Constants and conversions:
$1\ \mathrm{M}_\odot = 2.0 \times 10^{30}$ kg
$1\ \mathrm{L}_\odot = 3.8 \times 10^{26}$ W
$R_\odot = 7.0 \times 10^8$ m
$c = 3 \times 10^8\,\mathrm{m\,s^{-1}}$
$G = 6.7 \times 10^{-11}\ \mathrm{N\,m^2\,kg^{-2}} = 4.3 \times 10^{-6}$ kpc $(\mathrm{km\ s^{-1}})^2\ \mathrm{M_\odot}^{-1}$
$h = 6.6 \times 10^{-34}\,\mathrm{J\,s}$, $\hbar = h/2\pi$
$m_p \approx m_n \approx m_H = 1.7 \times 10^{-27}$ kg
$m_e \approx m_p/1800 = 9.1 \times 10^{-31}$ kg
$1\ \mathrm{eV} = 1.6 \times 10^{-19}$ J
$1\ \mathrm{pc} = 3.1 \times 10^{16}$ m
$1\ \mathrm{yr} = 3.2 \times 10^7$ s
1 radian = 206265 arcsec

Redshift

$$z = \frac{\lambda_{\rm obs} - \lambda_{\rm em}}{\lambda_{\rm em}} \tag{1}$$

Doppler shift

$$\frac{\Delta\lambda}{\lambda} = \frac{v_r}{c} \tag{2}$$

$z = v/c$ for small z

Hubble law

$$v = H_0 d \tag{3}$$

$H_0 = 70.4^{+1.3}_{-1.4}\ \mathrm{km\ s^{-1}\ Mpc^{-1}}$, Hubble time $t_H = 1/H_0 = 13.8$ Gyr

Magnitudes and fluxes: $m_2 - m_1 = 2.5\log(F_1/F_2)$

Distance modulus: $m - M = 5\log(d/10\ \mathrm{pc})$

Kepler's third law:

$$P^2 = \frac{4\pi^2}{G(m_1 + m_2)} a^3, \tag{4}$$

Schwarzchild radius:

$$R_{\rm Sch} = \frac{2GM_{\rm BH}}{c^2} \tag{5}$$

Exponential surface brightness profile (scale height h, central surface brightness Σ_0): $\Sigma(r) = \Sigma_0 e^{-r/h}$

or

$$\mu(r) = \mu_0 + 1.086\ \frac{r}{h}. \tag{6}$$

with surface brightness in magnitudes.

de Vaucouleurs or $r^{1/4}$ profile:

$$\mu(r) = \mu_0 + 8.33\left(\frac{r}{r_e}\right)^{1/4} \tag{7}$$

where r_e is the effective radius, the radius which encloses half of the total light.

Sérsic profile:

$$\mu(r) = \mu_0 + 8.33\left[\left(\frac{r}{r_e}\right)^{1/n} - 1\right]. \tag{8}$$

Circular velocity

$$v_c^2 = \frac{GM}{r} \tag{9}$$

Isothermal density profile of dark matter halos

$$\rho(r) = \frac{v_c^2}{4\pi G r^2}. \tag{10}$$

Tully-Fisher relation, $L \propto v^4$; in magnitudes and km s^{-1} :

$$M_B = -10.2 \log v_{\rm max} + 2.71 \tag{11}$$

(this is in the B-band, and for Sb galaxies).

Virial theorem

$$-2\,\langle KE\rangle = \langle PE\rangle. \tag{12}$$

and virial mass

$$M = \frac{5R\sigma^2}{G} \tag{13}$$

Faber-Jackson relation $L \propto \sigma^4$, fundamental plane $L \propto \sigma^{2.65}\, r_e^{0.65}$

Galaxy interactions

Tidal radii

$$l_1 = a\left[0.500 - 0.227 \log\left(\frac{M_2}{M_1}\right)\right] \tag{14}$$

$$l_2 = a\left[0.500 + 0.227 \log\left(\frac{M_2}{M_1}\right)\right], \tag{15}$$

where a is the distance between M_1 and M_2.

Dynamical friction

$$f_d = C\,\frac{G^2 M^2 \rho}{v_M^2} \tag{16}$$

AGN luminosity and accretion rate (where η is the efficiency):

$$\dot{M} = \frac{L}{\eta c^2} = 0.018\ {\rm M}_\odot\ {\rm yr}^{-1}\left(\frac{L}{10^{37}\ {\rm W}}\right)\left(\frac{\eta}{0.1}\right)^{-1} \tag{17}$$

Eddington limit

$$\dot{M}_E = \frac{L_E}{\eta c^2} = 2\ {\rm M}_\odot\ {\rm yr}^{-1}\left(\frac{M_{\rm bh}}{10^8\ {\rm M}_\odot}\right)\left(\frac{\eta}{0.1}\right)^{-1} \tag{18}$$