習題三

1. Solution:
2. since is a polynomials of order, a constant.
3. The maximum occurs at . Therefore .
4. , since , again a constant. It peaks at the peak of , ie That is on the plane.
5. Ch. 10 10-1. For the eigenstate with the higher eigenvalue, measure .what are (or is) the possible values? What are (or is) the corresponding probabilities?

Solution:

A picture containing text

Description automatically generated

The possible values: . The corresponding probabilities are respectively: and

1. Ch. 10 ，calculate the expectation value of .

Measure , what are (or is) the possible values? What are (or is) the corresponding probabilities?

Hint: The expansion components 分量 of along equals .

Solutions:

The possible values are again: . The corresponding probabilities are respectively:

and .

1. As in class, use the eigenstates of the spin operator in direction as the basis of the electron spin States. Consider the spin operator pointing in the direction of with . This spin operator can be studied in the following setup. We assign the direction of electron beam as axis. Rotate the magnet in a SG experiment around axis by an angle . The magnetic field of this second SG is along .

A diagram of a beam

AI-generated content may be incorrect.

1. Derive from that .
2. Find the eigenvectors of , expressed as column vectors in the basis of : . You can choose the coefficient to be all real. Calculate the coefficients . Please normalize the coefficients so that .
3. As in the setup above, place a typical SG with magnetic field and then a second SG with magnetic field. In the first SG only spin-up electron is allowed to pass, ie: . Calculate the probability for it to pass the second SG as ie with measured? It is a function of . Think a little bit when the probability would be the largest and the smallest and whether it makes sense. (25)

Solution:

1. *.*
2. *,* 此式只有在行列式為零時有非零解：, ,

如預期。

若，

若，

1. The probability for to pass as equals:

check， is the same as , the probability is 1, correct.