Galaxies - equations

$$F = \frac{L}{4\pi r^2} \tag{1}$$

$$\frac{dF}{d\Omega} = \frac{I}{4\pi} \quad \text{demonstrate distance independent} \tag{2}$$

$$\frac{dI}{dr} = -A\,I \tag{3}$$

$$(m - M) = 5\log(r) - 5 + Ar \quad \text{derivation} \tag{4}$$

$$n(R, \phi, z) \propto \exp(-R/R_{\rm h})\,\exp(-|z|/z_h) \quad \text{disk} \tag{5}$$

$$I(r) = I_e\,\exp(-7.67(r/r_e)^{1/4} - 1) \quad \text{bulge/elliptical} \tag{6}$$

$$n(r) = n_0\,(r/r_0)^{-3.5} \quad \text{stellar halo} \tag{7}$$

$$[\mathrm{Fe/H}] \equiv \log_{10}\left[\frac{M_{\rm Fe}/M_{\rm H}}{(M_{\rm Fe}/M_{\rm H})_\odot}\right] \tag{8}$$

$$\dot{R} = \frac{\dot{N}}{4\pi n R^2(t)} \quad \text{derivation} \tag{9}$$

$$M_J = \left(\frac{5k_{\rm B}T}{\mu m_{\rm H}{\rm G}}\right)^{3/2}\left(\frac{3}{4\pi\rho}\right)^{1/2} \tag{10}$$

$$\frac{V_c^2}{R} = \frac{{\rm G}M(<R)}{R} \quad \text{plus derivation} \tag{11}$$

$$v_r = A\,d\sin(2l) \quad \text{long derivation} \tag{12}$$

$$\rho(R) = \frac{V_c^2}{4\pi{\rm G}R^2} \quad \text{derivation} \tag{13}$$

$$v_e^2 = 2V_c^2\,[1 + \ln(R_\star/R)] \quad \text{derivation} \tag{14}$$

$$\frac{vt}{r} = \frac{\sin\theta\,(\theta - \sin\theta)}{(1 - \cos\theta)^2} \quad \text{derivation} \tag{15}$$

$$\nabla\phi = -\frac{\nabla p}{\rho_{\rm gas}} \quad \text{derivation} \tag{16}$$

$$\rho_{\rm tot}(r) = \frac{k_{\rm B}T}{2\pi{\rm G}\mu m_{\rm H}}\,r^{-2} \quad \text{derivation} \tag{17}$$

$$|\delta \mathbf{v}_\perp| = \frac{2\mathrm{G}m}{bv} \quad \text{derivation} \tag{18}$$

$$M = \frac{R\,\sigma^2}{\mathrm{G}} \quad \text{derivation} \tag{19}$$

$$\frac{\mathrm{G}M}{R} = \frac{3}{2}\frac{\mathrm{k_B T}}{\mu \mathrm{m_H}} \quad \text{derivation} \tag{20}$$

$$L \propto V_c^4 \tag{21}$$

$$L \propto \sigma^4 \tag{22}$$

$$\epsilon = \frac{L}{\dot{M}\,c^2} \tag{23}$$

$$\alpha = \frac{4\mathrm{G}M}{bc^2} \tag{24}$$