

# Stellar Population Studies using MaStar SDSS Data

Statistical and Data Analysis Methods in Science Final Project

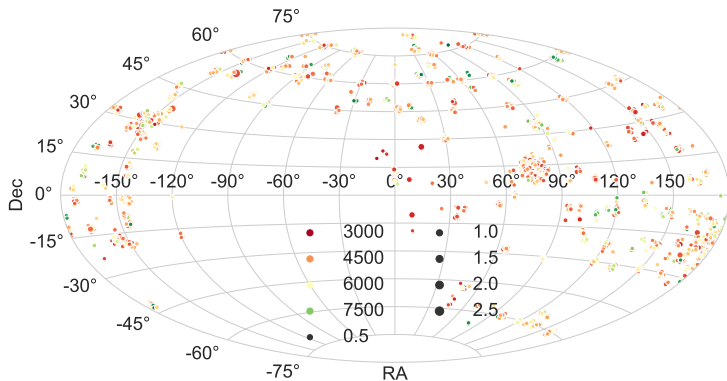
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# Research Question

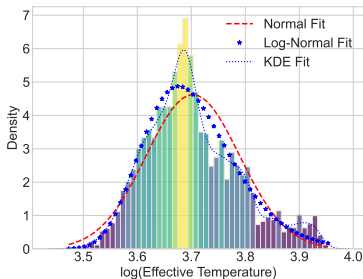
- ▶ What is the distribution of stars for various stellar parameters?
- ▶ Finding correlations between stellar parameters.

# Sky Map of Stars

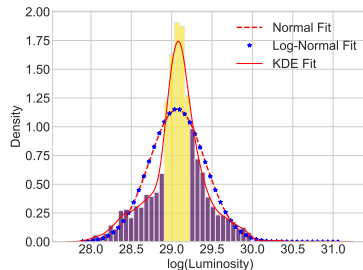


**Figure:** Sky Map of stars in the galactic coordinate system

# Histograms for different parameters



**Figure:** Distribution of stars based on temperature. For normal fit  $\mu = 3.70286$ ,  $\sigma = 0.08634$  and log-normal  $\mu = 3.298705$ ,  $\sigma = 0.395193$



**Figure:** Distribution of stars based on luminosity. For both normal and log-normal,  $\mu = 29.06908$  and  $\sigma = 0.34506$ . This distribution is highly Gaussian.

