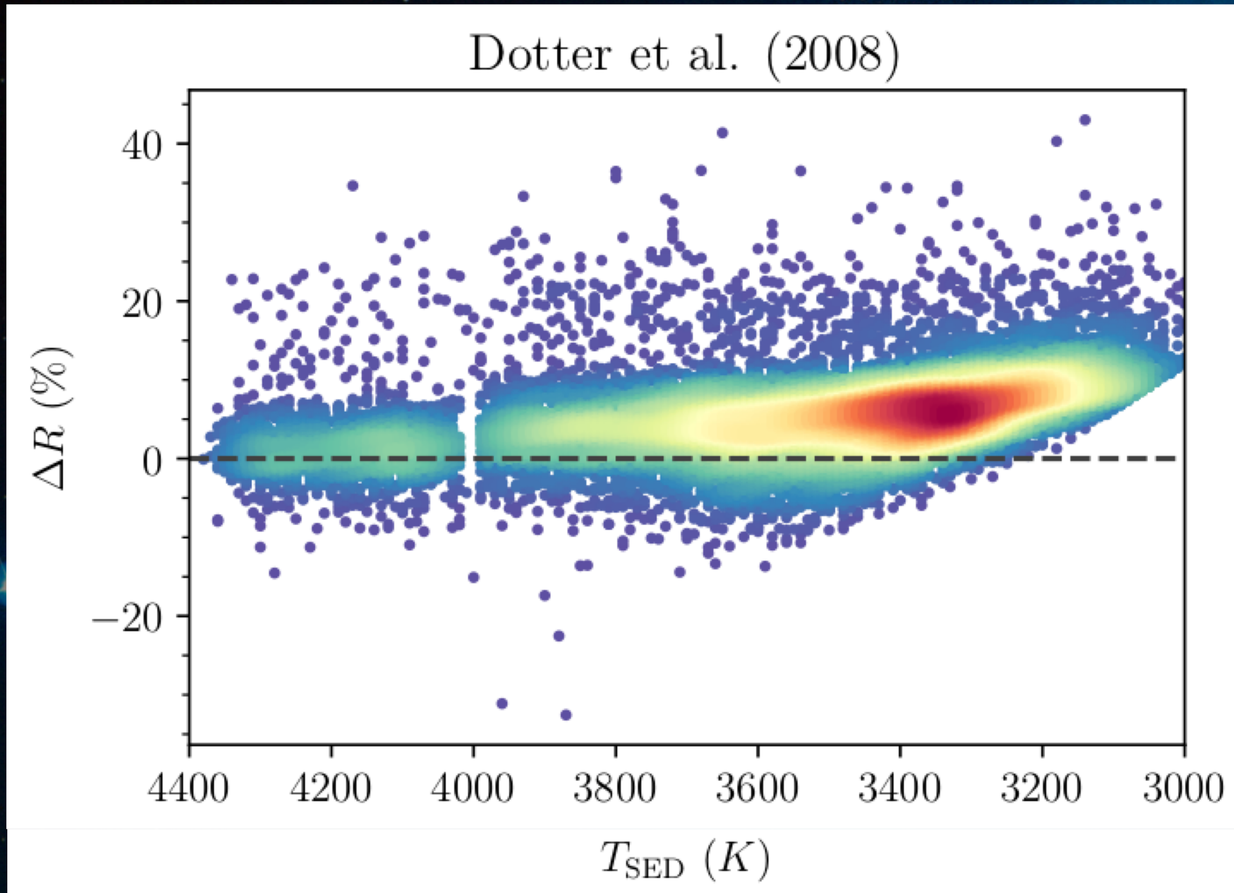
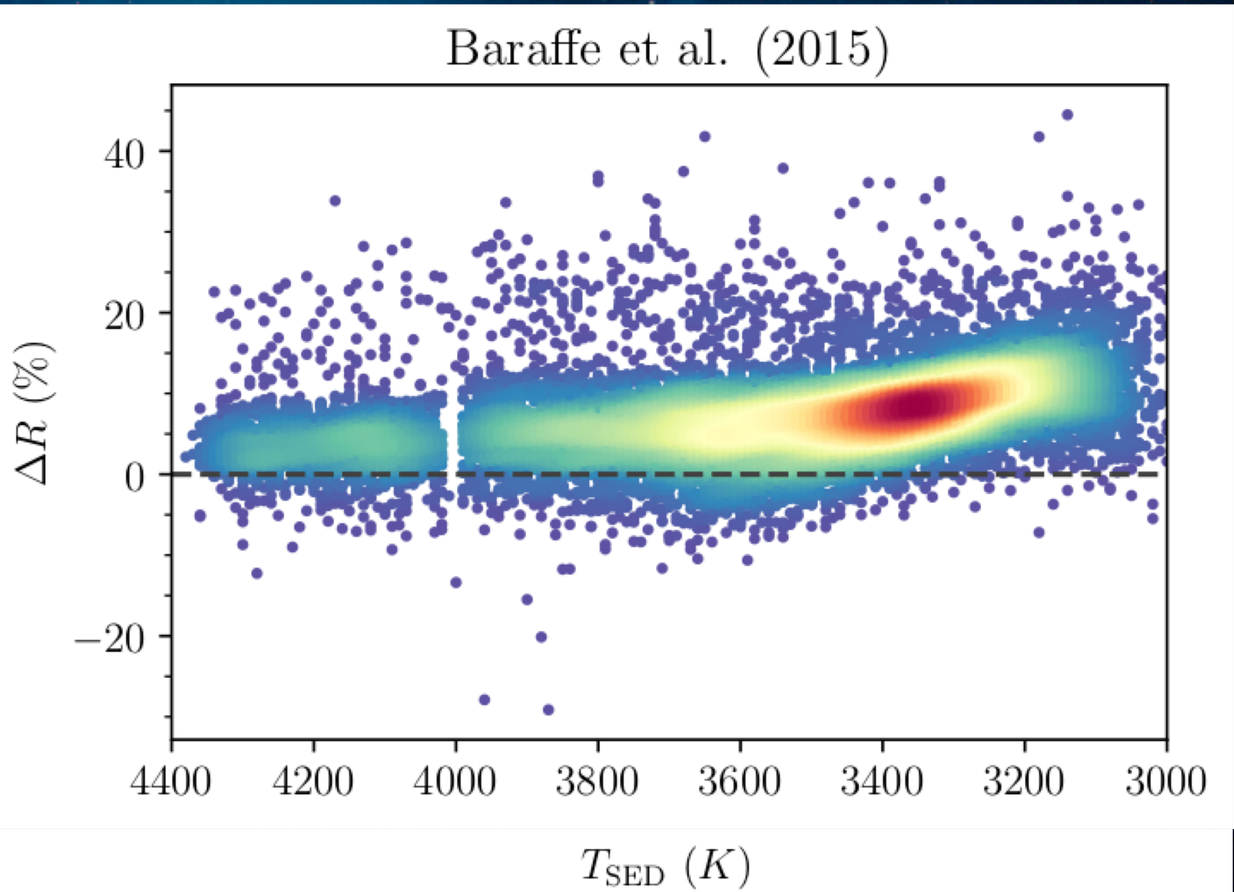
