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№6.5

$$V_{гр} = \frac{\partial \omega}{\partial k} \Rightarrow V_{гр}^{-1} = \frac{\partial k}{\partial \omega}, \quad V_{ф} = \frac{c_0}{n}, V_{ф}^{-1} = \frac{n}{c_0} = \frac{k}{\omega}$$

$$V_{гр}^{-1} = \frac{\partial}{\partial \omega}\left(\frac{n(\omega)\cdot\omega}{c_0}\right) = \frac{n}{c_0} + \frac{\omega}{c_0}\cdot\frac{\partial n}{\partial \omega}$$

$$V_{гр}^{-1} - V_{ф}^{-1} = \frac{n}{c_0} - \frac{\omega}{c_0}\frac{\partial n}{\partial \omega} - \frac{n}{c_0} = \frac{\omega}{c_0}\cdot\frac{\partial n}{\partial \omega} = \frac{2\pi}{\lambda}\frac{\partial n}{\partial \lambda}\frac{\partial \lambda}{\partial \omega} \Leftarrow$$

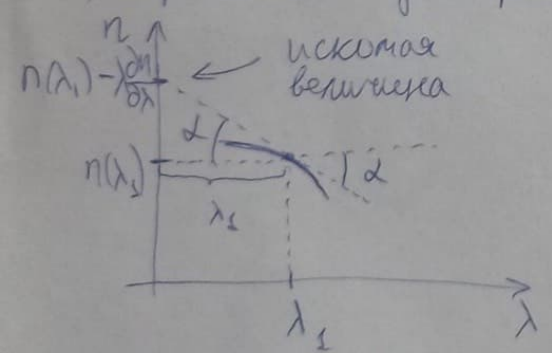
$$\lambda = \frac{2\pi c_0}{\omega}, \quad \omega = \frac{2\pi c_0}{\lambda}$$

$$\Leftarrow \frac{2\pi}{\lambda}\cdot\left(-\frac{2\pi c_0}{\omega^2}\right)\frac{\partial n}{\partial \lambda} = -\frac{c_0}{\lambda}\left(\frac{\lambda}{c_0}\right)^2\frac{\partial n}{\partial \lambda} = -\frac{\lambda}{c_0}\frac{\partial n}{\partial \lambda}$$

$$\Rightarrow \frac{1}{V_{гр}} = \frac{1}{V_{ф}} - \frac{\lambda}{c_0}\frac{\partial n}{\partial \lambda}$$

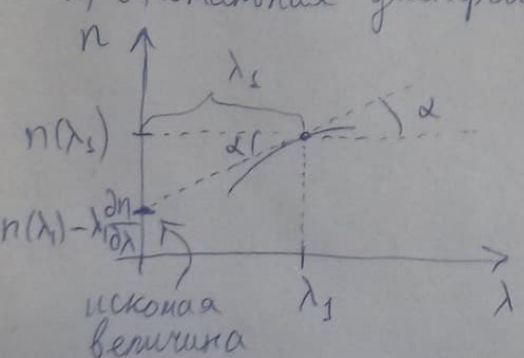
$$\frac{c_0}{V_{гр}} = \frac{c_0}{V_{ф}} - \frac{\lambda\cdot c_0}{c_0}\frac{\partial n}{\partial \lambda} = \boxed{n - \lambda\frac{\partial n}{\partial \lambda}}$$

1) нормальная дисперсия: $\frac{\partial V_{ф}}{\partial \lambda} > 0$. $\frac{\partial V_{ф}}{\partial \lambda} = -\frac{c_0}{n^2}\frac{\partial n}{\partial \lambda} \Rightarrow \frac{\partial n}{\partial \lambda} < 0$



$$tg\,\alpha = -\frac{\partial n}{\partial \lambda} > 0$$

2) аномальная дисперсия: $\frac{\partial V_{ф}}{\partial \lambda} < 0 \Rightarrow \frac{\partial n}{\partial \lambda} > 0$



$$tg\,\alpha = \frac{\partial n}{\partial \lambda} > 0$$

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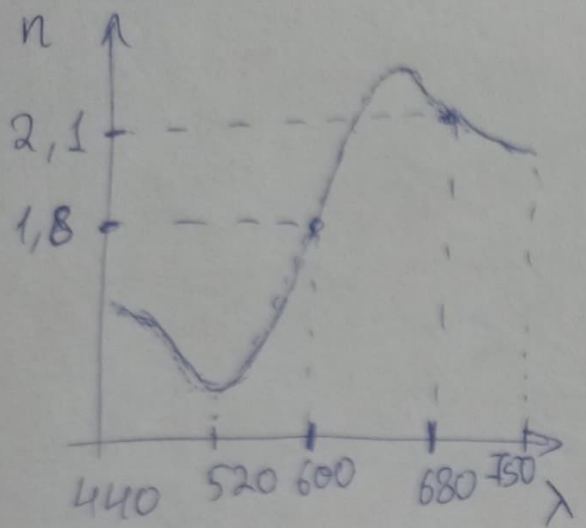

$\lambda_1 = 600$ нм

$\lambda_2 = 680$ нм

$\frac{\partial n(\lambda_1)}{\partial \lambda} \approx \frac{1,1}{80\text{ нм}} > 0$ – аном. дисп.

$\frac{\partial n(\lambda_2)}{\partial \lambda} \approx -\frac{0,4}{120\text{ нм}} < 0$ – норм. дисп.

$n(\lambda_1) \approx 1,8$

$n(\lambda_2) \approx 2,1$

~~$\frac{c}{v_{гр}}\Big|_{\lambda=\lambda_1} = 2,1 + \frac{0,4}{120\text{нм}} \cdot 680\text{нм} \approx 4,4$~~

$\frac{c}{v_{гр}}\Big|_{\lambda=\lambda_2} = 2,1 + \frac{0,4}{120\text{ нм}} \cdot 680_{\text{нм}} \approx 4,4$

$\frac{c}{v_{гр}}\Big|_{\lambda=\lambda_1} = 1,8 - \frac{1,1}{80\text{ нм}} \cdot 600\text{ нм} \approx -6,45$