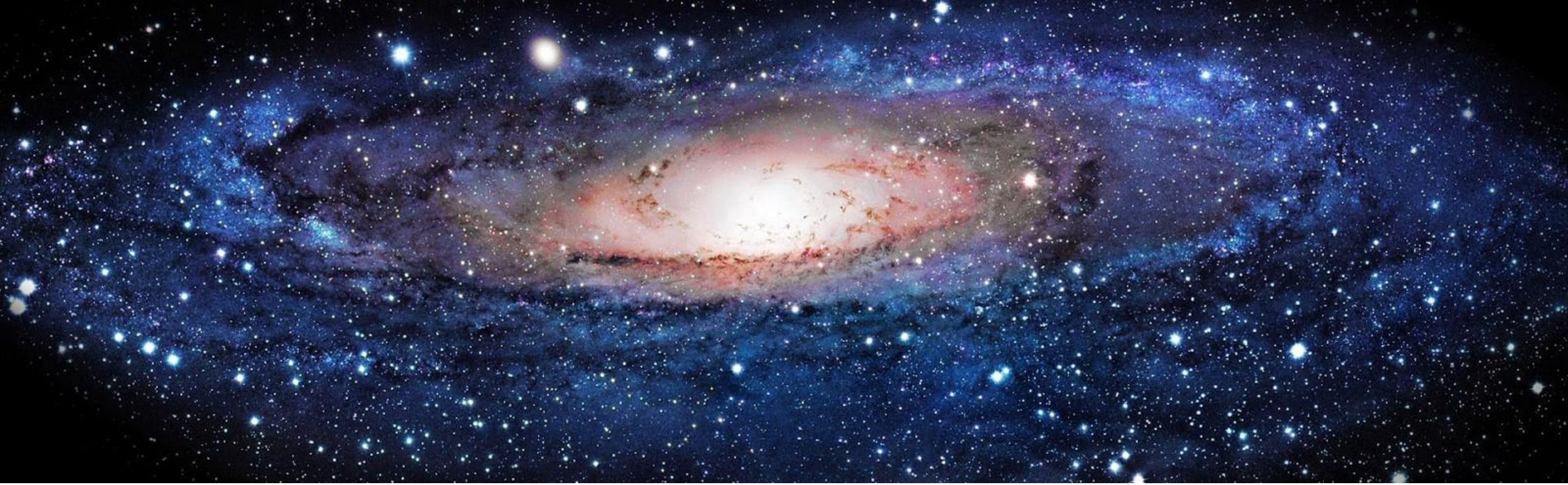
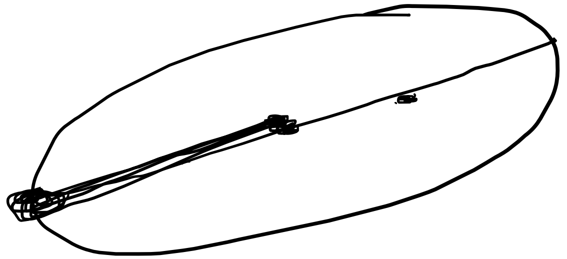


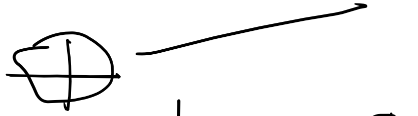
Майнор. Астрофизика.

Семинар 1. (03.09)

1. $c = 300\,000$ км/с



$l = v \cdot t$



150 млн. км = 1 а.е.

$\frac{150 \cdot 10^6 \text{ км}}{3 \cdot 10^5 \text{ км/с}} = 500$ с

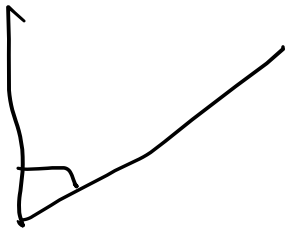
2. св. год

$365{,}25 \cdot 24 \cdot 60 \cdot 60 = 3{,}1 \cdot 10^7$ сек

$3 \cdot 10^{10} \frac{\text{см}}{\text{с}} \cdot 3{,}1\ldots \cdot 10^7 \text{ с} \approx 10^{18}$ см = 1 св. г.

