

Chapter 5: The Schrödinger Equation

THE SCHRÖDINGER EQUATION



Quantum mechanics provides a mathematical framework in which the description of a process often includes different and possibly contradictory outcomes. A favorite illustration of that situation is the case of Schrödinger's cat. The cat is confined in a chamber with a radioactive atom, the decay of which will trigger the release of poison from a vial. Because we don't know exactly when that decay will occur, until an observation of the condition of the cat is made the quantum-mechanical description of the cat must include both "cat alive" and "cat dead" components. Mehau Kulyk / Science Source

Non-Relativistic and
Non-Quantum Case

①

$$\vec{F} = \sum_{i=1} \vec{f}_i = m \vec{a}$$

$$\frac{d\vec{v}}{dt} = \frac{\vec{F}}{m}$$

$$\frac{d^2\vec{r}}{dt^2} = \vec{a}$$

$$\begin{cases} \frac{dV}{dt} = a \\ \frac{dr}{dt} = v \end{cases} \rightarrow \frac{d^2r}{dt^2} = a$$

$$r(t=0) = r_0$$

$$v(t=0) = v_0 = \left. \frac{dr}{dt} \right|_{t=0} = v_0$$

$$r(t=0) = r_0$$

$$r(t=b) = r_0$$

با یک سرابط اولیه به طور دقیق بزرگ

ذرات غیر نسبیتی و غیر کوانتومی

میرورت استخراج می شود.

Non-Relativistic and

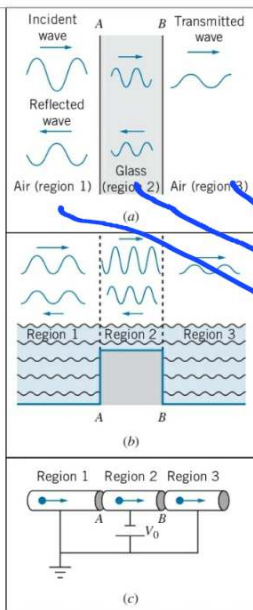
در مورد (۲)

Quantum case

معادله شرودینگر به جای معادلات نیوتن یکا گرفته می شود.

trajectory of
Particles

Wave function
Evolution



5.1: Behavior of waves at Boundaries

$$A_1, \lambda_1 \quad A_2, \lambda_2 \quad A_3, \lambda_3$$

(1)

$A_1 \neq A_2 \neq A_3 \rightarrow$ انتقال، جذب و عبور

$$\lambda_3 = \lambda_1 \neq \lambda_2$$

معیار اول در هم نیاید

FIGURE 5.1 (a) A light wave in air is incident on a slab of glass, showing transmitted and reflected waves at the two boundaries (A and B). (b) A surface wave in water incident on a region of smaller depth similarly has transmitted and reflected waves. (c) The de Broglie waves of electrons moving from a region of constant zero potential to a region of constant negative potential V_0 also have transmitted and reflected components.

۵) چه شکلی نامرئی داریم

☆ موج رونو به است راست در زمان ۱

☆ موج منقش شده به است چپ در زمان ۱

☆ موج عبوری در زمان ۲

☆ موج منقش شده در زمان ۲

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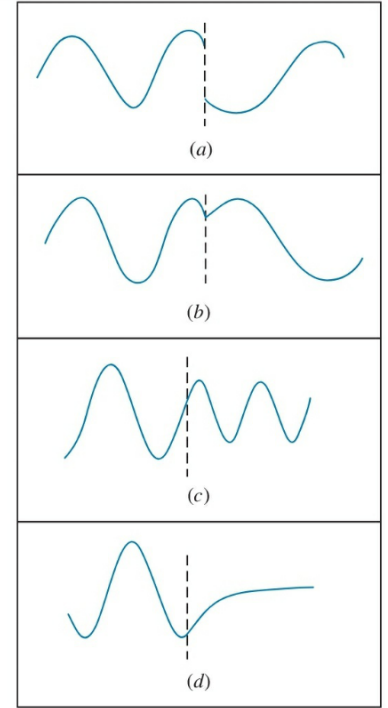


FIGURE 5.2 (a) A discontinuous wave. (b) A continuous wave with a discontinuous slope. (c) Two sine waves join smoothly. (d) A sine wave and an exponential join smoothly.