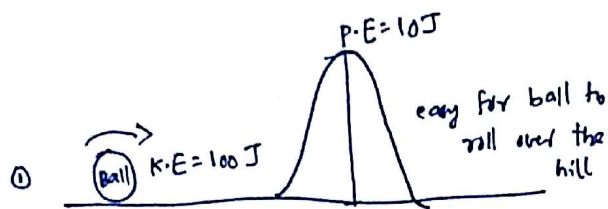


QUANTUM TUNNELING

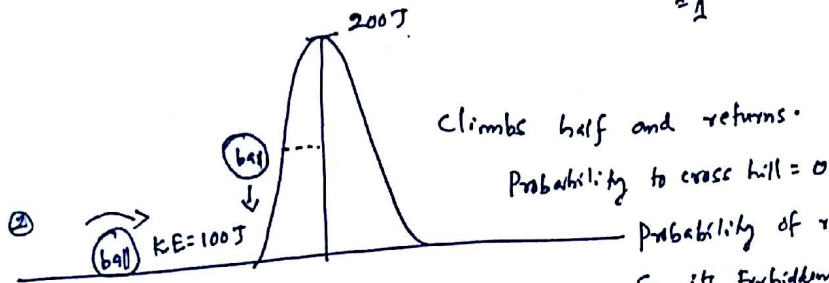
In QM

Particle \Rightarrow Probability Density ψ^2
wave function

eg: Sun
STM
Tunnel Diode



probability for ball in classical physics $= 1$



So its forbidden to cross in classical physics.

In Q.M particle = wave packet in space, So the wave can reach the other side of hill. (bungee in desert analogy!)

$$\psi = 0; x < 0$$

$$U_0; 0 \leq x \leq L$$

$$\psi = 0; x > L$$

In Q.M

penetrate and reflects like classical.

If barrier hgt is finite with infinite width, wave packet penetrates but distorts afterwards.

If both barrier hgt and width is finite the transmitted wave packet can reach to transmission side.

physics of tunneling.

Introduced by Hund in 1927.

Used this by Gamow in 1928 for radioactive α -decay of atomic nuclei as tunneling phenomenon.

1957 - electronics industry accepted Q.M.

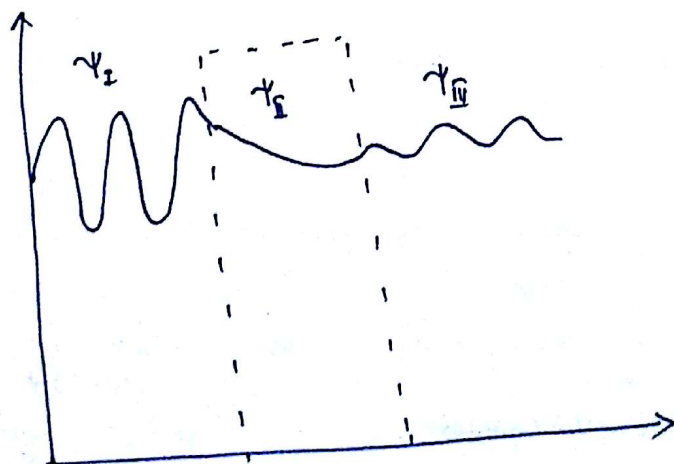
2000 - Nanotechnology accepted Q.M. properties of matter in 1-100 scale.

Nature of Quantum Mechanics

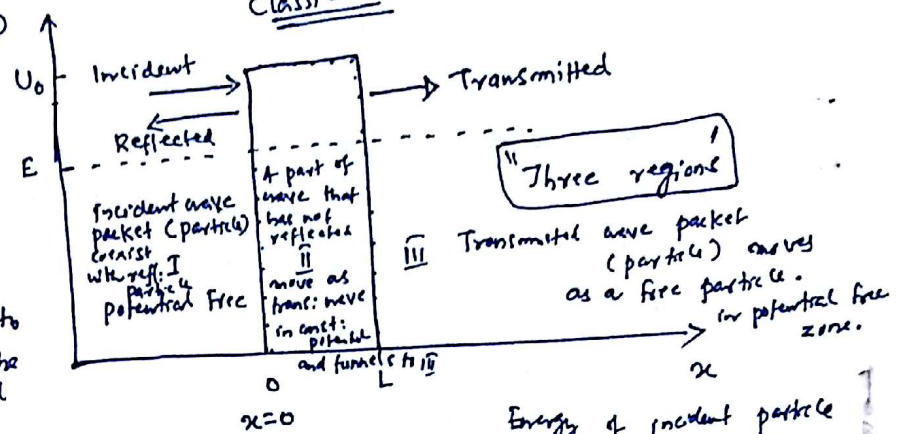
Sun - Teach us Q.M.

