《量子信息基础》第二章第一部分：

1. <即教材\*问题1.5>

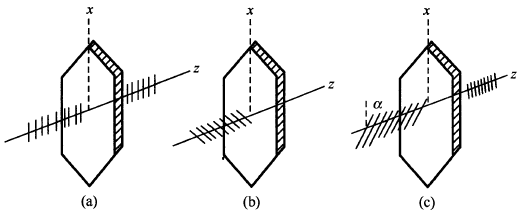
Consider the wave function

where , *λ*, and are positive real constants.

1. Normalize .
2. Determine the expectation values of and .
3. Find the standard deviation of . Sketch the graph of , as a function of , and mark the points and , to illustrate the sense in which represents the “spread” in .
4. What is the probability that the particle would be found outside this range (which means outside of and )?

A photon propagates in the direction and passes a linear optical polarizer which is oriented in the direction (see figure below). The state in Figure (a) is while the state in Figure (b) is .

1. Write done the formula of , assuming the light beam is polarized with an angle of *α* to the axis.
2. How much is the probability that a single photon could pass the polarizer in (c)?
3. How does the system maintain the normalization condition?



1. <即教材\*问题1.15>

Show that

for any two (normalizable) solutions to the Schrödinger equation (with the same ), and .

\* David J. Griffiths, and Darrell F. Schroeter, Introduction to Quantum Mechanics (3rd Edition), Cambridge University Press (2018).