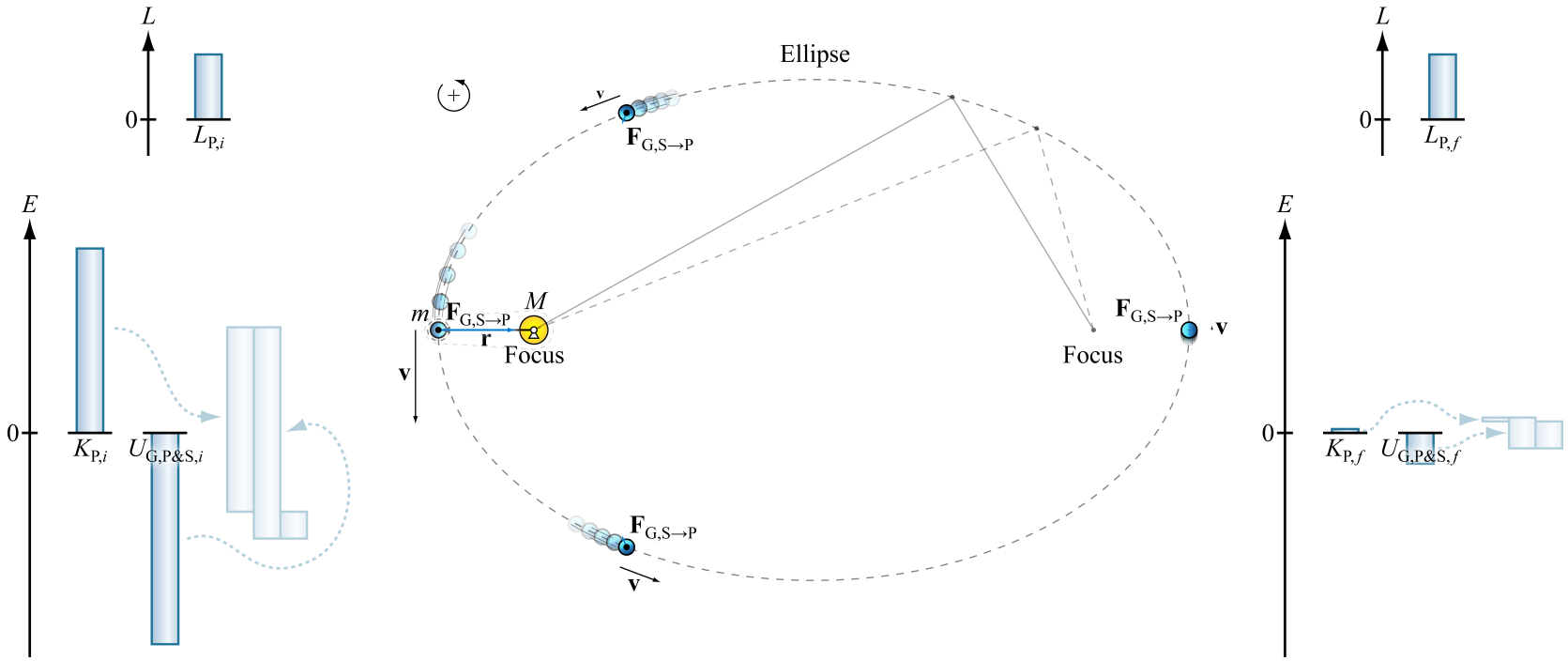
A mass gravitationally attracted to another anchored mass can trace out an ellipse



Force

magnitude	$\left\vert\vec{\mathbf{F}}_{\mathrm{G,S\to P}}\right\vert = G\dfrac{Mm}{r^2}$
direction	attractive
Universal constant	$G = 6.67\times10^{-11}\ \mathrm{N}\cdot\dfrac{\mathrm{m}^2}{\mathrm{kg}^2}$
Gravitational potential energy	$U_{\mathrm{G,S\&P}} = -G\dfrac{Mm}{r}$

Angular momentum of the planet

$$\Sigma L_i + \left(\sum_{\mathrm{EXT\to SYS}} \tau_{\mathrm{AVG}}\right)\Delta t = \Sigma L_f$$

$$mv_i r_{\perp,i} = mv_f r_{\perp,f}$$

Mechanical energy of the planet-star system

$$K_i + U_{\mathrm{G},i} + U_{\mathrm{S},i} + \Delta W_{\mathrm{OUF}} = K_f + U_{\mathrm{G},f} + U_{\mathrm{S},f} + \Delta U_{\mathrm{INT}}$$

$$\frac{1}{2}mv_i^2 - G\frac{Mm}{r_i} = \frac{1}{2}mv_f^2 - G\frac{Mm}{r_f}$$