

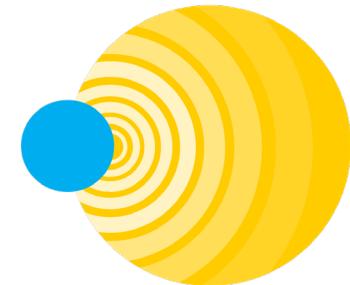
Signal Synchronization Strategies and Time Domain SETI with Gaia DR3

Andy Nilipour, James Davenport, Steve Croft



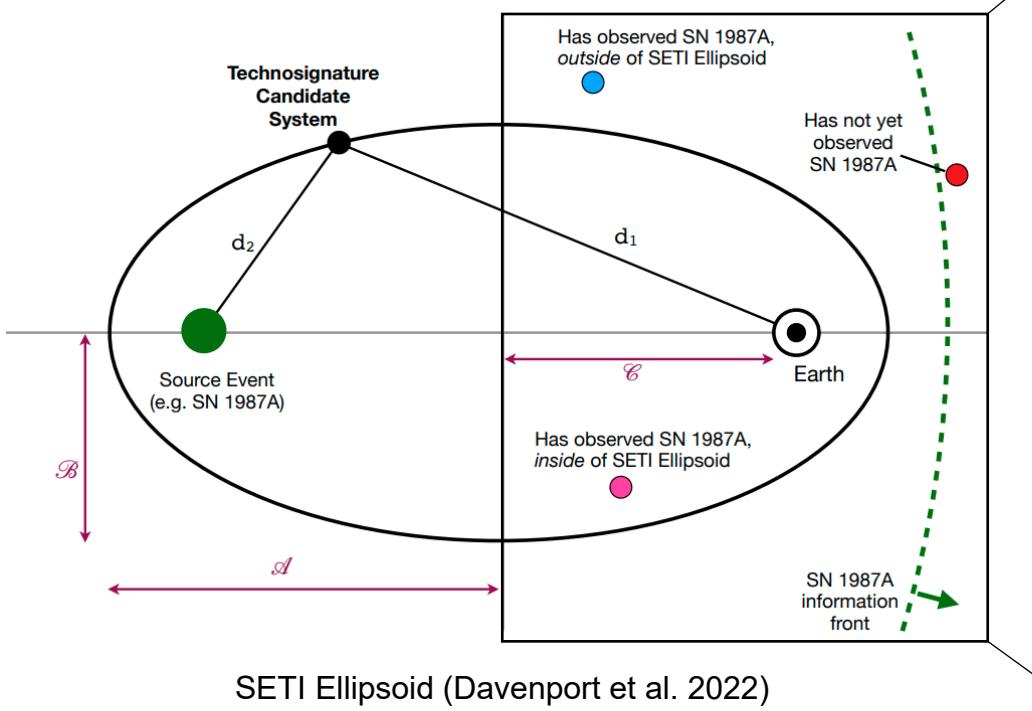
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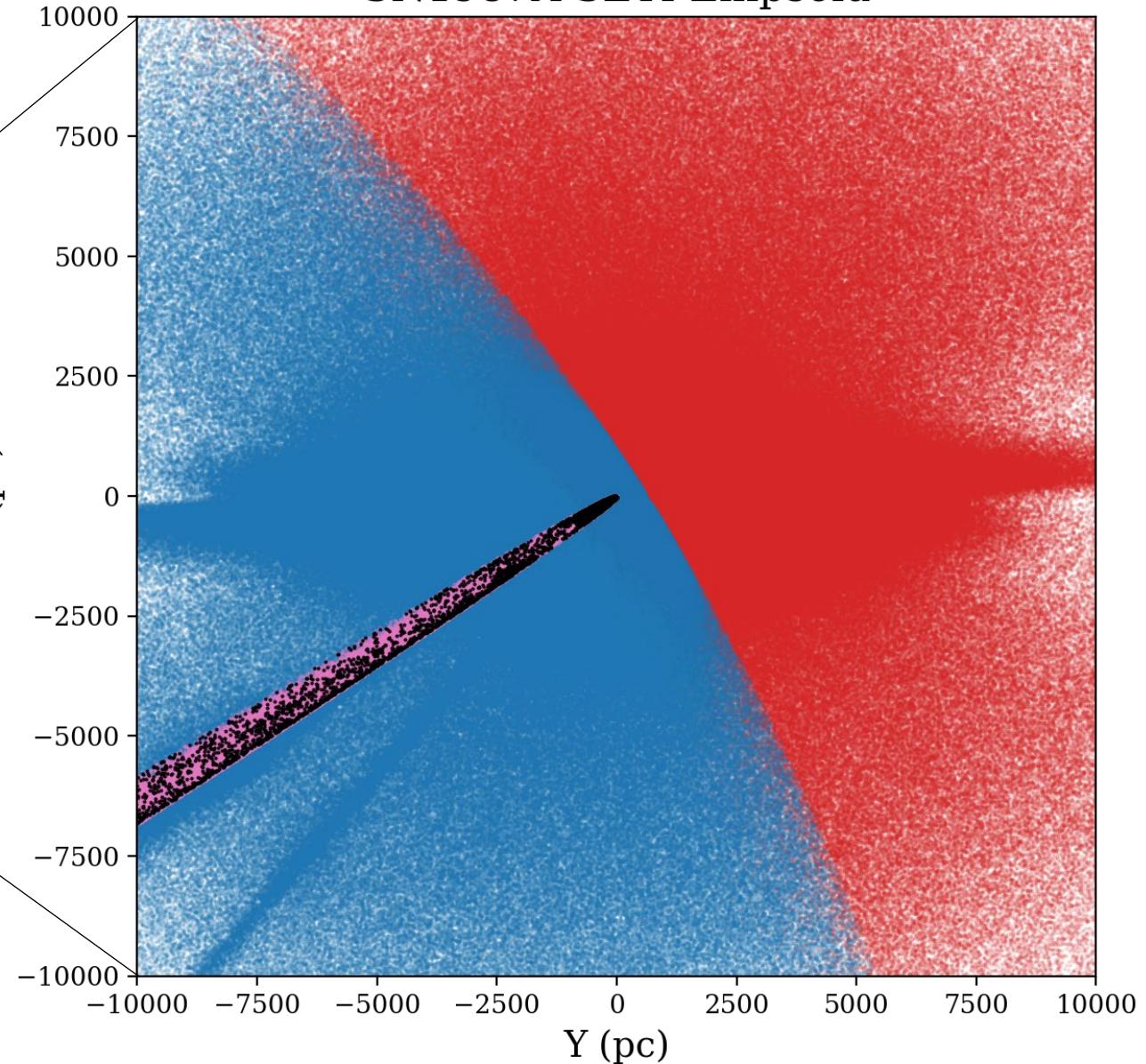


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SETI Ellipsoid with Gaia DR3