3. Парсек

параллакс



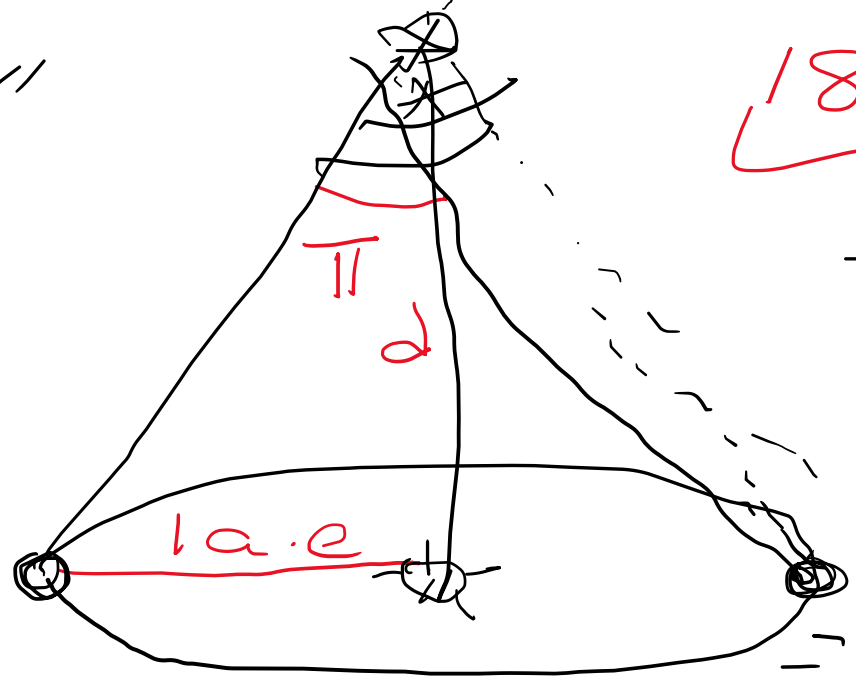
$1^\circ = 60'$

$1' = 60''$

$1рад = 206265''$

$d[пк] = \frac{1}{\pi''}$

$\pi = 0,01''$



$d = \frac{1 а.е}{tg\,\pi}$

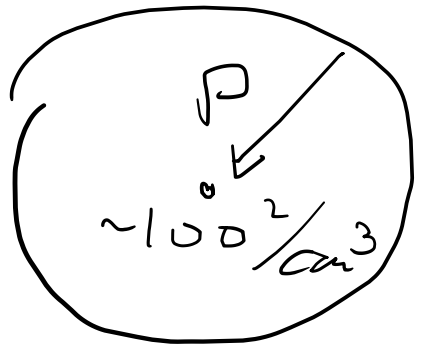
$180^\circ = \pi$

$tg\,\pi \approx \sin\pi \approx \pi$

$d = \frac{1 а.е}{\pi[рад]}$

$1пк = 206265 а.е. = 3,15 \cdot 10^{18} см = 3,26$ св. г.

4. $\rho = \frac{M}{V}$ $\quad V = \frac{4}{3}\pi R^3$



a. $M_\odot = 1.99 \cdot 10^{33}\,g$

$R_\odot = 696000\,km$

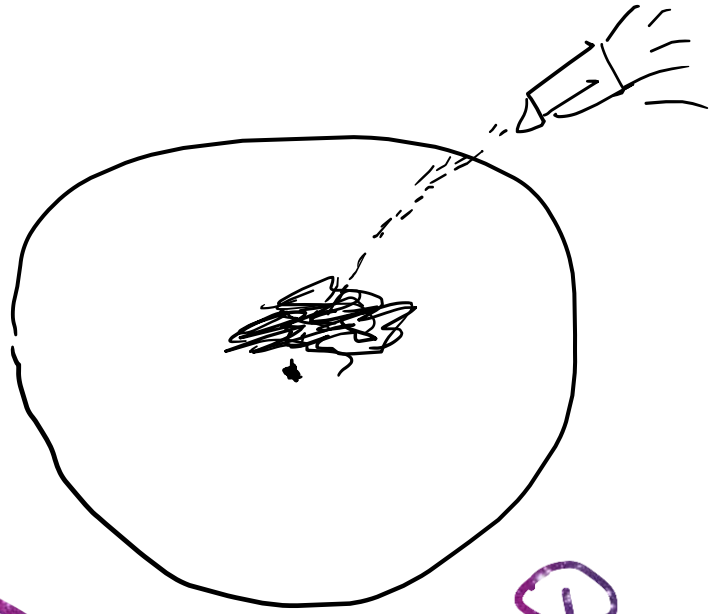
$\rho_\odot = \frac{3.2 \cdot 10^{33}\,g}{4\pi (6.96 \cdot 10^{10}\,cm)^3} \simeq 1,4 \frac{g}{cm^3}$

