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What is the Classical Physics program?

The model and the rules are often defined in a set of postulates.

What is a postulate?

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- 1 suggest or assume the existence, fact, or truth of (something) as a basis for reasoning, discussion, or belief.
"a theory postulated by a respected scientist"
synonyms: suggest, advance, posit, hypothesize, propose, assume
- 2 (in ecclesiastical law) nominate or elect (someone) to an ecclesiastical office subject to the sanction of a higher authority.

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How do you know it's correct? DATA!

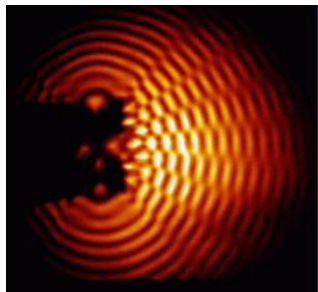
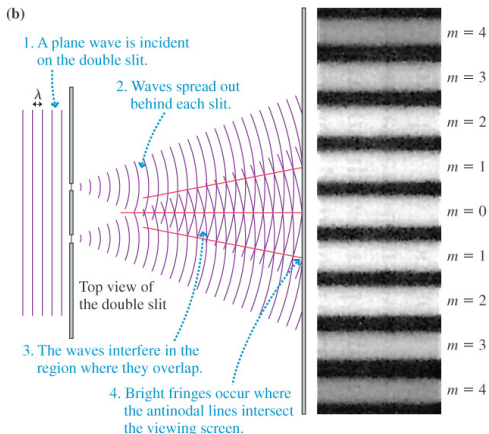
See [here](#) for an example of impeccable logic.

- ① Waves acting as particles: Planck's hypothesis,
 $E = h\nu = \hbar\omega$

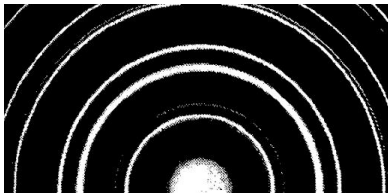
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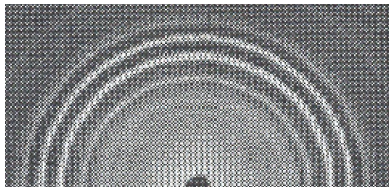
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- ④ Need a wave function $\Psi(\vec{r}, t)$, a differential equation, and a program/procedure to follow.



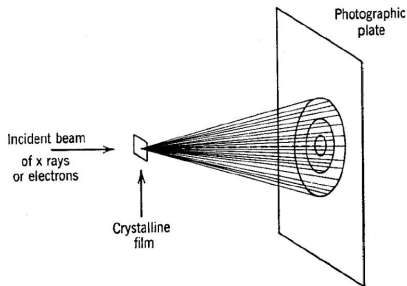
Interfering waves



Electron diffraction by gold



X-ray diffraction by Cr_2O_3



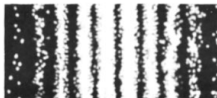
Debye-Scherrer Scattering



(a) After 28 electrons



(b) After 1000 electrons

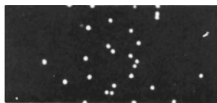


(c) After 10000 electrons



(d) Two-slit electron pattern

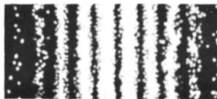
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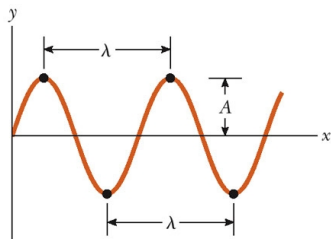
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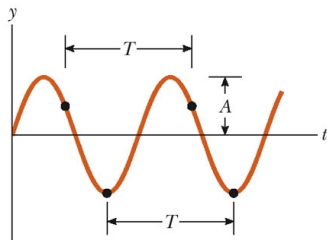
$$E = h\nu$$

$$p = \frac{h}{\lambda}$$



(a)

$$y = A \sin(kx - \omega t)$$



(b)

See more [here](#)

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- 2 de Broglie hypothesis built in.
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- 4 What is
superposition/interference?

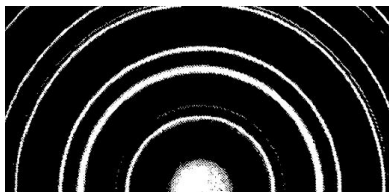
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- 3 The state of a system is represented by a wave function Ψ that is continuous, differentiable and contains all possible information about the system. The 'intensity' is proportional to $|\Psi|^2$ and is interpreted as a probability. The average value of any observable A is $\langle A \rangle = \int_{all\ space} \Psi^* \hat{A} \Psi d\vec{r}$.

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- 4 The time and spatial dependence of $\Psi(x, t)$ is determined by the time dependent Schroedinger equation.

$$i\hbar \frac{\partial}{\partial t} \Psi(x, t) = -\frac{\hbar^2}{2\mu} \frac{\partial^2}{\partial x^2} \Psi(x, t) + V(x)\Psi(x, t) \quad \mu \equiv \text{reduced mass.}$$



Electron diffraction by gold

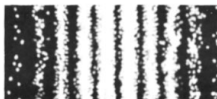
The square of the magnitude of the wave function $|\psi(x, t)|^2 = \psi^*(x, t)\psi(x, t)$ is the probability density.



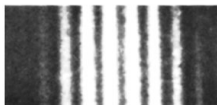
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