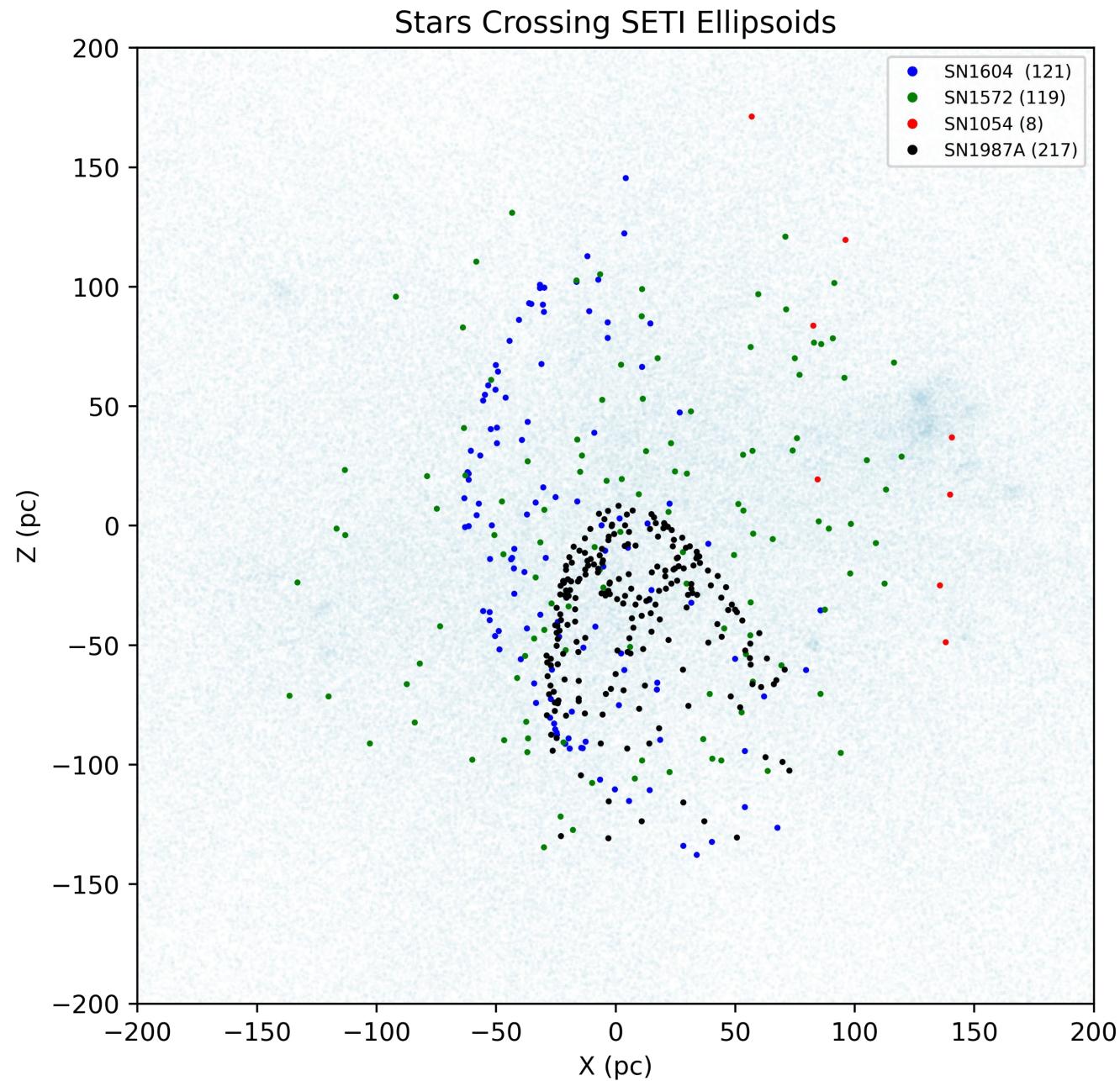


SN1987A SETI Ellipsoid



SETI Ellipsoid with Gaia DR3

465 stars crossed the SETI Ellipsoids for SNe 1987A, 1604, 1572, or 1054 between 2014 and 2017

