PHY 122 LAB 5: Log-Log addendum

Introduction

It is sometimes useful to make a log-log plot of data. This has two purposes:

1. cover an enormous range of data (many magnitudes) on either/both scales
2. reveal a power law relation for y(x).

Power-law:

Suppose our model function is a simple power law, namely

$$y(x) = Ax^n \qquad \text{Eq. 1}$$

We can "linearize" this function by taking the log of both sides, thus

$$[\ln(y)] = \ln A + n*\ln(x) \qquad \text{Eq. 2}$$

Eq. 2 can now be fit using linear regression. The slope of this fit is "n", while the intercept is lnA. Note that "n" is dimensionless, while A and x are not. This can also be done by eyeball, using log-log paper. This paper is printed so that the physical distance between lines corresponds to the log of the value of the lines. This scale might be different on each axis (rectangular grid), so the "slope" must be calculated in units of "(# of cycles rise)/(# of cycles run)". These in turn are determined from (cycles/cm) * cm.

GA has no log-scale option for plots, but EXCEL does. In GA, you need to calculate the log (or natural ln) and plot these values on a linear scale. In EXCEL, you make an XY-Scatter plot, then change axes to log.