Quiz #2 Solution 9/29/21

1. $\Delta\lambda = 10\ nm$ $\quad f\lambda = c$, $\quad f = \frac{c}{\lambda}$

$\lambda = 600nm$

$$\frac{\Delta f}{f} = \frac{\Delta\lambda}{\lambda} \rightarrow \Delta f = \Delta\lambda \frac{f}{\lambda} = \frac{c}{\lambda^2}\Delta\lambda = \frac{1\cdot10^{-8}}{(6\cdot10^{-7})^2} 3\cdot10^{8} = \frac{3}{64}\cdot10^{14} = \underline{4.7\ THz}$$

$$\Delta f \Delta\tau = 1, \quad \Delta\tau = \frac{1}{\Delta f} \rightarrow l_\tau = c\Delta\tau = \frac{c}{\Delta f} = \underline{6.4\times10^{-5}}\ \text{or}\ 64\ \mu m$$

$$= \underline{2.1\times10^{-13}\ (s)}\ \text{or}\ 210\ fs.$$

2. $V \equiv \dfrac{I_{max} - I_{min}}{I_{max} + I_{min}}$

Interference fringe : $I = \langle E\cdot E^* \rangle = \langle I_1 + I_2 + \underline{2Re(\bar{E}_1\cdot\bar{E}_2^*)} \rangle$

$2\sqrt{I_1 I_2}\,|\gamma_{12}|$

$I_{max} = I_1 + I_2 + 2\sqrt{I_1 I_2}\,|\gamma_{12}|$

$I_{min} = I_1 + I_2 - 2\sqrt{I_1 I_2}\,|\gamma_{12}|$

$\therefore V = |\gamma_{12}|$ for $I_1 = I_2$.

If $V = 0$, then $|\gamma_{12}| = 0$.

Thus, the measured intensity is $\underline{2I_0}$ from $I_{max} = I_{min}$.