Homework No. 04 (Spring 2018) PHYS 530A: Quantum Mechanics II

Due date: Tuesday, 2018 Feb 13, 4.30pm

1. (20 points.) Using the notation for the probability for a measurement in the Stern-Gerlach experiment, introduced in the class, show that

$$p([+;\theta_1,\phi_1] \to [-;\theta_2,\phi_2]) = \frac{1-\cos\Theta}{2},\tag{1}$$

where

$$\cos\Theta = \cos\theta_1 \cos\theta_2 + \sin\theta_1 \sin\theta_2 \cos(\phi_1 - \phi_2).$$
(2)

2. (20 points.) Show that

$$p([+;0,0] \to [+;\pi,0]) = 0.$$
 (3)

Further, show that

$$p([+;0,0] \to [\pm;\theta,\phi] \to [+;\pi,0]) = 0,$$
 (4)

which is a statement of destructive interference. Compare this with the probability for

$$p([+;0,0] \to [+;\theta,\phi] \to [+;\pi,0])$$
(5)

and

$$p([+;0,0] \to [-;\theta,\phi] \to [+;\pi,0]).$$
 (6)

3. (20 points.) Show that

$$p([+;0,0] \to [-;\pi,0]) = 1.$$
 (7)

Further, show that

$$p([+;0,0] \to [\pm;\theta,\phi] \to [-;\pi,0]) = 1,$$
 (8)

which is a statement of constructive interference. Compare this with the probability for

$$p([+;0,0] \to [+;\theta,\phi] \to [-;\pi,0]) \tag{9}$$

and

$$p([+;0,0] \to [-;\theta,\phi] \to [-;\pi,0]).$$
 (10)