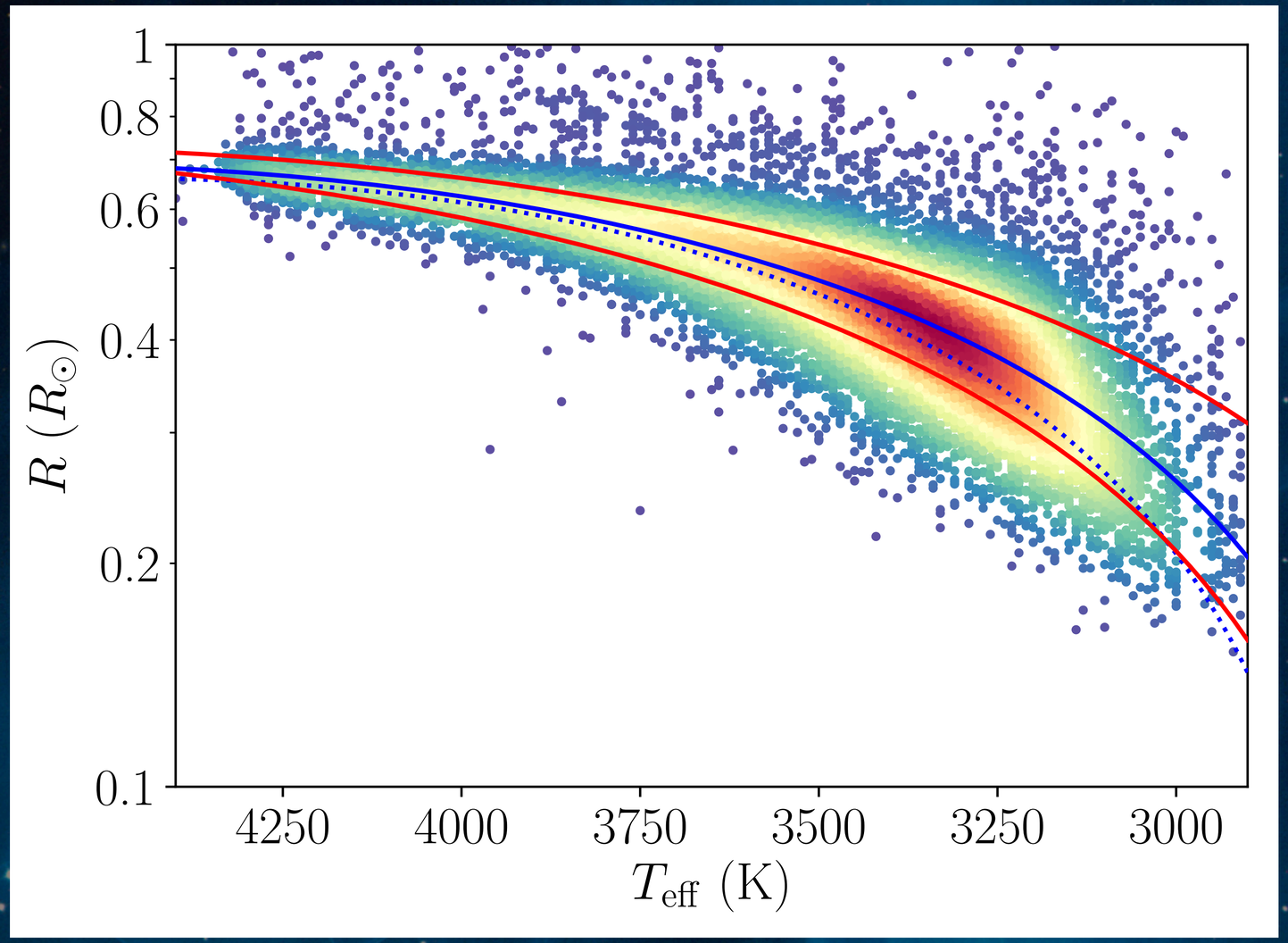






Subsolar Metallicities



Sky Coverage

