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1. For the ground state of a quantum simple harmonic motion, , the eigenfunction can be written as . Plug it into the time-independent Schrodinger Equation

to verify it does satisfy the equation and find eigenvalue .

Solution: Plugin

Hence the function is a solution with .

1. To calculate observable results, we need to change the length unit back by and choose the constant by normalization condition:

. The final ground state eigenfunction is:

For the ground state,

1. calculate the expectation values The result is so simple that it does not need a integration but please give a reason for your result,
2. ,

Hint:

1. .

Hint: Instead of doing the integration, you can simply use the formula .

Solution:

is an even function but is an odd function. Hence is an odd function. The integration of an odd function is zero since integration in positive and negative with cancel.

for the same reason.