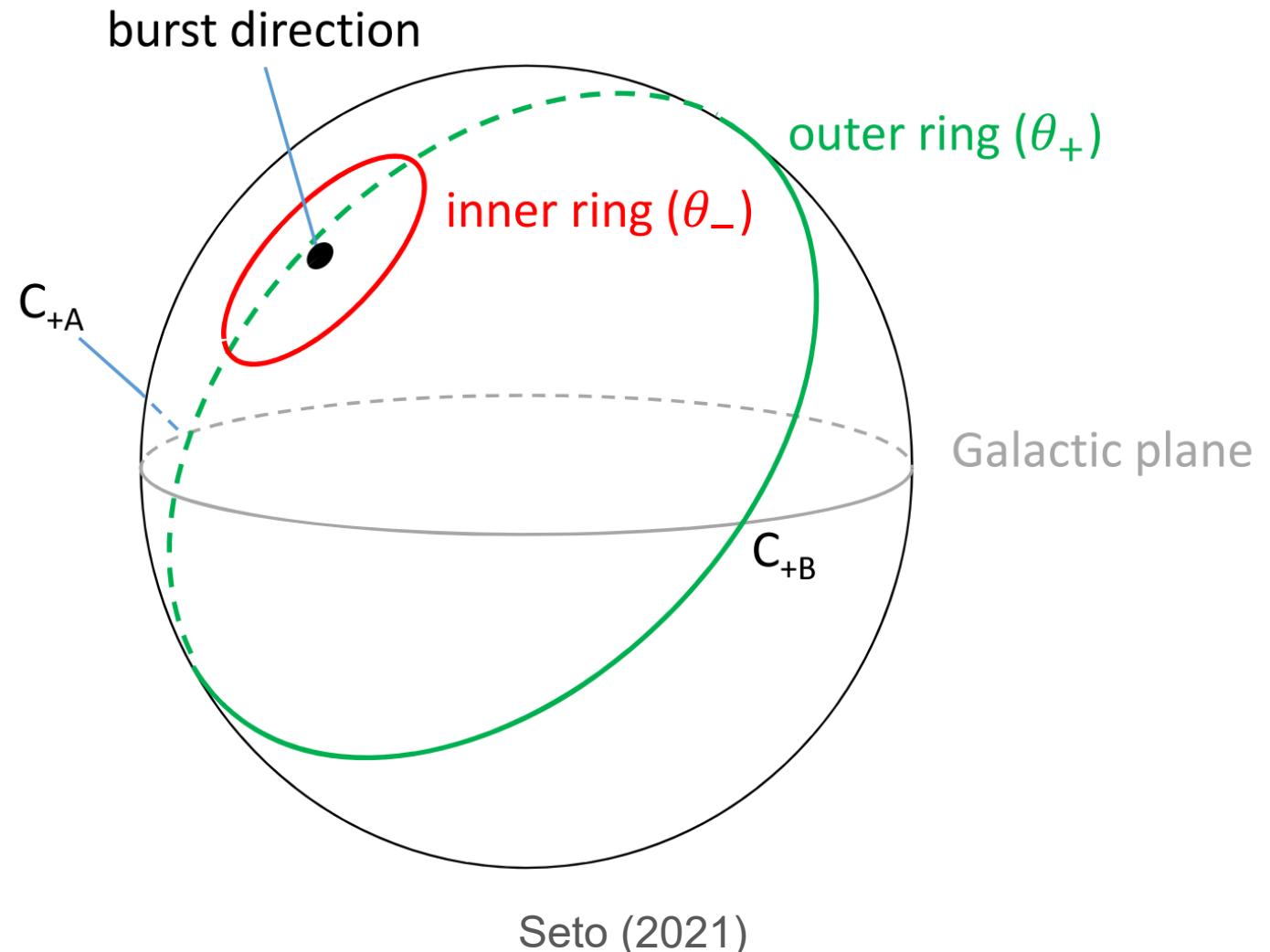


Seto (2021) Signaling Scheme

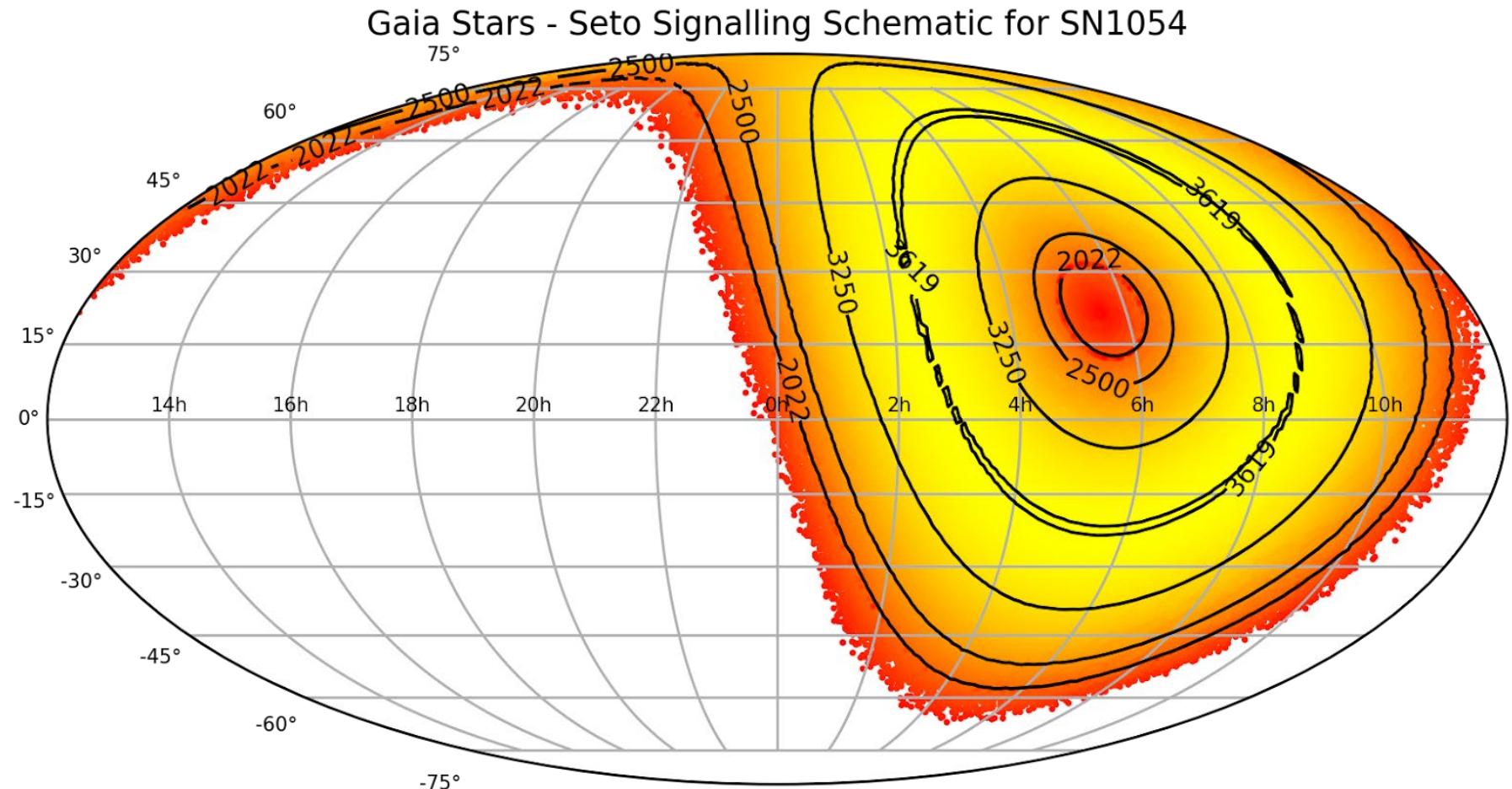
Via the Seto scheme, any stars within the SETI Ellipsoid along the lines of sight that form right angles in the ellipsoid are candidate systems



