Quantum Mechanics Fall 2019

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Important equations and constants

Schrödinger equation

$$\frac{\partial}{\partial t}\Psi(x,t) = -i\hbar\frac{\partial^2}{\partial x^2}\Psi(x,t) + V\Psi$$

Week 1

Get to know the quntum world

Notes on Lesson 1

Monday Sep 2

Notes on Lesson 2

Tuesday Sep 3

Notes on Lesson 3

Friday Sep 6

Born Statistical Interpretation of Wave Function

The wave function $\Psi(x,t)$ discribes the "Amplitude" of the probability finding the paticle at coordinate(x,t). While the probability density equals amplitude squared.

That is, the probability finding the particle among $x \in [a,b]$ at time t_0 is discribed as:

$$P(x \in [a,b], t = t_0) = \int_a^b |\psi|^2 dx = \int_a^b \psi^* \psi dx$$

Or, to say, the ***Probability Density*** can be written as:

$$p(x,t) = |\psi(x,t)|^2 = \psi^*(x,t)\psi(x,t)$$

Homework

[week1 hw1]

- **Problem 1 - [Thinking][Optional] A Brief History of Clues**

- **Problem 2 - Caculate wave length of an electromn after a 1000V potential field**

- **Problem 3 - Derivation of Klein-Golden equation**

[week1 hw2]

- **Problem 4 - Griffiths 1.2**

(a) Find the standard deviation of the distribution in Example 1.1.
(b) What is the probability tha a photograph, selected at ramdom, would show a distance x more than one standard deviation away from tha average?

• **Problem 5 - Griffiths 1.4**

At time $t = 0$ a particle is represented by the wave function

$$\Psi(x,0) = \begin{cases} A\dfrac{x}{a}, & if \;\; 0 \leq x \leq a, \\ \\ A\dfrac{(b-x)}{(b-a)}, & if \;\; a \leq x \leq b, \\ \\ 0, & otherwise, \end{cases}$$

where A, a and b are constants.

(a) Normalize Ψ (that is, find A in terms of a and b)

(b) Sketch $\Psi(x, 0)$, as a function of x.

(c) Where is the particle most likely to be found, at $t = 0$?.

(d) What is the probability of finding the particle to the left of a? Check your result in the limiting cases $b = a$ and $b = 2a$.

(e) What is the expectation value of x?