Spacetime and the Quantum World: Guide 5

Fall 2025 v1.0

1. Reading:

Styer, *The Strange World of Quantum Mechanics*
Chapters 4 - 7

2. Questions: Due Thursday November 13, at 11 PM

All numbered questions are in Styer.

(1) 4.1

(2) 4.2

(3) 4.3

(4) 4.4

(5) 4.5

(6) 4.7

(7) 4.9

(8) 4.10

(9) 5.1

(10) 5.4

(11) In class (and in section 5.3) we found the conditional probability $P(+|m_z = +m_B)$ for a particle to exit the + output of the switched Stern-Gerlach experiment given that its state was prepared in the $m_z = +m_B$ state. What is the probability if
   (a) the particle is prepared in the $m_z = -m_B$ state?
   (b) the particle is prepared in the $m_b = +m_B$ state?
   (c) the particle is prepared in the $m_c = -m_B$ state?

(12) You leave a friend in charge of your plant while you go on a week-long trip. Without water, the plant has a 90 percent chance of dying (!). Even with proper watering, it has a 20 percent chance of dying. And you estimate the probability that your friend will forget to water the poor plant is 30 percent.
   (a) What is the chance that your plant will survive the week? Hint: Start with the two histories - your friend forgets and your friend remembers.
   (b) If it is dead when you return, what's the chance that your friend forgot to water it?
   Hint: It may help to imagine 100 ailing plants and determine on average how many of them get watered or not and how many of those go on to die or not based on the information given.
   With thanks to Steve Stogatz

This plot of $\cos^2(\theta/2)$ is helpful for tilted Stern-Gerlach experiments.

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