quED Work Sheet – Bell's Inequality

1. Set the source to produce the entangled state $|\phi_+\rangle$. Set the polarizers to the 16 different angle settings below and record the coincidence count rates for each setting. Calculate the expectation values E and the two S values. Mark the corresponding spot in the graph.

$$\frac{0°,22.5° - 0°,112.5° - 90°,22.5° + 90°,112.5°}{0°,22.5° + 0°,112.5° + 90°,22.5° + 90°,112.5°} = E(0°,22.5°) = E(0°,22.5°)$$

$$+ \qquad -$$

$$\frac{45°,22.5° - 45°,112.5° - 135°,22.5° + 135°,112.5°}{45°,22.5° + 45°,112.5° + 135°,22.5° + 135°,112.5°} = E(45°,22.5°) = E(45°,22.5°)$$

$$- \qquad -$$

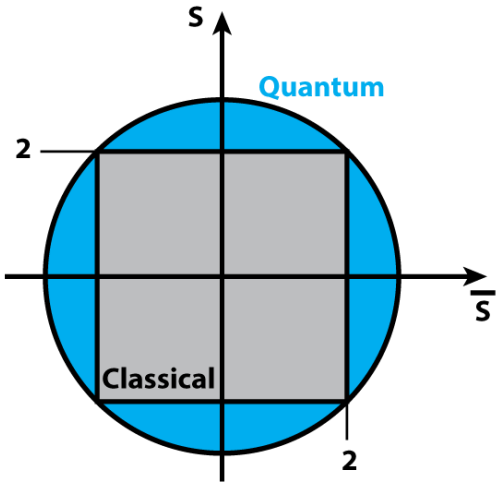
$$\frac{0°,67.5° - 0°,157.5° - 90°,67.5° + 90°,157.5°}{0°,67.5° + 0°,157.5° + 90°,67.5° + 90°,157.5°} = E(0°,67.5°) = E(0°,67.5°)$$

$$+ \qquad -$$

$$\frac{45°,67.5° - 45°,157.5° - 135°,67.5° + 135°,157.5°}{45°,67.5° + 45°,157.5° + 135°,67.5° + 135°,157.5°} = E(45°,67.5°) = E(45°,67.5°)$$

$$= \qquad =$$

$$S \qquad \overline{S}$$



2. Set the waveplate in the source to produce the $|\phi_-\rangle$ state (the $|HH\rangle$ state) and repeat the above measurements and calculations (you can use the automatic mode this time).