

$$\begin{aligned}
 Q1. \quad u &= e^{i\delta} (\cos\delta F + \sin\delta G) \\
 &= e^{i\delta} \left\{ \frac{(e^{i\delta} + e^{-i\delta})}{2} F + \frac{(e^{i\delta} - e^{-i\delta})}{2i} G \right\} \quad (II) \\
 &= \frac{e^{2i\delta}}{2} F + \frac{1}{2} F + \left(\frac{e^{2i\delta} - 1}{2i} \right) G \left(-\frac{1}{2} F + \frac{1}{2} F \right) \\
 &= F + \left(\frac{e^{2i\delta} - 1}{2i} \right) [G + iF] = \underline{F + T_\ell H^+}
 \end{aligned}$$

from (II)

$$\begin{aligned}
 &= \frac{e^{2i\delta}}{2} F + \frac{1}{2} F + \left(\frac{e^{2i\delta}}{2i} - \frac{1}{2i} \right) G \\
 &= i \frac{e^{2i\delta} F}{2i} + \frac{iF}{2i} + \frac{1}{2i} (e^{2i\delta} - 1) G \\
 &= \frac{i}{2} \left\{ \frac{e^{2i\delta} F}{i} + \frac{F}{i} - (e^{2i\delta} - 1) G \right\} \\
 &= \frac{i}{2} \left\{ (G - iF) - e^{2i\delta} (G + iF) \right\} \\
 &= \underline{\underline{\frac{i}{2} \left\{ H^- - S_\ell H^+ \right\}}}
 \end{aligned}$$