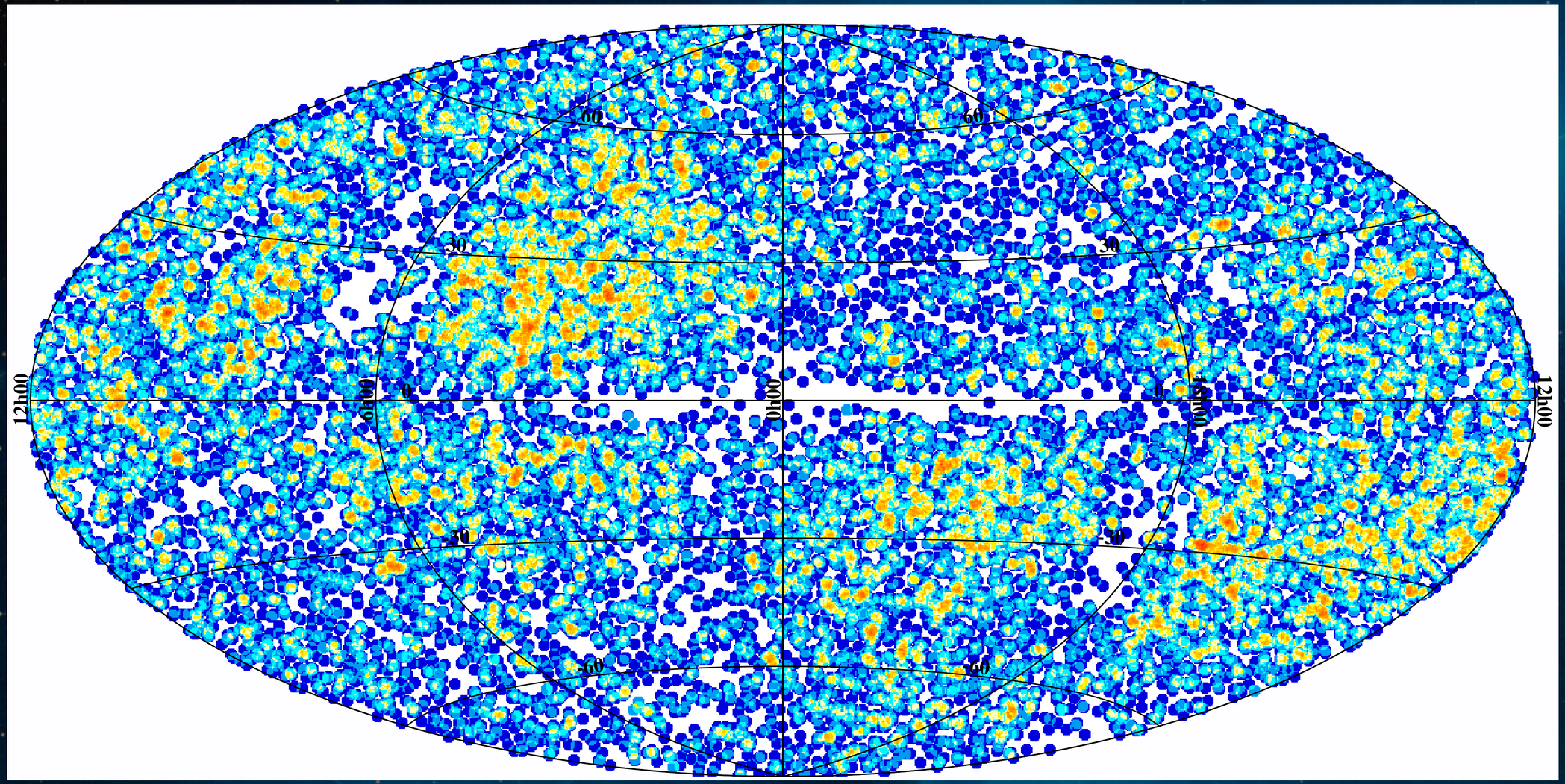


Image Credit: NASA, ESA and AURA/Caltech