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Assignment 2

A is absorption as a function of angle θ

$$A(\cancel{\sin}\,\theta) = \tau^2 \exp(-2\tau^2) =$$

$$= \left(\left(k_0 L\right)^{1/3} \sin\theta\right)^2 \exp\left(-2\left(k_0 L\right)^{\frac{1}{3}} \sin\theta\right)^2\Big)$$

$$a = \left(k_0 L\right)^{1/3}$$

$$= a^2 \sin^2\theta \exp(-2a^2 \sin^2\theta)$$

$$\frac{\partial}{\partial\theta} A(\sin\theta) =$$

$$= \frac{\partial}{\partial\theta}\left(a^2 \sin^2\theta \exp(-2a^2\sin^2\theta)\right) =$$

$$= a^2 \sin\theta \cos\theta \cdot 2 \cdot \exp(-2a^2 \sin^2\theta) -$$

$$+ 2a^2 \sin^2\theta \cdot (-2a^2 \cdot 2) \sin\theta \cos\theta \cdot$$

$$\cdot \exp(-2a^2 \sin^2\theta)$$

$$\frac{\partial}{\partial\theta} A(\cancel{\sin}\,\theta) = 0$$

To find min of function $A(\theta)$

$$\frac{\partial A(\theta)}{\partial\theta} = 0.$$

$$\cancel{a^2}\cancel{\sin\theta\cos\theta}\cdot 2\cdot\cancel{\exp}\left(-2a^2\sin^2\theta\right)-$$

$$-2\cancel{a^2}\sin^2\theta\left(-2a^2\right)\cancel{\sin\theta\cos\theta}\cdot$$

$$\cancel{\exp\left(-2a^2\sin^2\theta\right)}=0$$

$$1-2a^2\sin^2\theta=0$$

$$\sin\theta=\left(\frac{1}{2a^2}\right)^{\frac{1}{2}}$$

$$\sin\theta=\left(2^{-\frac{1}{2}}a^{-\frac{1}{2}\cdot 2}\right)=$$

$$=2^{-\frac{1}{2}}a^{-1}=2^{-\frac{1}{2}}\cdot\left(k_0L\right)^{-\frac{1}{3}}$$

$$\cancel{\sin}\ \boxed{\theta=\sin^{-1}\left(2^{-\frac{1}{2}}\left(k_0L\right)^{-\frac{1}{3}}\right)}$$

b) Only p-polarised light undergoes resonance absorption, because the light has to have some of component of $\vec{E}$ directed into the surface. If a light is not p-polarised, there is not component of $\vec{E}$ into the surface.

c) Resonance absorption is not significant under low laser irradience, lower than 10^{14} W/cm². Because there is not ionasistion. of plasma, which happens because of multiphoton absorption. For multiphoton absorfion we need high irradience more than 10^{14} W/cm².

2. (a) Inverse bremsstrahlung radiation heats mostly slow electrons and doesn't heat fast electrons. Because fast electrons have a very low cross-section for interaction with light.

For ICF we need to heat substance evenly.

But if we heat fast electrons, these electrons escape with a lot of energy.

2) (b). Condition of Raman scattering is that it happens in area of 1/4 of critical plasma density.

However if a pulse of laser is too short, it is not enough energy to form and achieve ~~a~~ plasma density high enough. So, plasma density is to low to satisfy Roman scattering.

(3)

n_e - electron density
ρ - is density of raw material.
V_{ion} - ion velocity