Seto (2021) Signaling Scheme

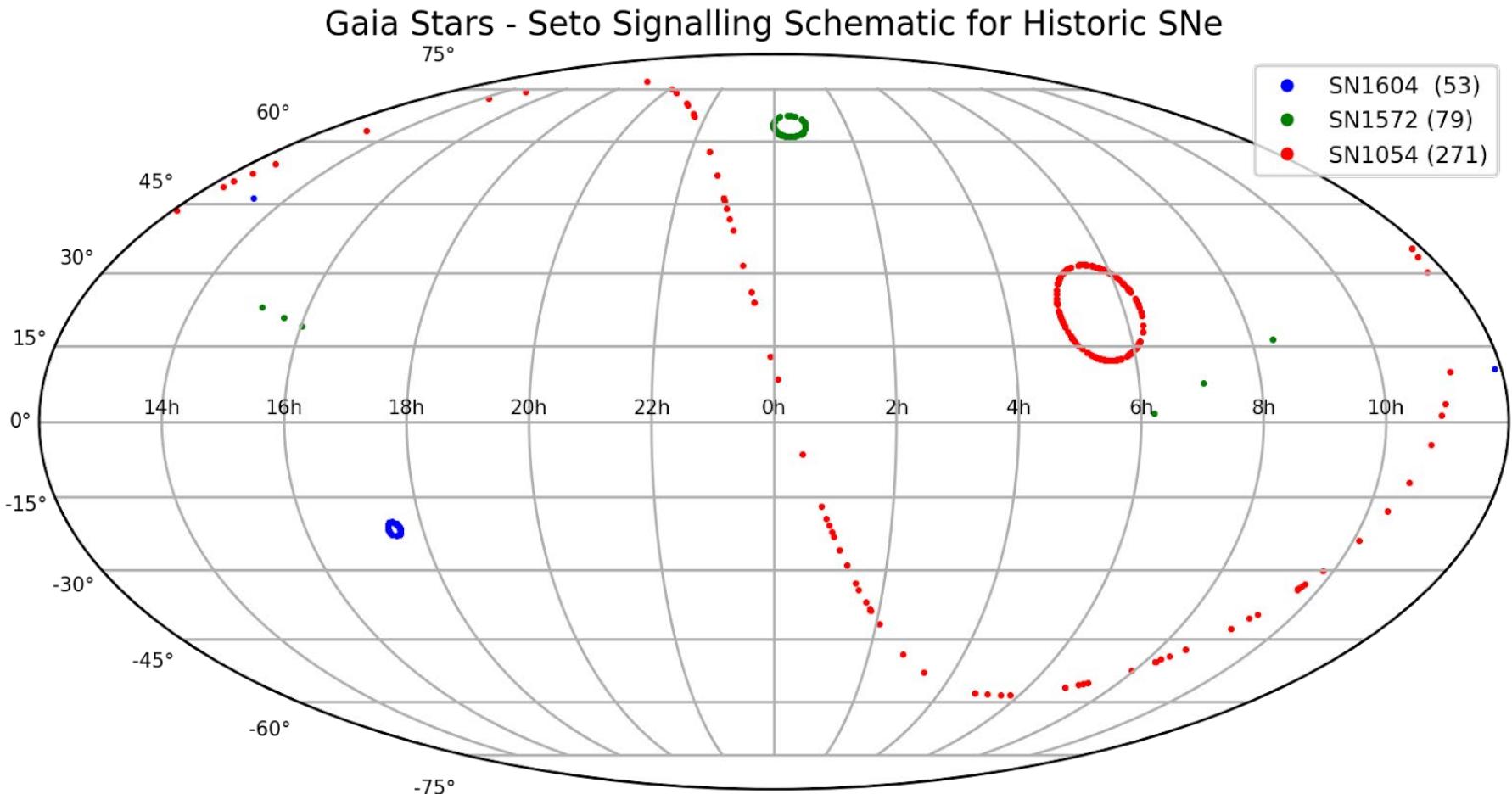


Seto Scheme with Gaia DR3



We can similarly define crossing times for
the Seto scheme

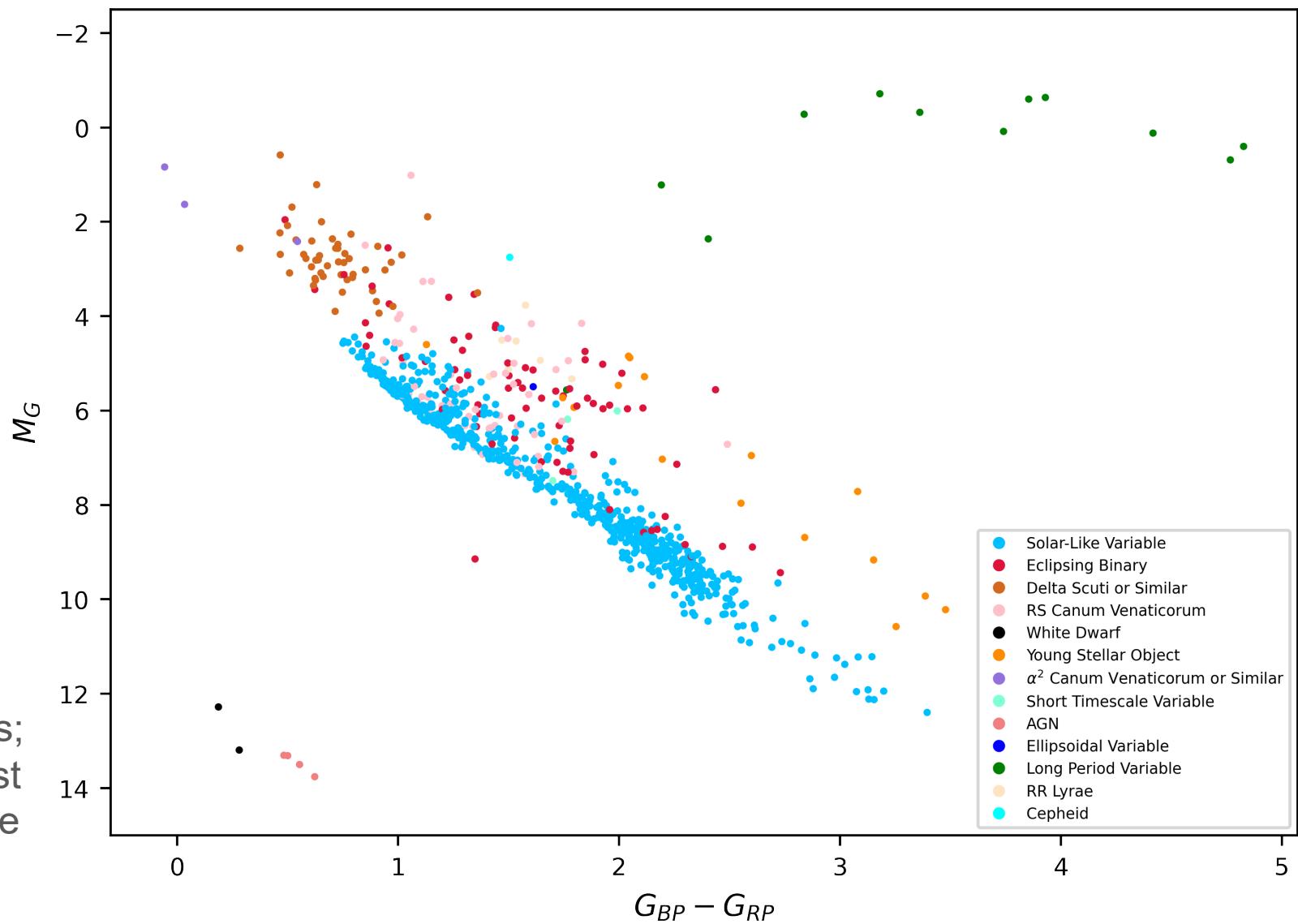
Seto Scheme with Gaia DR3



403 stars following this signaling scheme
would be observation candidates between
2014 and 2017

Candidate Exploration

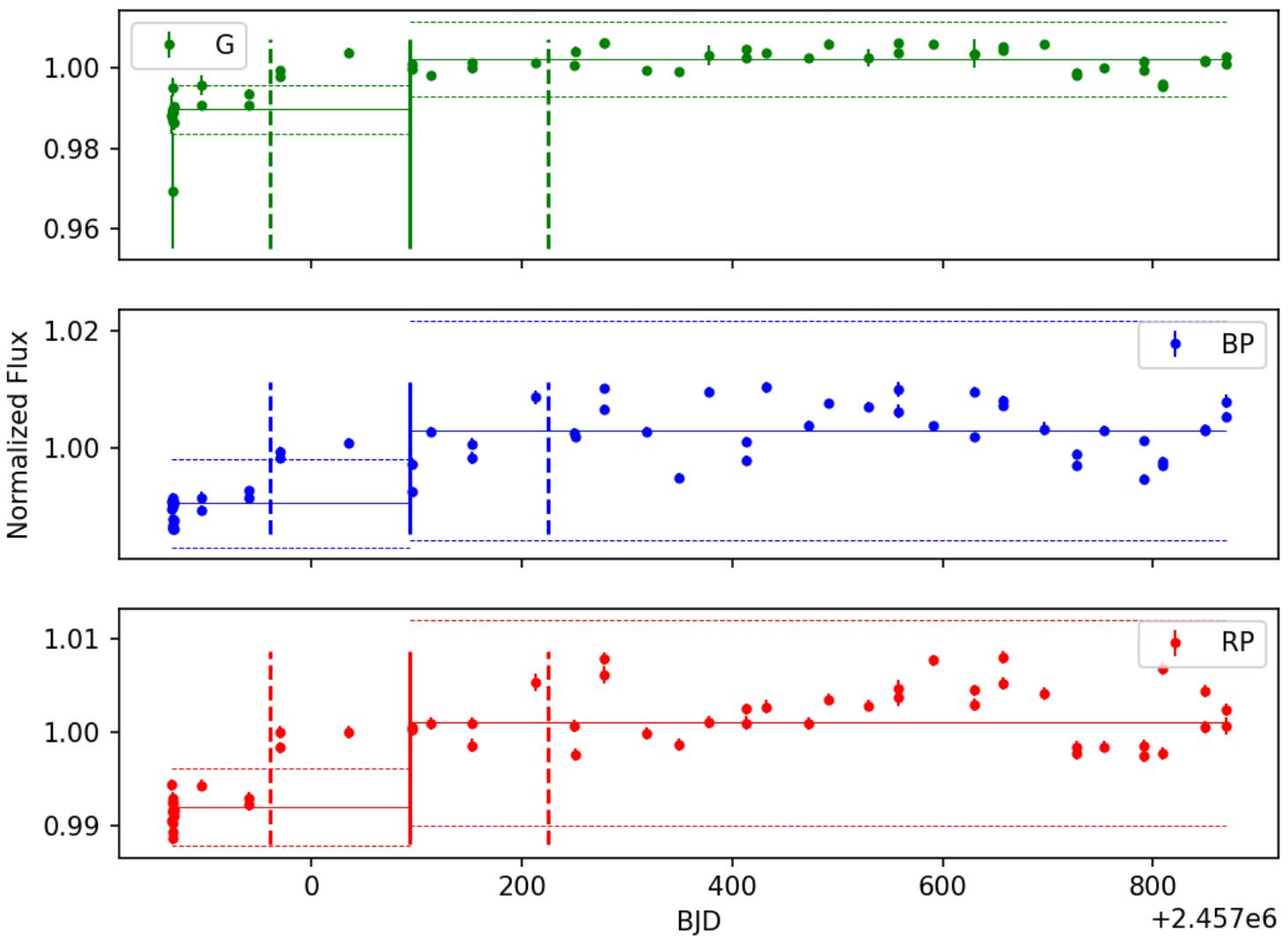
Crossing Stars with Gaia DR3 Epoch Photometry



Most candidates are solar-like variables;
we focus on eclipsing binaries, the most
common periodic variable in the sample

