homework3

计算球状星团（10^5Msun），椭圆星系（10^11Msun）,星系团（10^14Msun)中的速度弥散度，穿越时标和弛豫时标

$$\mathcal{M} \approx 5\sigma^2 R_e / G.$$

V^2=GM/R 尺度：球状星团（1pc），椭圆星系（1Kpc）,星系团（1Msnpc)

G = 4.301x10^{-9} km^2 Mpc $MSun^{-1}$ s^{-2}

In [1]:
```
m_q = 1e5
m_t = 1e11
m_x = 1e14
R = [1e-6,1e-3,1]
g = 4.301*1e-9
def v(m,cdu):
    return (m*g/5/cdu)**0.5
```

In [2]:
```
v_q = v(m_q,R[0])
print("球状星团速度弥散度:",v_q,'km/s')
v_t = v(m_t,R[1])
print("椭圆星系速度弥散度:",v_t,'km/s')
v_x = v(m_x,R[2])
print("星系团速度弥散度:",v_x,'km/s')
```

```
球状星团速度弥散度: 9.274696760541556 km/s
椭圆星系速度弥散度: 293.29166370696595 km/s
星系团速度弥散度: 293.29166370696595 km/s
```

穿越时标 t_{cross} = R/V

10^{-6} Mpc= 1pc = 3.0857x10^{13} km

In [3]:
```
def v(v_,cdu):
    return cdu/v_*3.0857*10e13/3600/24/365
t_q = v(v_q,R[0])
print("球状星团:",t_q,'Myear')
t_t = v(v_t,R[1])
print("椭圆星系:",t_t,'Myear')
t_x = v(v_x,R[2])
print("星系团速:",t_x,'Myear')
```

```
球状星团: 1.054987647041832 Myear
椭圆星系: 33.361638679939894 Myear
星系团速: 33361.6386799399 Myear
```

弛豫时标 t_{relax} = N/(6*ln(N/2)*)t_{cross}

粒子数：球状星团（10^5），椭圆星系（10^{11}）,星系团（10^3)

In [4]:
```
import numpy as np
R = [1e5,1e11,1e3]
def v(t_,n):
    return n/(6*np.log(n/2))*t_
t_q1 = v(t_q,R[0])
print("球状星团:",t_q1,'Myear')
t_t1 = v(t_t,R[1])
print("椭圆星系:",t_t1,'Myear')
```

```python
t_x1 = v(t_x,R[2])
print("星系团速:",t_x1,'Myear')
```

```
球状星团: 1625.0912900897345 Myear
椭圆星系: 22570358922.519417 Myear
星系团速: 894710.1772571945 Myear
```

homework4

$$\lambda = J|E|^{\frac{1}{2}} \cdot G^{-1} \cdot M^{-\frac{5}{2}}$$

将(7),(11)代入

$$\lambda = \frac{1}{j_d} \cdot 2M_d \cdot R_d \cdot V_c \cdot \left|\frac{M V_c^2}{2}\right|^{\frac{1}{2}} \cdot G^{-1} \cdot M^{-\frac{5}{2}}$$

$$= \frac{1}{j_d} \sqrt{2} \cdot 3kpc \cdot (200 km/s)^2 \cdot \frac{1}{G} \cdot \frac{M_d}{M^2}$$

$$\frac{3\sqrt{2} \cdot 40000}{10^{11} \cdot 4.301 \times 10^{-6}} = \frac{m_d}{M j_d} 3\sqrt{2} \cdot 40000 \cdot \frac{1}{4.301 \times 10^{-6}} \quad (M_{sun})$$

In [6]:
```python
3*np.sqrt(2)*40000/4.301/1e5
```

Out[6]:
```
0.3945724889206496
```

In [ ]:
```python

```