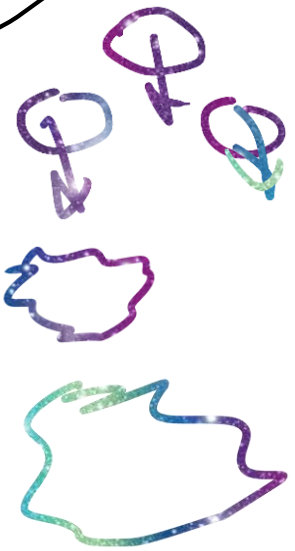
$G = 6.67 \cdot 10^{-8}$ cgs

$R_{BH} = \frac{2GM_{BH}}{c^2} \sim M_{BH} \simeq 3\,km \frac{M_{BH}}{M_\odot}$

$\rho \sim \frac{M}{R^3} \quad \langle \rho_{BH} \rangle \sim M_{BH}^{-2}$

$\langle \rho_{BH} \rangle \geq 5 \langle \rho_* \rangle$





6. Земля

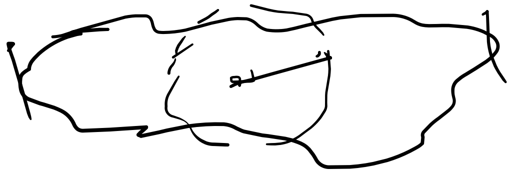
$R_\oplus = 6400\ km$

$M_\oplus = \frac{1}{330000} M_\odot = 6 \cdot 10^{27}\ g$

$\rho_\oplus = \frac{3 \cdot 6 \cdot 10^{27}}{4\pi \cdot (6400 \cdot 10^5)^3} = \frac{9}{2\pi} \cdot \frac{10^{27}}{6.4^3\ 10^{24}} = \frac{5 \cdot 10\,10 \cdot 10}{2\pi\ 64\ 6.4\ 6.4} \approx 5{,}477\ g/cm^3$

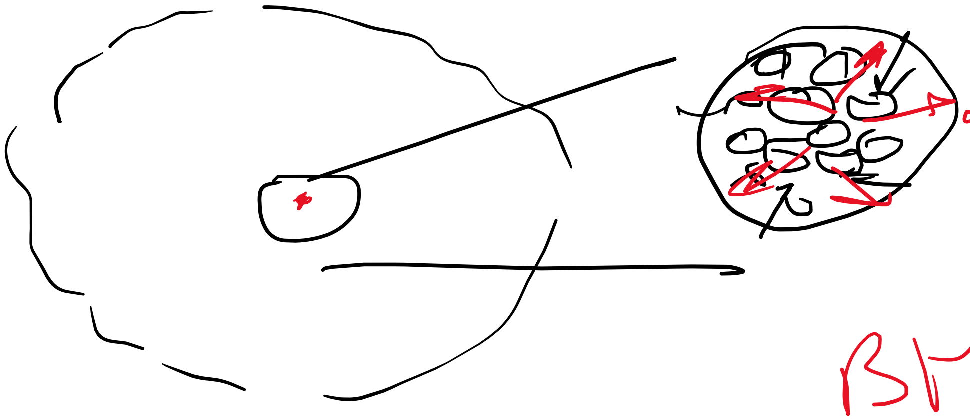
6. Нейтр. зв.

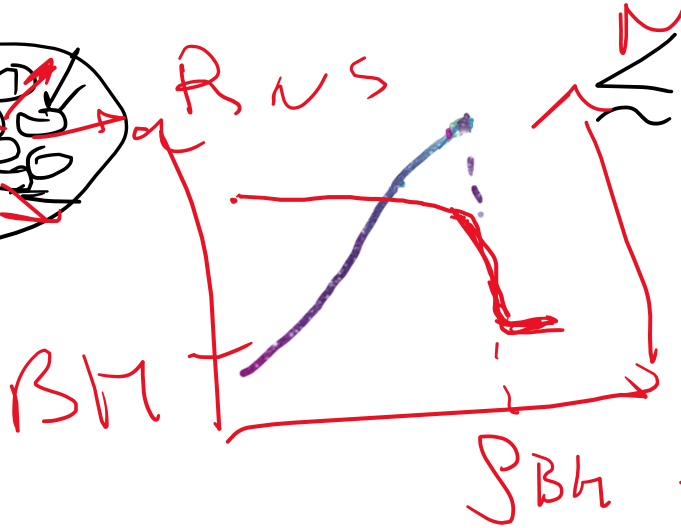
$R_{NS} \simeq 10\ \text{km}$



$M_{NS} \simeq (1 \div 2) \cdot M_\odot$

$$\rho_{NS} \simeq \frac{3 \cdot 1{,}5 \cdot 2 \cdot 10^{33}\ \text{g}}{4\pi\ 10^{18}\ \text{cm}^3} = \frac{9}{4\pi}\ 10^{15}\ \text{g}/\text{cm}^3$$





