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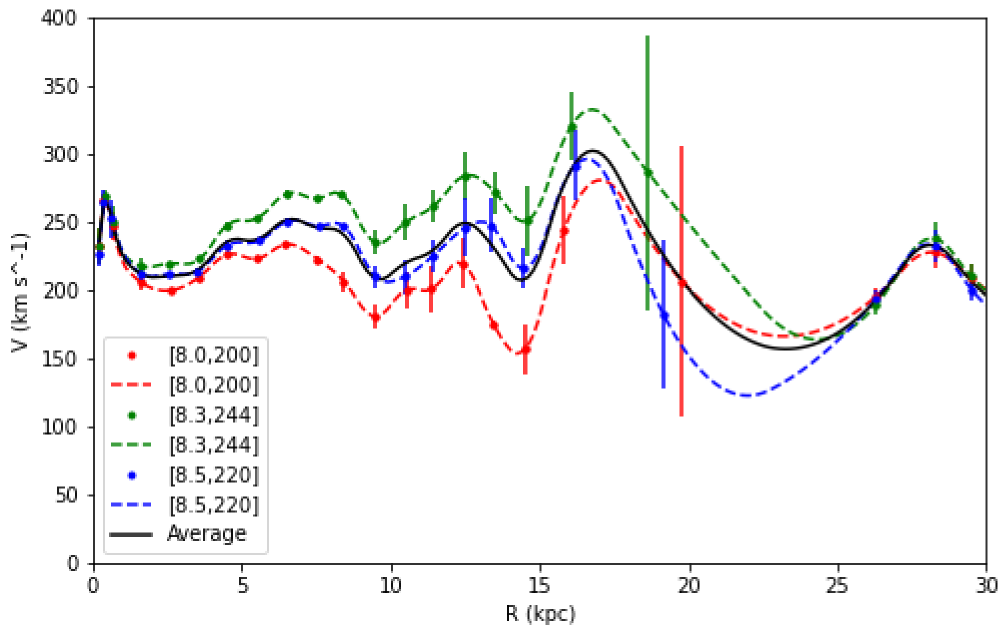
ASTR5465

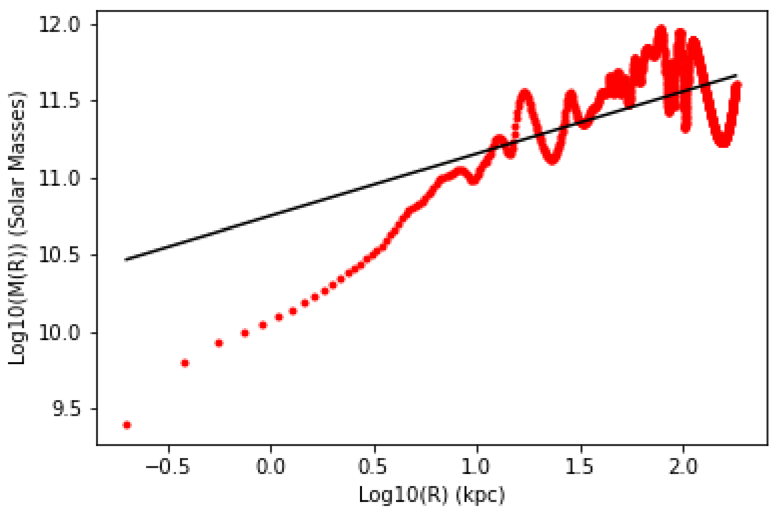
Use the data summarized by Bhattacharjee (2014) to plot the Galactic rotation curve in Python. Use your own judgement on how to plot it.

Compute an appropriate average by fitting a spline to each data set for interpolation and combining them.

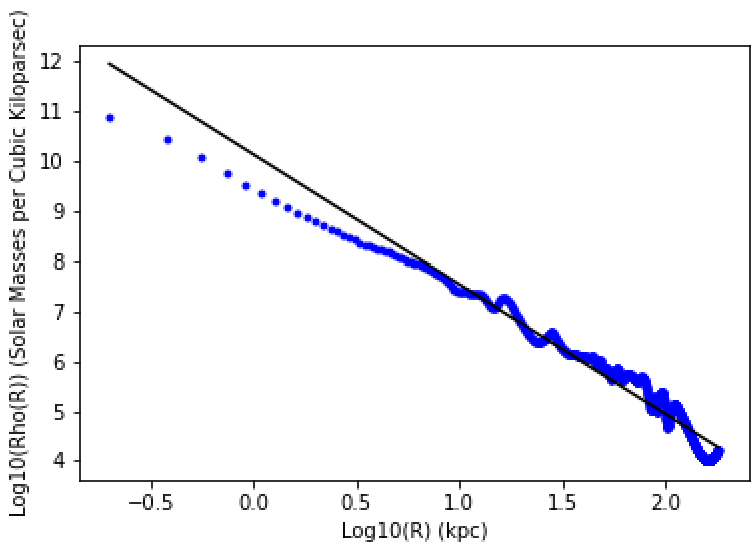


Using the data from Bharracharjee (2014), the rotation curve for the Milky Way is shown above for three different values of R_0, the distance of the Sun from the center of the Milky Way, and V_0, the Sun's velocity about the Galactic center, with error bars signifying the 1σ error in velocity. This plot was zoomed in and shows the rotation curve out to 30 kpc to capture the subtle differences between each set of data. The solid black line is the average of the interpolations. I would have expected the interpolations of the rotaiton curve to be more flat.

Assume a spherical mass model for the Galaxy and compute both M(R) and r(R). Make a plot of your results and fit a polynomial model. Comment on your results and provide a summary of your results.



Shown above is a log-log plot of the total calculated mass of the galaxy as a function of distance from the galactic center in units of solar masses and kilo-parsecs respectively. The mass at a particular data point is in red and the overall trend-line is in black. The plot looks nearly linear, signifying a power relation between the mass of the Milky Way and radius. The total enclosed mass of the galaxy increases exponentially as the radius is increased. It is noteworthy how the shape of the data calculated from the spline interpolation shows significant variation.



Plotted above is the log-log plot of the calculated density, in units of solar masses per kpc^{-3}, against the radius, in units of kpc. The density at a particular data point is shown in blue and the overall trend-line is shown in black. The log-log plot of density versus radius exhibits a linear regression, again signifying a power relation. This time however, it is found that the density of the galaxy decreases exponentially with radius. As noted before, significant error and variation can be seen in the data which is presumably from manipulation of spline interpolated data.

Summary

Using the data from Bhattacharjee (2014), a rotation curve of the galaxy was plotted for a set of different constants. Spline interpolation was used to fit each set of data and averaged to find the overall shape of the rotation curve.

This averaged spline interpolation was then used to calculate the mass of the Milky Way as a function of radius as well as density, assuming a spherical mass distribution. Each manipulation of the spline interpolation resulted in an amplification of error resulting in significant variation in the data.