

Ay190 – Worksheet 05
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1 Exercise 1

1.1 1a

I used the data file emailed by Michael to plot Figure 1.

We will let x indicate log of stellar velocity dispersion σ_* and y indicate log of black hole mass M_{BH} in solar masses.

1.2 1b

See Figure 2.

Our best fit is

$$y = 0.931069678177 + 1.27049767574 x \quad (1)$$

But wait! Green and Ho (2006) rescale x by 200 km s^{-1} . After rescaling, my best fit is

$$y = 7.66256957769 + 1.27049767574 x \quad (2)$$

The intercept agrees fairly well with the data given in Green and Ho. The slope is small by a factor of 3.

1.3 1c

I used a left finite difference estimate for the derivative. In cases where we had multiple data points for a given value of x , I fixed the derivative at 0 so that it would remain finite. I also drop the last data point because we cannot extrapolate a left finite difference to these. Including errors roughly halves our intercept and slightly increases slope. See Figure 3.

Our best fit is

$$y = 0.423118215597 + 1.38550311068 x \quad (3)$$

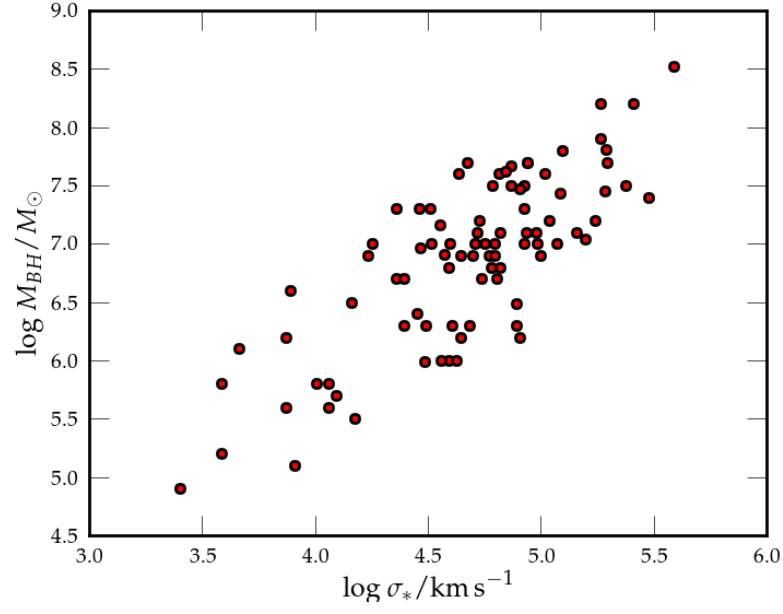


Figure 1: M_{BH} vs σ_* scatter.

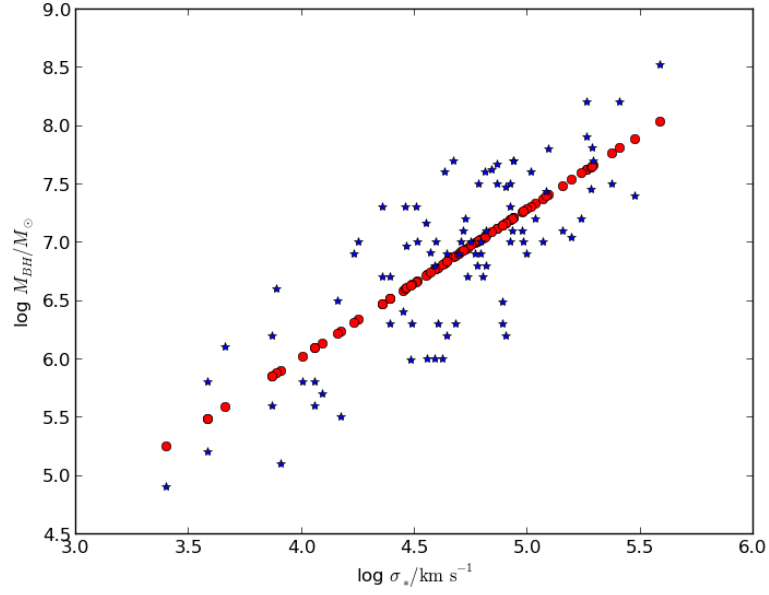


Figure 2: Linear Fit, No Errors.

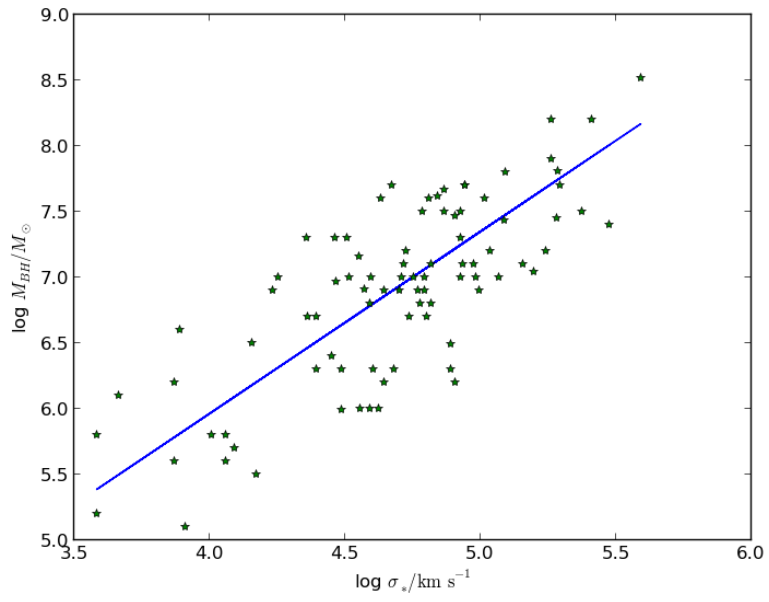


Figure 3: Linear Fit Including Errors.