# Histograms for different parameters

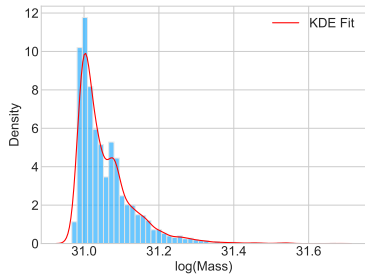


Figure: Distribution of stars based on mass

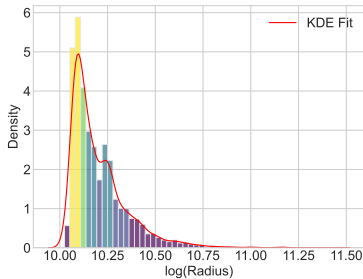


Figure: Distribution of stars based on radius

# Histograms for different parameters

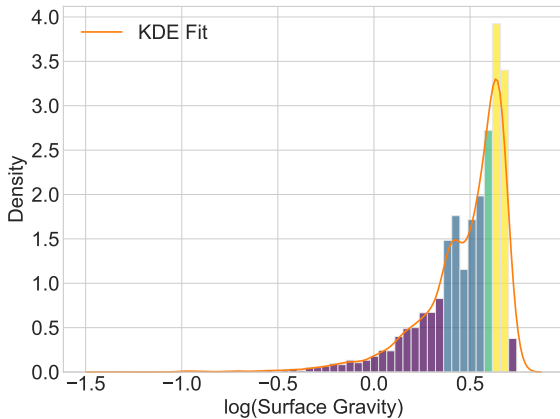


Figure: Distribution of stars based on surface gravity

# Correlation between parameters

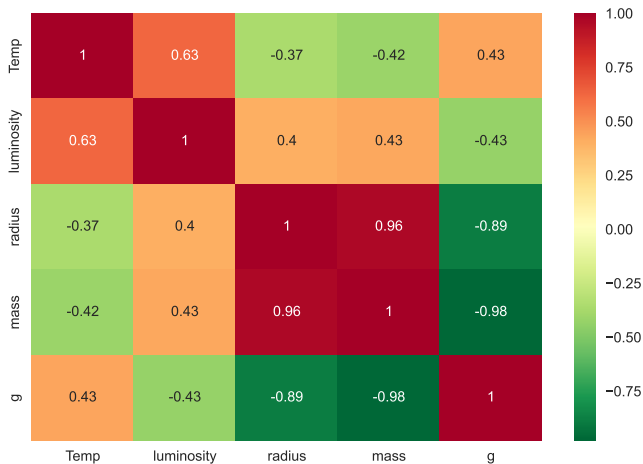


Figure: Using Pearson coefficients

# Correlation between parameters

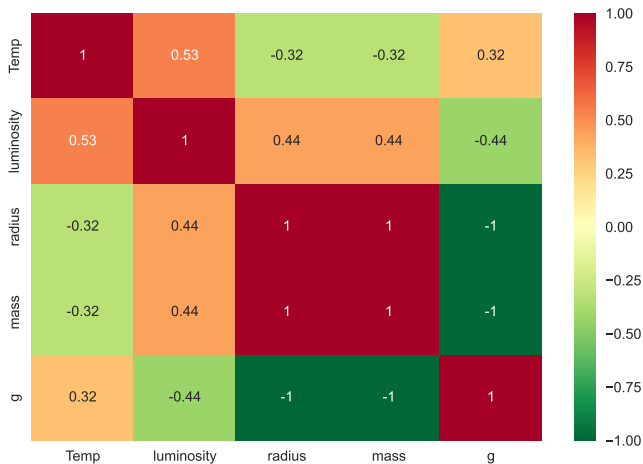
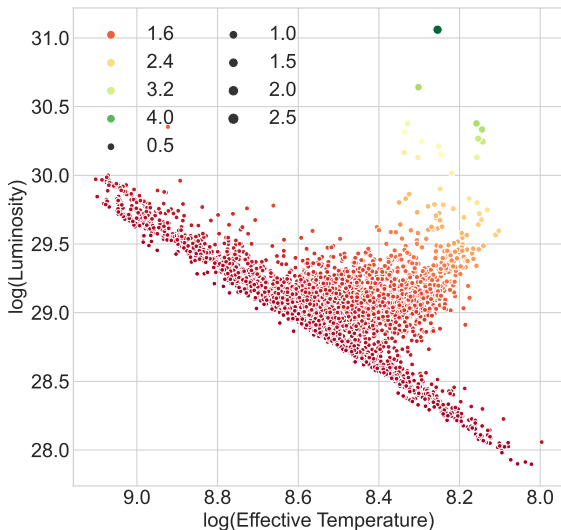