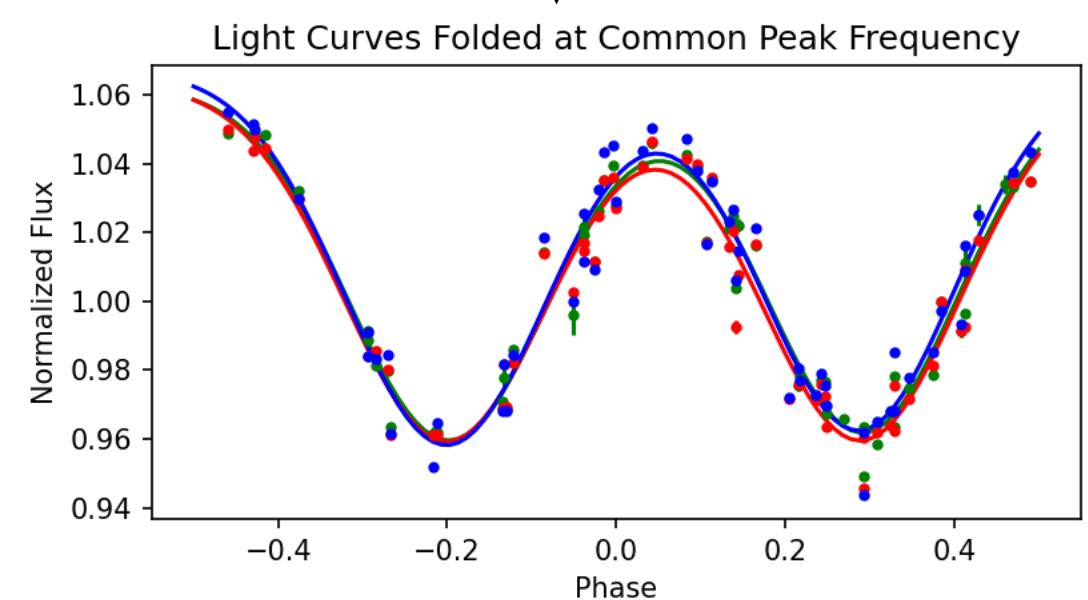
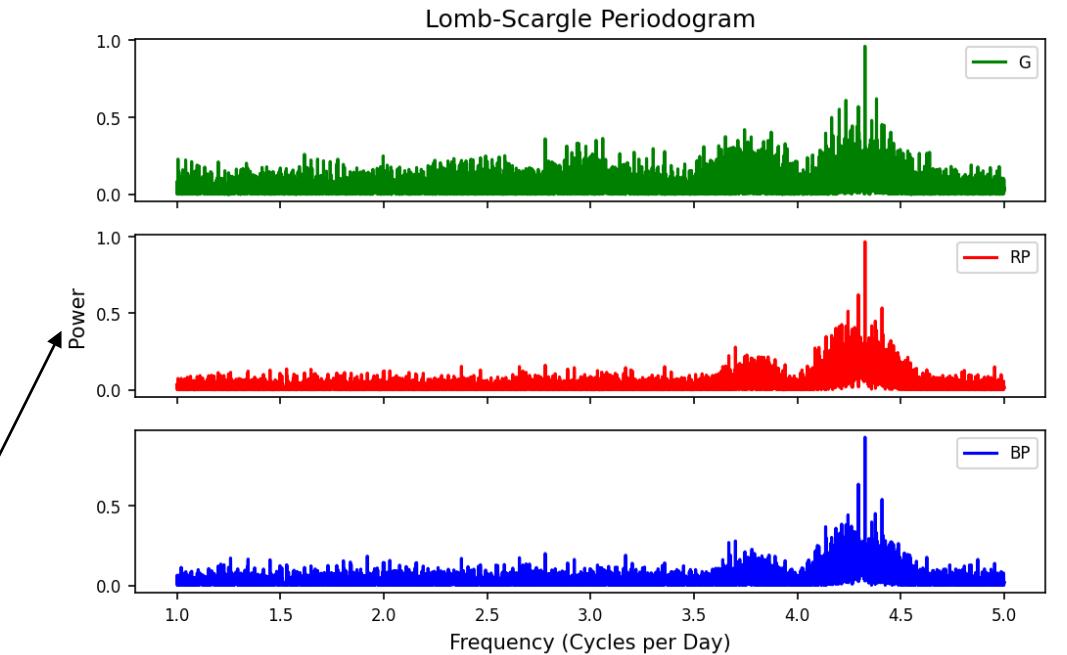
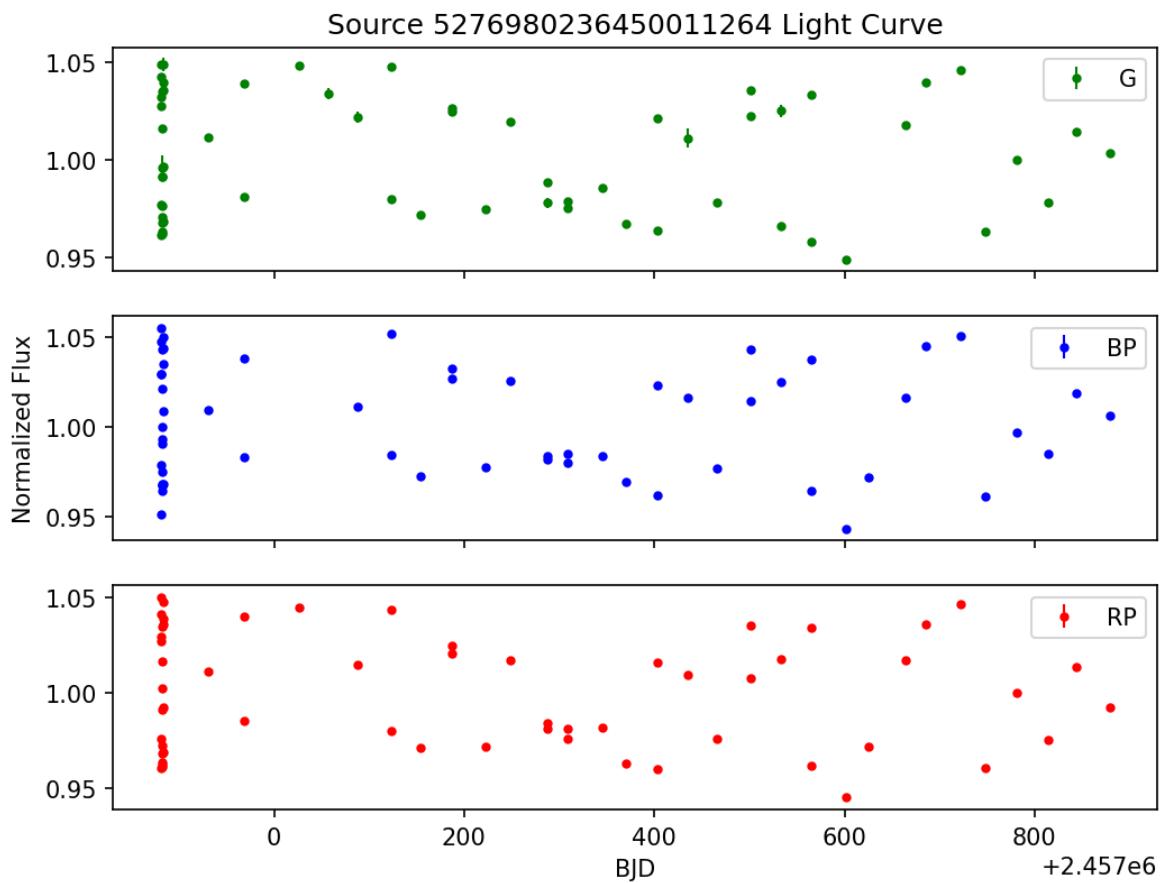
Gaia Epoch Photometry