$\lesssim 10^{15}\ \text{g}/\text{cm}^3$

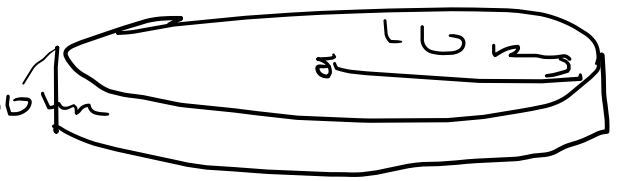
$2{,}5\ M_\odot$

5. Пл-п МЗС

$M_{\text{к}} \cong 10^{11} M_{\odot}$

МЗС: пыль + газ

$M_{gas} = 10\% M_{\text{к}} = 10^{10} M_{\odot}$

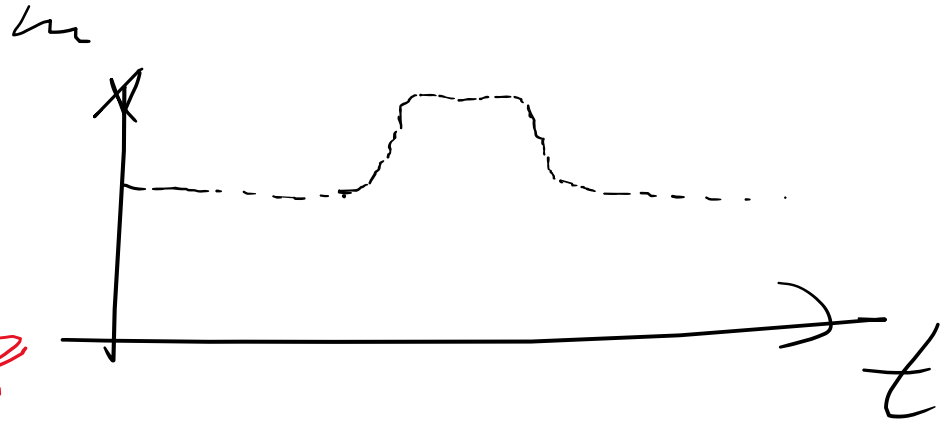


$m_p = 10^{-24}$ г

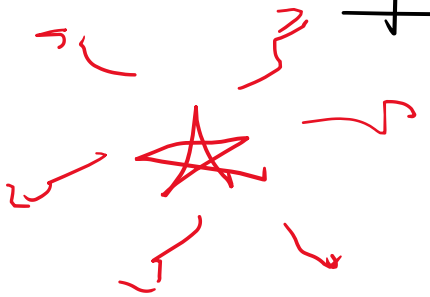
$n_{\text{ISM}} = \frac{M_{gas}}{\pi R^2 \cdot h} = \frac{10^{10} \cdot 2 \cdot 10^{33}}{\pi (10^4 \cdot 3{,}1 \cdot 10^{18})^2 \cdot 300 \cdot 3{,}1 \cdot 10^{18}} =$

$= \frac{2 \cdot 10^{43}}{\pi \cdot 3{,}1^3 \cdot 3{,}1 \cdot 10^{44} \cdot 10^2 \cdot 10^{18}} = \frac{2 \cdot 10^{43}}{\pi \cdot 10^{66}} \cong 10^{-232}/\text{см}^3 \Rightarrow 10 \frac{\text{ат.}}{\text{см}^3}$?

6.



$F\left[\frac{эр^2}{см^2 \cdot с}\right]$



$f = \frac{L}{4\pi l^2}$

$L_\odot = 3{,}86 \cdot 10^{33} \frac{эр}{с}$

$10^{-7}\ эр^2 \div 1D_m$

$L_\odot \div 3{,}86 \cdot 10^{26}\ Вт$

$F_ф = F - \Delta F$

$\frac{\Delta F}{F}$

$$F \sim S$$

$$\Delta F \sim \Delta S$$

$$S = \pi R^2$$

$$\frac{\Delta F}{F} = \frac{S_{pl}}{S_\star} = \frac{R_{pl}^2}{R_\star^2}$$

$$M = M_\odot$$

$$M_{pl} = M_{Jup} = \frac{1}{1000} M_\odot$$

$$\langle \rho_\odot \rangle \simeq \langle \rho_{Jup} \rangle$$

$$\rho = \frac{M}{\frac{4}{3}\pi R^3}$$

$$\frac{\rho_\odot}{\rho_{pl}} = \frac{M_\odot}{M_{pl}} \frac{R_{pl}^3}{R_\odot^3} = 1$$

$$\frac{R_{pl}}{R_\star} = \left(\frac{M_{pl}}{M_\star} \right)^{1/3}$$

$$\frac{\Delta f}{f} = \left(\frac{M_{pl}}{M_\star} \right)^{2/3} = \left(\frac{1}{1000} \right)^{2/3} = \frac{1}{100} \Rightarrow \Delta f = 1\%$$

7. Parker Probe

696000 km

$$\alpha = \frac{1}{5} \approx 11^\circ$$

$$l = 5h = \underline{\underline{75\ m}}$$