

Astro 270 – Astrophysical Dynamics – Study Guide

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1. Orders of Magnitude

- Galactic properties: Page 18
- Parameters of clusters: 31
- Star clusters have $10^2 - 10^6$ stars
- Galaxies can have $10^5 - 10^{12}$ stars
- Milky Way orders of Mag
- Luminosities
 - Sun: 10^{26}

2. Equations to Know

2.1 Potential Theory

- General potential:

$$\Phi(x) = -G \int d^3\mathbf{x}' \frac{\rho\mathbf{x}'}{|\mathbf{x}' - \mathbf{x}|} \quad (1)$$

- Poisson's equation

$$\nabla^2\Phi = 4\pi G\rho \quad (2)$$

2.2 Spherically Symmetric Potentials

- Blah

$$\Phi(r) = -4\pi G \left[\frac{1}{r} \int_0^r dr' r'^2 \rho(r') + \int_r^\infty dr' r' \rho(r') \right] \quad (3)$$

- Point mass

$$\Phi(r) = -\frac{GM}{r} \quad (4)$$

- Homogeneous sphere within radius a

$$\Phi(r) = -2\pi G\rho(a^2 - \frac{1}{3}r^2) \quad (5)$$

- Homogeneous sphere outside radius A

$$-\frac{4\pi G\rho a^3}{3r} \quad (6)$$

- Plummer Model

$$\Phi = -\frac{GM}{\sqrt{r^2 + b^2}} \quad (7)$$

2.3 Circular velocities

- Blah

$$v_c^2 = \frac{GM(r)}{r} \quad (8)$$

- Escape speed

$$v_e(r) = \sqrt{2|\Phi(r)|} \quad (9)$$

3. Definitions

- Radial period - The time that it takes a star to go from apocenter to pericenter back to apocenter
- True Anomaly
- Eccentric anomaly