Source 4738129894277454336

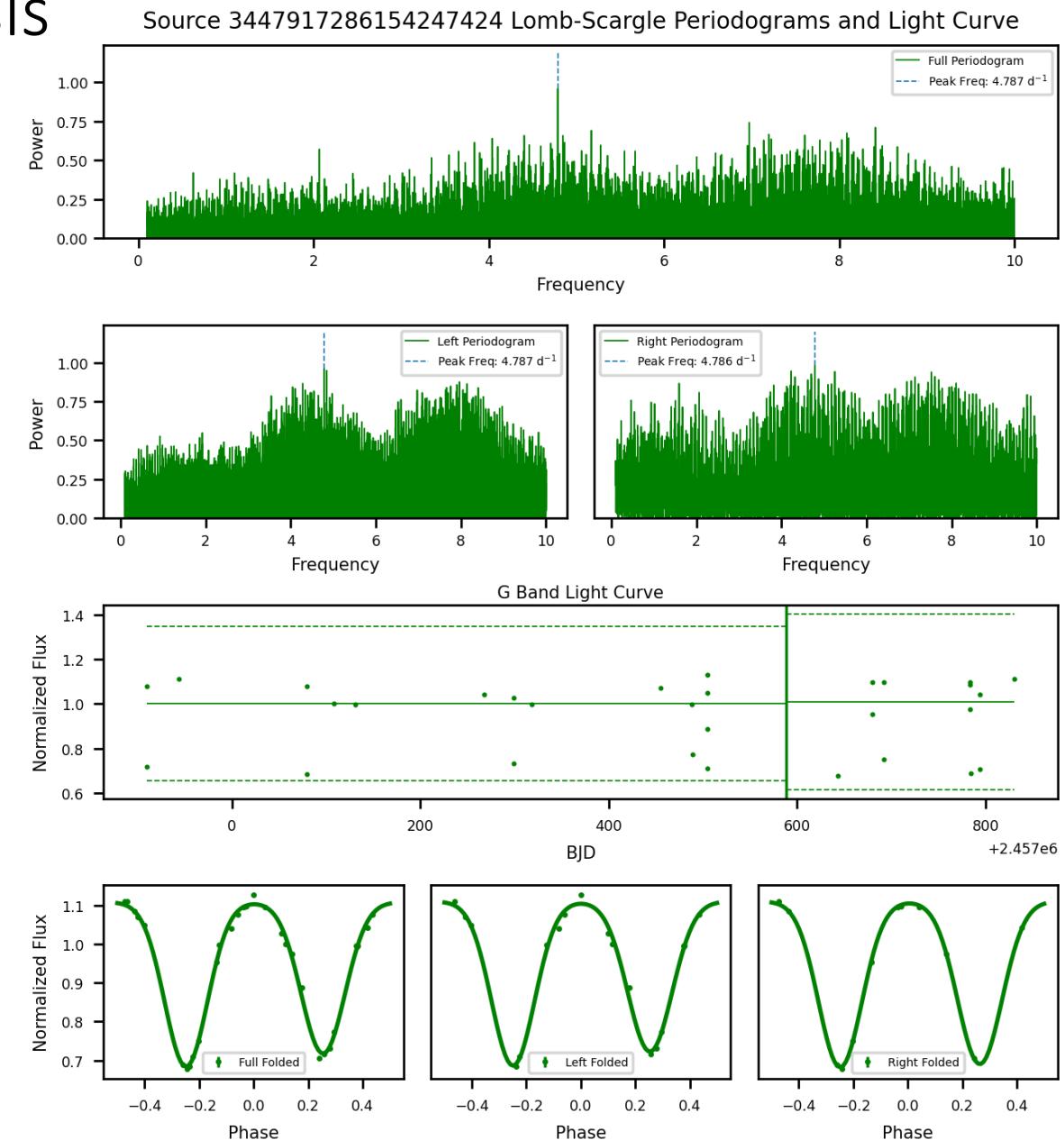


Solar-like variable Gaia light curve sample;
noticeably sparse and incomplete, but has
long-term stability

Eclipsing Binary Variability Analysis

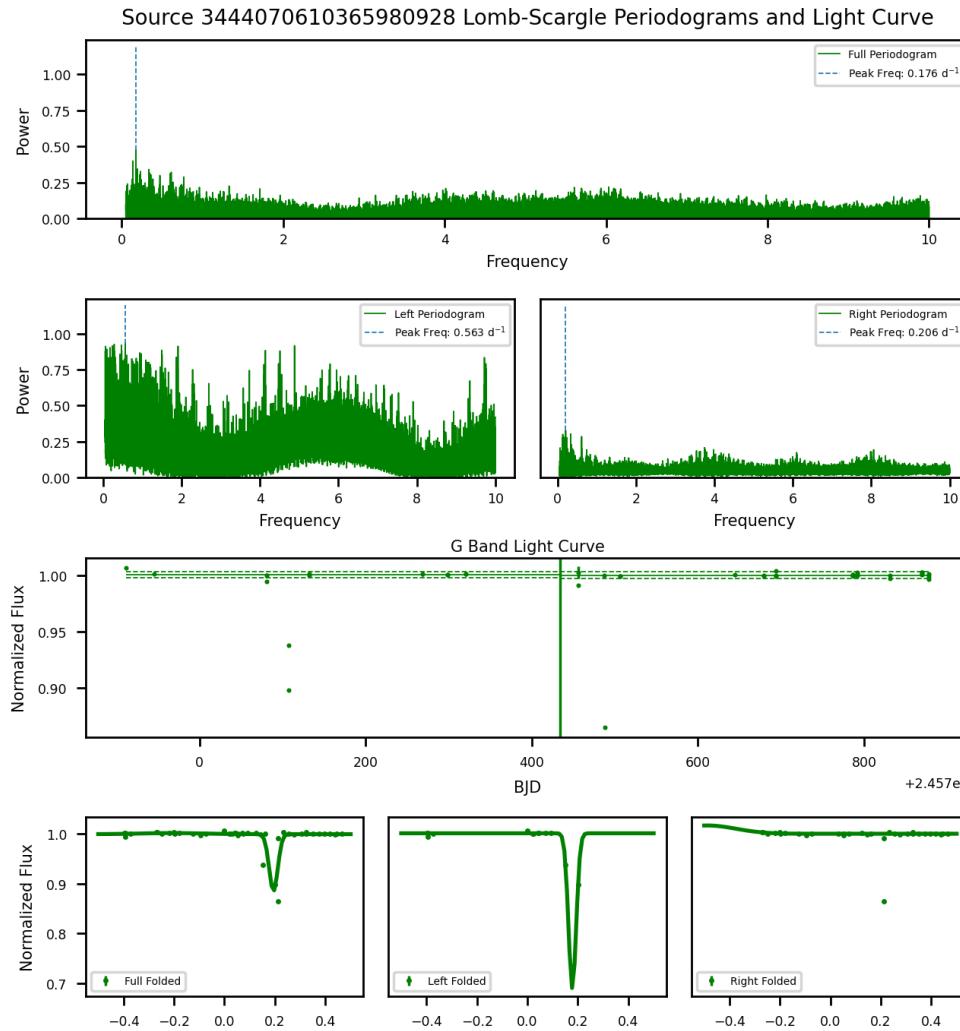


Eclipsing Binary Variability Analysis



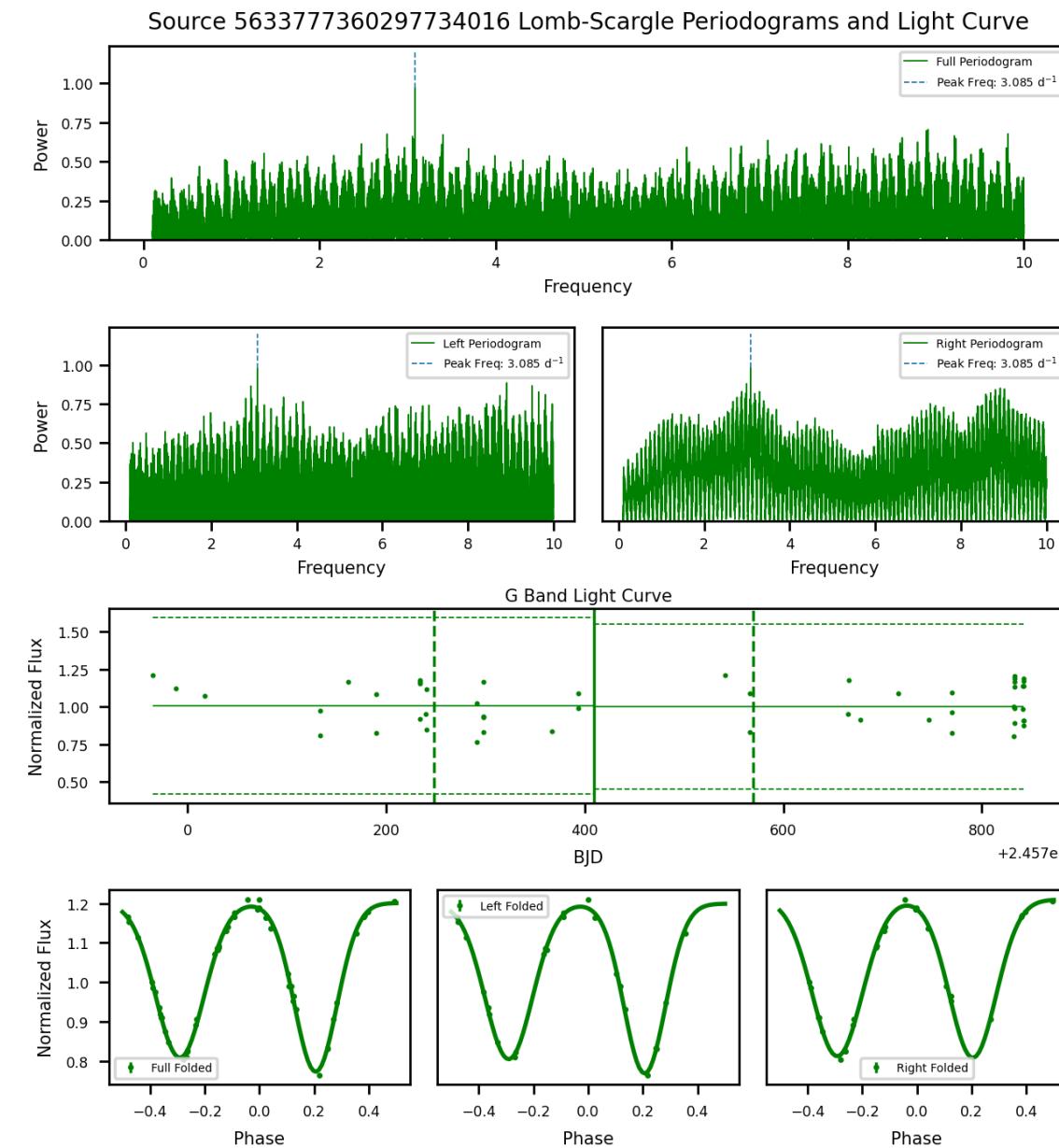
We ranked all eclipsing binary candidate systems using the error weighted distance between left and right light curves for nine variability parameters