Greatest source of concentrated energy in the universe - from starlight (single objects)

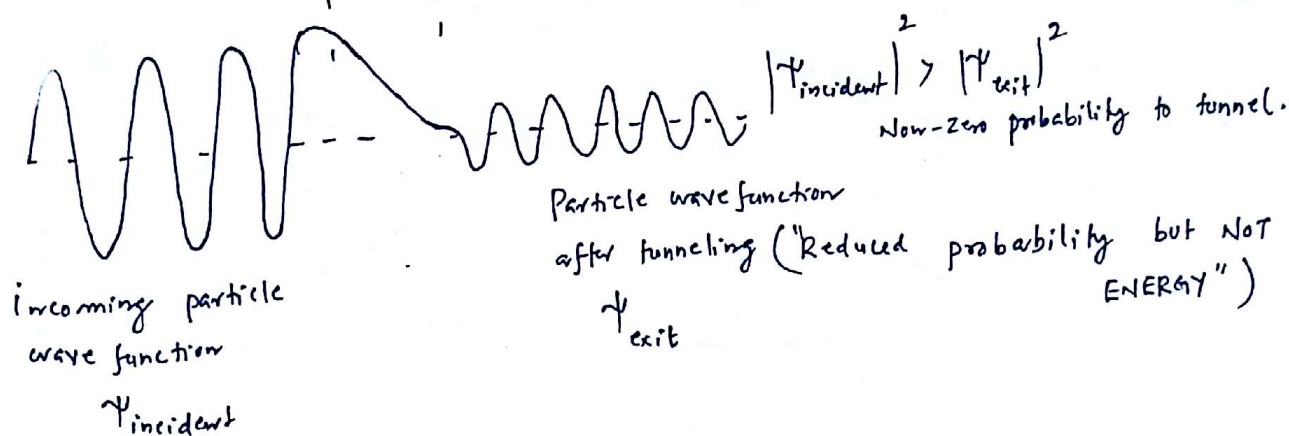
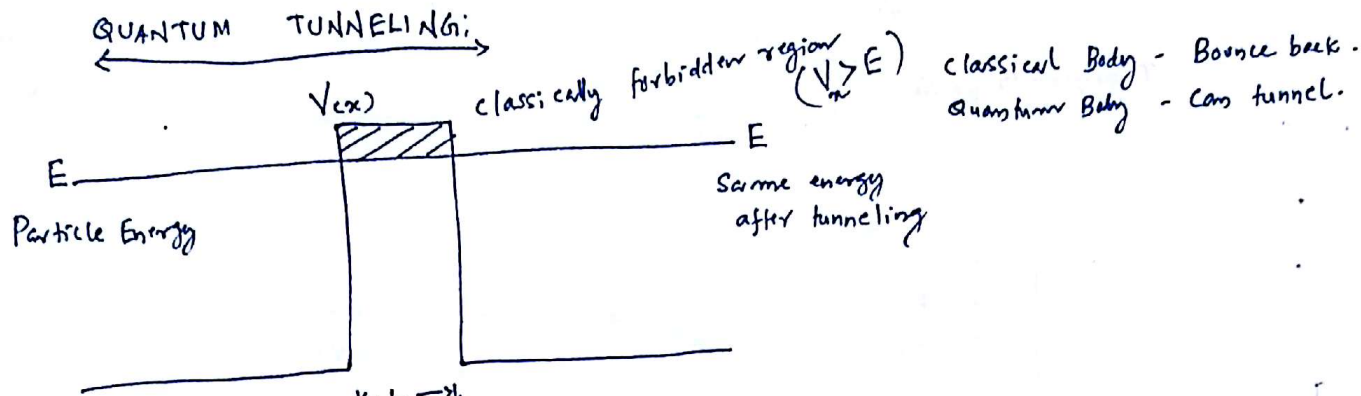
Smallest processes - Fusion



Classical



Energy of incident particle is indicated as 'E'.



$|\psi_{incident}|^2$ and $|\psi_{exit}|^2$ (Probabilities) can be measured correctly and precisely and will be fun: of L , E and V (wall height).

Is there any maximum/min: thickness ' L '? No, as $L \uparrow$ $P_{exit} \downarrow$ and goes to zero.

SUN ENERGIZES @M! Greatest source of single object energy - starlight (Sun!)

How? Light elements fuse together under extreme conditions, to heavier ones (fusion) -

@ T - 4 Million Kelvin! 4 protons into fusion to form Helium-4 nucleus - 28 MeV energy.

@M enabled to understand 4×10^{38} protons into Helium 4 every second! /

The quantum nature of particles in the universe, their wave functions and uncertainty enable nuclear fusion