PHY-765 SS19: Gravitational Lensing. Worksheet Week 9

1 Journal Club #2: Paper presentation

Last week you selected a recent lensing paper based on title and abstract. You have prepared a short overview which will be presented in class this week in a journal club setting.

2 The total magnification of a point mass microlens

In the following the expressions of $\theta_\pm$ for a point mass lens described in week 5

$$\theta_\pm = \frac{\beta}{2}\left[1 \pm \sqrt{1 + \frac{4\theta_\mathrm{E}^2}{\beta^2}}\right] \tag{1}$$

and the corresponding magnifications of the individual images described in week 7

$$\mu_\pm = \frac{1}{1 - (\theta_\mathrm{E}/\theta_\pm)^4} \tag{2}$$

will be needed.

2.1

Using this knowledge, show that the sum of the unresolved image's magnification in the point source lens is given by

$$\mu \equiv \mu_+ + |\mu_-| = \frac{y^2+2}{y\sqrt{y^2+4}} \quad \text{where} \quad y = \frac{\beta}{\theta_\mathrm{E}} \tag{3}$$

2.2

Also show that the ratio of the magnifications is equal to the square of the ratio of the normalized positions, i.e.,

$$\left|\frac{\mu_-}{\mu_+}\right| = \left(\frac{y - \sqrt{y^2+4}}{y + \sqrt{y^2+4}}\right)^2 = \left(\frac{x_-}{x_+}\right)^2 \quad \text{where} \quad x_\pm = \frac{\theta_\pm}{\theta_\mathrm{E}} \tag{4}$$