

Q7

$$\dot{C}_f^{(2)}(t) = \frac{1}{i\hbar} \sum_j V_{fj}(t) \cdot e^{i\omega_{fj}t} C_j^{(1)}$$

$$\& C_j^{(1)} = \frac{V_{ji}}{\hbar\omega_{ji}} (1 - e^{i\omega_{ji}t})$$

$$\Rightarrow C_f^{(2)} = \frac{1}{i\hbar} \sum_j \frac{V_{fj} V_{ji}}{\hbar\omega_{ji}} e^{i\omega_{fj}t} (1 - e^{i\omega_{ji}t})$$

$$\downarrow \Rightarrow \frac{1}{i\hbar} \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fj}t} - \frac{V_{fj} V_{ji}}{E_{ji}} e^{i(\omega_{fj} + \omega_{ji})t}$$

$$\begin{aligned} \omega_{fj} + \omega_{ji} &= \omega_f - \omega_j + \omega_j - \omega_i \\ &= \omega_f - \omega_i = \omega_{fi} \end{aligned}$$

$$C_f^{(2)} = \frac{1}{i\hbar} \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fj}t} - \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fi}t}$$

pu 3203

Adwait Noravane
tqms151

Q8

~~$$C_f^{(2)} = \sum_j V_{ji} V_{fj} \left(\frac{1 - e^{i\omega_{fi}t}}{E_{fi} E_{ji}} - \frac{1 - e^{i\omega_{ff}t}}{E_{fi} E_{oj}} \right)$$~~

$$C_f^{(2)}(t) =$$

~~$$- \frac{i}{\hbar E_{fi}} \sum_j V_{ji} V_{fi} \frac{e^{i\omega_{fi}t}}{E_{ji}}$$~~

$$C_f^{(2)}(t) = \sum_j V_{fj} V_{ji} \left\{ \frac{1 - e^{i\omega_{fj}t}}{E_{fj} E_{ji}} - \left[\frac{1 - e^{i\omega_{fi}t}}{E_{fi} E_{ji}} \right] \right\}$$

$$C_f^{(2)}(t) = \sum_j \frac{-i\omega_{fi}}{\hbar E_{fi} E_{ji}} V_{fi} V_{ji} e^{i\omega_{fi}t} - \sum_j \frac{-i\omega_{fi} V_{fj} V_{ji}}{\hbar E_{fi} E_{ji}} e^{i\omega_{fi}t}$$

$$\Rightarrow C_f^{(2)}(t) = -\frac{i}{\hbar} \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fi}t} - \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fi}t}$$

$$\Rightarrow C_f^{(2)}(t) = \frac{1}{i\hbar} \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fi}t} - \frac{1}{i\hbar} \sum_j \frac{V_{fj} V_{ji}}{E_{ji}} e^{i\omega_{fi}t}$$

Q9 $|C_f(\tau)|^2$

$$\sum V_{fj} V_{ji} \left(\frac{1 - \cos(\omega_f \tau)}{E_{ji} E_{fj}} \right)$$

$$= \left[\frac{1 - \cos(\omega_f \tau)}{E_{ji} E_{fj}} \right]$$

$$= \sum \frac{V_{fj} V_{ji}}{E_{ji} E_{fj}} \left(\frac{\sin \omega_f \tau}{E_{ji} E_{fj}} \right)$$

$$= \frac{\sin(\omega_f \tau)}{E_{ji} E_{fj}}$$

$$\Rightarrow |C_f(\tau)|^2 = \left[\sum V_{fj} V_{ji} \left(\frac{1 - \cos \omega_f \tau}{E_{ji} E_{fj}} - \frac{1 - \cos \omega_f \tau}{E_{ji} E_{fj}} \right) \right]$$

$$+ \left(\sum V_{ji} V_{if} \sin \right) \neq \text{Ans} / \text{K}$$

None of above

Q10

$$\begin{aligned} & \left\langle \uparrow_N^{m-1} \mid \uparrow_N^m \right\rangle \\ &= \cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} e^{i \frac{2\pi}{N} (m-m+1)} \\ &= \cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} e^{i \frac{2\pi}{N}} \end{aligned}$$

$$\begin{aligned} \Rightarrow \alpha &= -i \operatorname{Im} \left[\ln \left[\left(\cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} e^{i \frac{2\pi}{N}} \right)^N \right] \right] \\ &= -N \operatorname{Im} \left[\ln \left[\cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} e^{i \frac{2\pi}{N}} \right] \right] \end{aligned}$$

$$\begin{aligned} & \left[\begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \right] \\ & \left[\begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \right] \\ & e^{i\theta} \left[\cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} \cos \left(\frac{2\pi}{N} \right) + i \sin^2 \frac{\theta}{2} \sin \left(\frac{2\pi}{N} \right) \right] \end{aligned}$$

$$\begin{aligned} \Rightarrow \alpha &= -i \operatorname{Im} \ln e^{i\theta} \\ \Rightarrow \theta &= N \tan^{-1} \left(\frac{\sin^2 \frac{\theta}{2} \sin \left(\frac{2\pi}{N} \right)}{\cos^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2} \cos \frac{2\pi}{N}} \right) \\ \Rightarrow \alpha &= -N\theta = -N \tan^{-1} \left[\dots \right] \end{aligned}$$

Q11