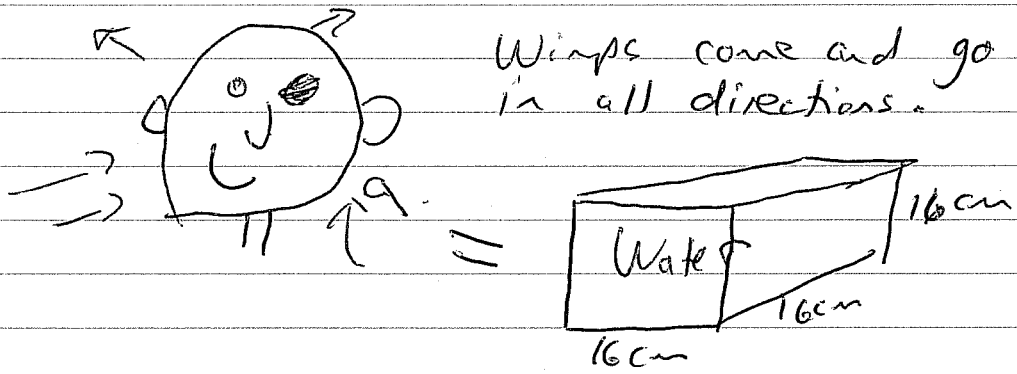
What's the Probability you will take a Wimp to the Head?

Wimp: Weakly interacting Massive Particle
($\frac{1000}{m^3}$, $220\ \frac{km}{sec}$, 120 x mass Proton, weak + gravity forces)



(Blockhead) Model the head as a tank of water, 16cm on all sides

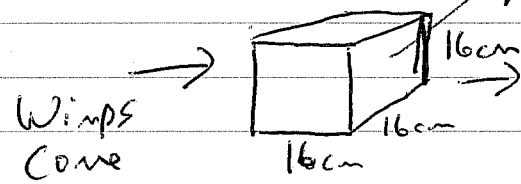
How many Protons in that head?

Head Volume, H_2O Density

$$N_p = 16^3\,cm^3 \times \frac{1\,g}{cm^3} \times \frac{mole}{18\,g} \times \frac{6.022 \times 10^{23}\ molecules}{mole} \times \frac{18\ Protons}{molecule}$$

$$N_p = 2.47 \times 10^{27}\ \frac{Protons}{in\ the\ head}$$

A = Area $= 16^2\,cm^2$



$\frac{1000\ Wimps}{m^3}$ average $= N$

$N\uparrow$

$$F = \frac{\#\,Wimps}{second}\ through\ head = 3vAN = 3FA$$

(3 sides; v = Wimps' Speed)

$$F = \frac{\#\,Wimp}{Area \cdot Sec} = \frac{NV}{3} = 1000\ \frac{Wimps}{m^3} \times \frac{220 \times 10^3\ m}{3\ sec} = \frac{73.3 \times 10^6\ Wimps}{m^2\,sec}$$

Wimps

↓ Head cross section Area

So $f = 3 * 73.3 \times 10^6 \frac{\text{wimps}}{m^2 \text{sec}} * 16^2 cm^2 * 10^{-4} \frac{m^2}{cm^2}$

$f = 5,632,000$ Wimps through the Head / second

At any time you have Λ wimps in your head.

$\Lambda = N \frac{\text{Wimps}}{\text{Volume}} * 16^3 cm^3 = \frac{1000}{m^3} * 16^3 cm^3 * 10^{-6} \frac{m^3}{cm^3}$

$\Lambda = 4.096$ Wimps in your head

$\Lambda = 4.1$ At Any time

How long will it take for a wimp to be absorbed? (1 event)

The cross section for absorption by a wimp and proton interaction is

$\sigma_{abs} = 10^{-42} \frac{cm^2}{\text{proton}}$.

The absorption cross section per head is

$\Omega_{ABS} = N_P \frac{\text{Protons}}{\text{head}} * \sigma_{abs} \frac{cm^2}{\text{Proton}} = 2.47 \times 10^{-15} \frac{cm^2}{\text{head}}$

This gives an efficiency for absorption of ...

$Q = \frac{\Omega_{ABS}}{16^2 cm^2} = 9.65 \times 10^{-18}$ (Really Small)

Time to wait for a wimp to be absorbed in your head.

$\tau_0^{-1} = 3F\Omega_{abs} \frac{\text{Wimps}}{\text{second}}$ absorbed, $\tau_0 = 1.84 \times 10^{10}$ seconds

$\tau_0 = 584$ years for a wimp to be absorbed in your head