1.4c $\sigma^2_{N_{ph}} = \langle N_{ph}^2 \rangle - \langle N_{ph} \rangle^2$

$$\langle N_{ph}^2 \rangle \simeq \langle N_{ph} \rangle^2 \left\langle 1 + \frac{1}{Ne^2} \sum_{j \neq k} e^{-\sigma_\omega^2 (t_j - t_k)} \right\rangle$$

$$\sigma^2_{N_{ph}} = \frac{\langle N_{ph} \rangle^2}{Ne^2} \sum_{j \neq k} e^{-\sigma_\omega^2 (t_j - t_k)} \cdot \frac{e^2}{Ne^2}$$

$$\sigma^2_{N_{ph}} = \frac{\langle N_{ph} \rangle^2}{Ne^2} \cdot Ne$$

$$= \langle N_{ph} \rangle^2$$