PEGASUS

PHOENIX EUV GRID AND STELLAR UV SPECTRA

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The Extreme Ultraviolet (EUV) Spectrum Dilemma

Stellar EUV flux contributes to atmospheric escape and water loss

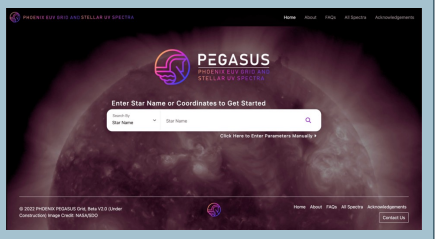
The EUV spectrum is currently unobservable

Computing synthetic EUV spectra for 5,500+ individual planet host stars is computationally expensive

A webtool providing access to EUV spectra of exoplanet host stars

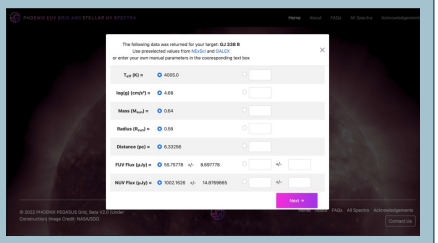
The PEGASUS webtool will identify a generalized high resolution ($\Delta\lambda$ < 0.01 Å) synthetic extreme ultraviolet (EUV; 100-1000 Å) spectrum for a searched target star from a grid of ~1,200 PHOENIX spectra with:

T_{eff} = 2500 - 5044 K
log(g) = 4.45 - 5.32 cm/s²
M = 0.08 - 0.89 M_{sun}



Required inputs for returning a spectrum are:

- T_{eff}
- log(g)
- Mass
- Radius
- Distance
- GALEX FUV and NUV flux densities



PEGASUS queries NExSCI and the GALEX archives for a searched target name or coordinates, or users can enter this information manually. This data is used to identify a subgrid of 75 models with similar parameters (T_{eff} +/- 200 K, log(g) +/- 0.5 cm/s², M +/- 0.1 M_{sun}).

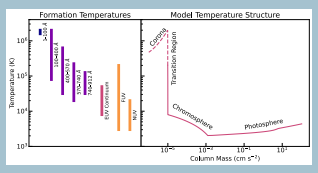
This subgrid is then searched for a model that matches the GALEX flux densities. *Note:* both the PHOENIX models and GALEX measurements are corrected for photospheric flux contribution.

A PEGASUS query will return any models that reproduce the GALEX measurements within the error bars. If no models exactly reproduce the observations, then X^2 minimization is used to find the closest match.

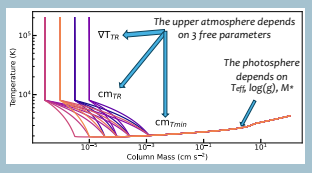
Users will download a coadded spectrum of:

1. The "generic" photosphere-subtracted spectrum that best matches the GALEX measurements
2. A "photosphere-only" spectrum specific to the host star that can be added to create the full spectrum of the star

The reason a generalized PHOENIX EUV grid works

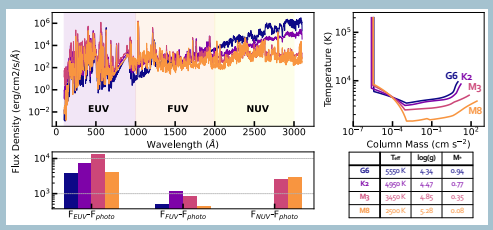


EUV flux originates in the stellar upper atmosphere and has no photospheric flux contribution.



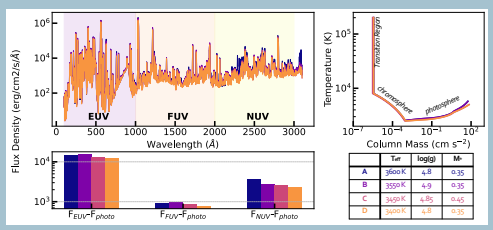
PHOENIX models consist of ad-hoc prescriptions for the transition region and chromosphere attached to an underlying photosphere.

If we eliminate the photospheric component, models that have the same prescription for the upper atmosphere should be the same...*right*?



	T_{eff}	log(g)	M*
G6	5559 K	4.34	0.94
K2	4999 K	4.47	0.77
M3	3459 K	4.85	0.35
M8	2900 K	5.28	0.08

For any GKM star that has the same prescription for the upper atmosphere: Removing the photospheric contribution from each model yields very different EUV, FUV, and NUV fluxes. This is a result of different slopes in the chromosphere and different minimum temperatures in the transition region (set by when hydrogen becomes fully ionized).



	T_{eff}	log(g)	M*
A	3600 K	4.8	0.35
B	3559 K	4.9	0.35
C	3459 K	4.85	0.45
D	3600 K	4.8	0.35

However, for stars within a spectral subtype: Removing the photospheric contribution from each model yields EUV, FUV, and NUV fluxes that are consistent within 15%. These similar fluxes are a consequence of nearly identical upper atmospheres.

Full version of the webtool will be launching in 2025 at: science.data.nasa.gov/data-repositories/pegasus-stellar-spectra
Beta version is live now at: **phoenixpegasusgrid.com**

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