Figure: Using Spearman coefficients



# Temperature vs Luminosity Plot



**Figure:** Plot of temperature vs luminosity. The size of point indicates radius and color indicates mass.

# Blackbody Curves

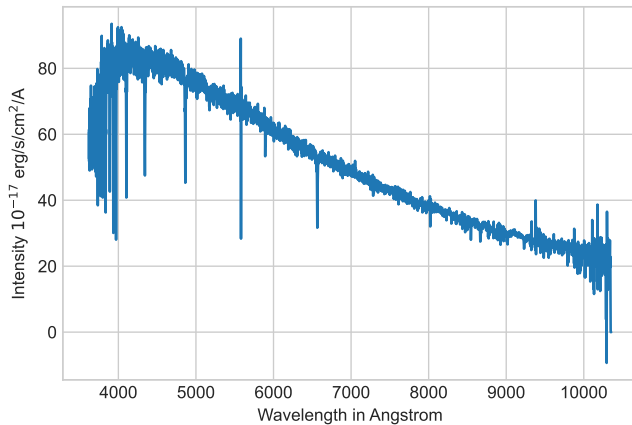


Figure: Blackbody curve for a particular star

# Blackbody Curves

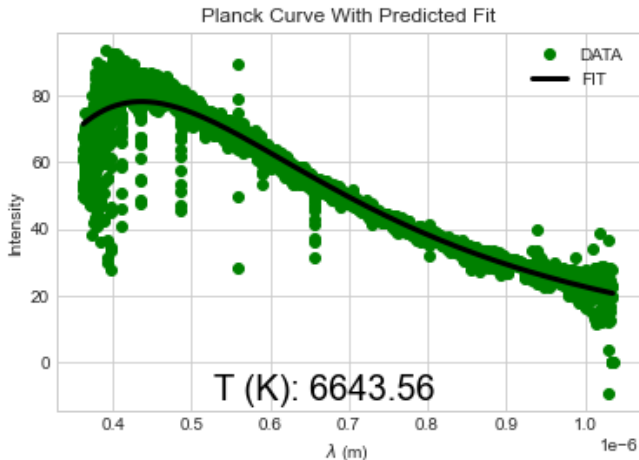
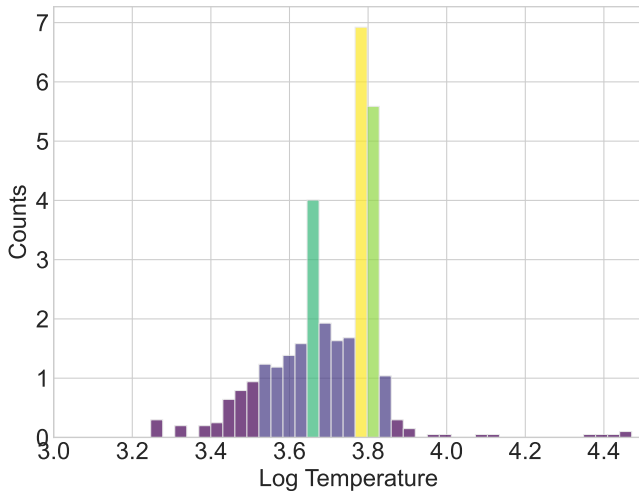


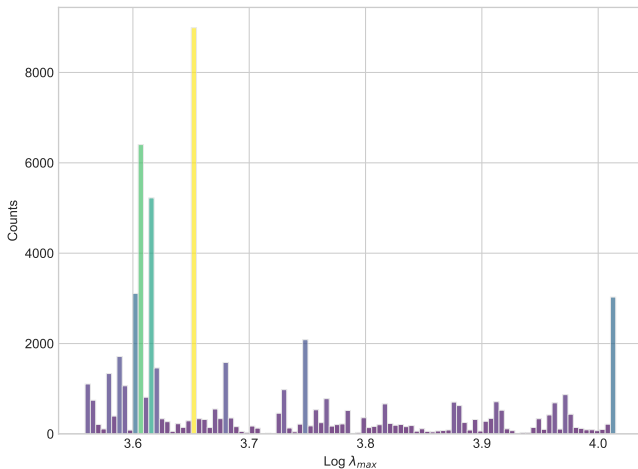
Figure: Fitting the blackbody curve with Planck function and finding temperature

# Temperature distribution of stars



**Figure:** Temperature distribution of stars calculated from blackbody spectrum

# Distribution of stars based on $\lambda_{max}$



**Figure:** Distribution of stars based on  $\lambda_{max}$  calculated using spectral data. The peaks show the presence of Ca II, Na I,  $H\beta$  etc. in the stars studied.

# References

1. Abdurro'uf, et al. "The Seventeenth Data Release of the Sloan Digital Sky Surveys: Complete Release of MaNGA, MaStar, and APOGEE-2 Data." *The Astrophysical Journal Supplement Series*, vol. 259, Apr. 2022, p. 35. NASA ADS, <https://doi.org/10.3847/1538-4365/ac4414>.
2. Yan, Renbin, et al. "SDSS-IV MaStar: A Large and Comprehensive Empirical Stellar Spectral Library—First Release." *The Astrophysical Journal*, vol. 883, Oct. 2019, p. 175. NASA ADS, <https://doi.org/10.3847/1538-4357/ab3ebc>.
3. "Astrophysics and Python." Astrophysics and Python, <https://astrophysicsandpython.com/>.
4. Professor-G, Blackbodyfit. <https://github.com/Professor-G/BlackbodyFit>

THANK YOU