Introduction to Quantum Mechanics I Quiz 6

Name:

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Compute

$$\operatorname{tr} \frac{1+\sigma_z}{2}.$$

What is the interpretation of this in terms of wavefunctions, and in terms of probabilities?

Solution:

$$\operatorname{tr}\frac{1+\sigma_z}{2} = \frac{1}{2}\operatorname{tr}1 = 1,$$

because tr $\sigma_z = 0$. Alternatively,

$$\operatorname{tr} \frac{1+\sigma_z}{2} = \operatorname{tr} |+z\rangle\langle+z| = \langle+z|+z\rangle = 1.$$

This just says the sum of the probabilities of finding some outcome is unity, or, in terms of wavefunctions,

$$|\psi(+)|^2 + |\psi(-)|^2 = 1.$$

In this case,

$$\psi = \left(\begin{array}{c} 1\\ 0 \end{array}\right).$$