8.15: GHZ Math Appendix

This appendix shows another way of "doing the math" in the GHZ experiment.

$$\Psi_{yyx} = \frac{1}{\sqrt{2}}(H_1H_2H_3 + V_1V_2V_3) \left| \begin{array}{l} \text{substitute, } H_1 = \frac{1}{\sqrt{2}}(R_1 + L_1) \\ \text{substitute, } H_2 = \frac{1}{\sqrt{2}}(R_2 + L_2) \\ \text{substitute, } H_3 = \frac{1}{\sqrt{2}}(H_3' + V_3') \\ \text{substitute, } V_1 = \frac{i}{\sqrt{2}}(L_1 - R_1) \\ \text{substitute, } V_2 = \frac{i}{\sqrt{2}}(L_2 - R_2) \\ \text{substitute, } V_3 = \frac{1}{\sqrt{2}}(H_3' - V_3') \\ \text{simplify} \end{array} \right. \rightarrow \Psi_{yyx} = \frac{1}{2}R_1R_2V_3' + \frac{1}{2}R_1L_2H_3' + \frac{1}{2}L_1R_2H_3' + \frac{1}{2}L_1L_2V_3'$$

$$\Psi_{yxy} = \frac{1}{\sqrt{2}}(H_1H_2H_3 + V_1V_2V_3) \left| \begin{array}{l} \text{substitute, } H_1 = \frac{R_1+L_1}{\sqrt{2}} \\ \text{substitute, } H_2 = \frac{(H_2'+V_2')}{\sqrt{2}} \\ \text{substitute, } H_3 = \frac{R_3+L_3}{\sqrt{2}} \\ \text{substitute, } V_1 = \frac{i}{\sqrt{2}}(L_1 - R_1) \\ \text{substitute, } V_2 = \frac{H_2'-V_2'}{\sqrt{2}} \\ \text{substitute, } V_3 = \frac{i(L_3-R_3)}{\sqrt{2}} \\ \text{simplify} \end{array} \right. \rightarrow \Psi_{yxy} = \frac{1}{2}R_1H_2'L_3 + \frac{1}{2}R_1V_2'R_3 + \frac{1}{2}L_1H_2'R_3 + \frac{1}{2}L_1V_2'L_3$$

$$\Psi_{xyy} = \frac{1}{\sqrt{2}}(H_1H_2H_3 + V_1V_2V_3) \left| \begin{array}{l} \text{substitute, } H_1 = \frac{H_1'+V_1'}{\sqrt{2}} \\ \text{substitute, } H_2 = \frac{R_2+L_2}{\sqrt{2}} \\ \text{substitute, } H_3 = \frac{R_3+L_3}{\sqrt{2}} \\ \text{substitute, } V_1 = \frac{H_1'-V_1'}{\sqrt{2}} \\ \text{substitute, } V_2 = \frac{i(L_2-R_2)}{\sqrt{2}} \\ \text{substitute, } V_3 = \frac{i(L_3-R_3}{\sqrt{2}} \\ \text{simplify} \end{array} \right. \rightarrow \Psi_{xyy} = \frac{1}{2}H_1'R_2L_3 + \frac{1}{2}H_1'L_2R_3 + \frac{1}{2}V_1'R_2R_3 + \frac{1}{2}V_1'L_2L_3$$

$$\Psi_{xxx} = \frac{1}{\sqrt{2}}(H_1 H_2 H_3 + V_1 V_2 V_3) \left| \begin{array}{l} \text{substitute, } H_1 = \frac{H_1' + V_1'}{\sqrt{2}} \\ \text{substitute, } H_2 = \frac{H_2' + V_2'}{\sqrt{2}} \\ \text{substitute, } H_3 = \frac{H_3' + V_3'}{\sqrt{2}} \\ \text{substitute, } V_1 = \frac{H_1' - V_1'}{\sqrt{2}} \\ \text{substitute, } V_2 = \frac{H_2' - V_2')}{\sqrt{2}} \\ \text{substitute, } V_3 = \frac{H_3' - V_3'}{\sqrt{2}} \\ \text{simplify} \end{array} \right. \rightarrow \Psi_{xxx} = \frac{1}{2} H_1' H_2' H_3' + \frac{1}{2} H_1' V_2' V_3' + \frac{1}{2} V_1' H_2' V_3' + \frac{1}{2} V_1' V_2' H_3'$$