$$W \;=\; -\,\frac{G}{2}\,\int_0^\infty \frac{M^2(r)}{r^2}\,dr$$

$$\rho(r) \;=\; \left(\frac{M}{4\pi r_J^3}\right)\;\frac{r_J^4}{r^2(r+r_J)^2}$$

$$\Phi(r) \;=\; \frac{G\,M}{r_J}\;\ln\left(\frac{r}{r+r_J}\right)$$

$$I(R) \;=\; I(R_e)\,exp\left\{-b\left[(R/R_e)^{1/n}-\,1\right]\right\}$$

$$L \;=\; \int_0^\infty I(R)\,2\pi R\,dR \;=\; 8!\,\frac{e^{7.67}}{(7.67)^8}\,\pi R_e^2\,I(R_e) \;\approx\; 7.22\,\pi R_e^2\,I(R_e)$$