Eclipsing Binary Variability Analysis



Lowest Ranking ECL

Highest Ranking ECL

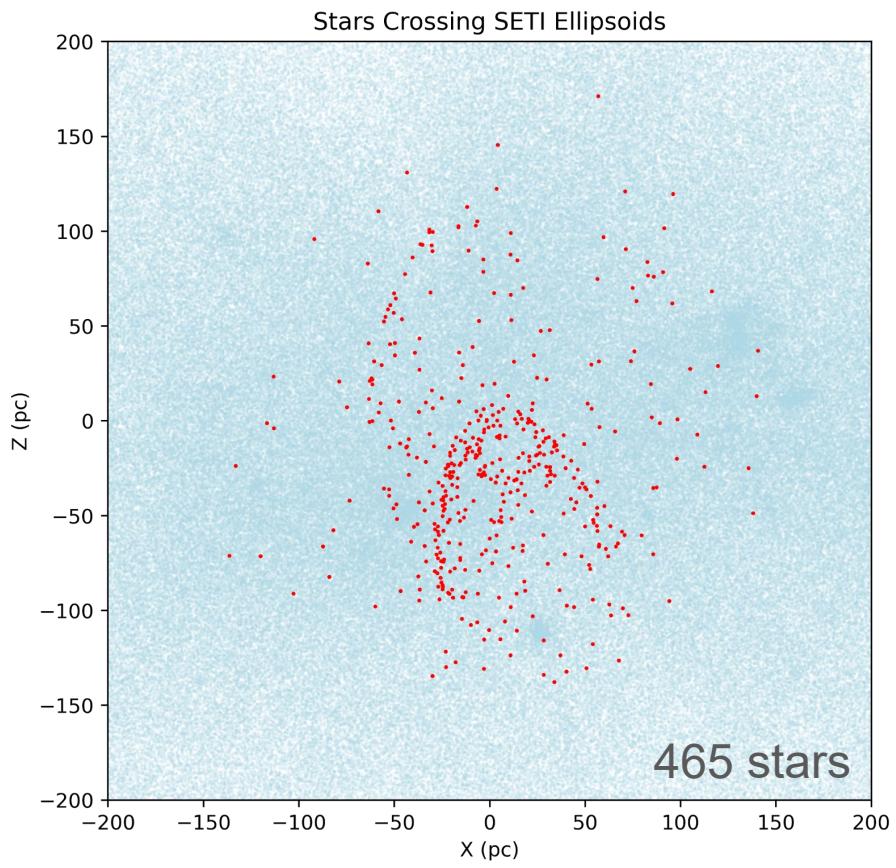


Limitations

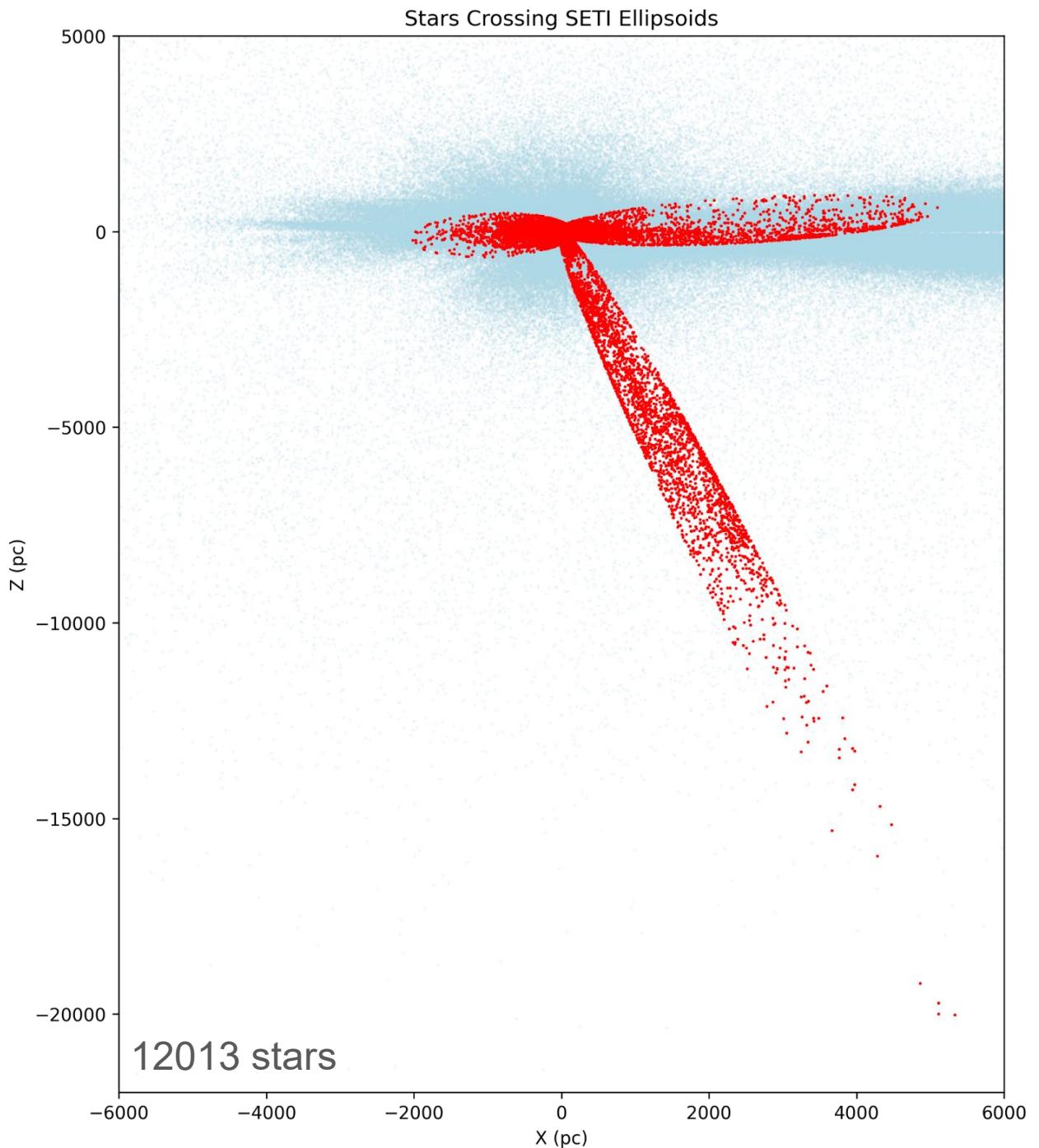
Gaia photometry: sparse and incomplete

Limitations

Stellar distance errors

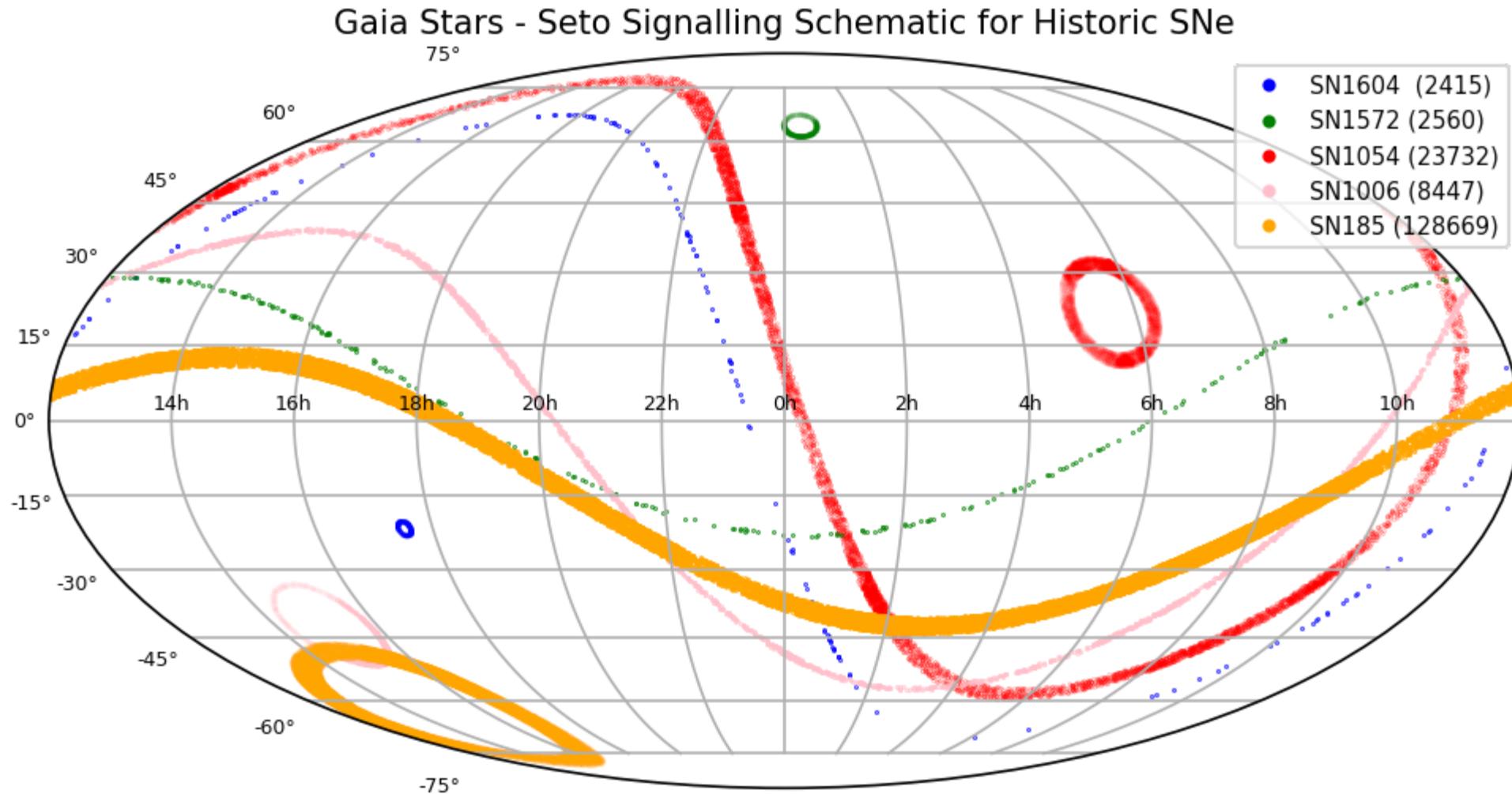


VS.



Limitations

SN distance errors



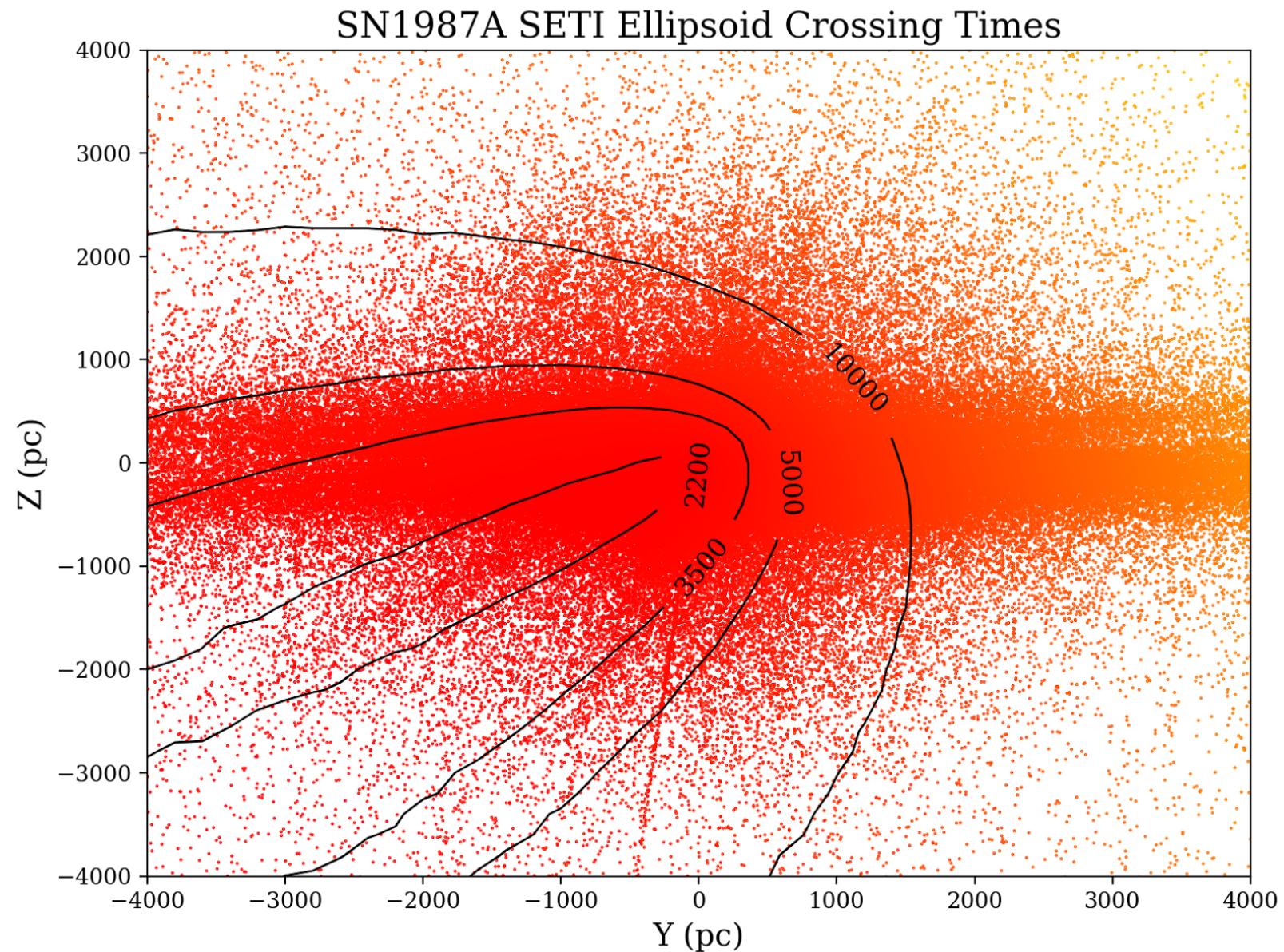
Potential Future Work

- Parametric statistics on other variable stars
- Waiting for Gaia DR4
- Cross-checking other catalogues
- Utilizing different telescopes and observatories in multiple wavelengths
- Scheduling observations

Summary

- Expanded SETI Ellipsoid technique to historical galactic supernovae
- Implemented Seto scheme with Gaia DR3
- Novel time domain variability analysis for SETI
- Powered by Gaia, but also limited by it

SETI Ellipsoid with Gaia DR3



Supernova Correlation

