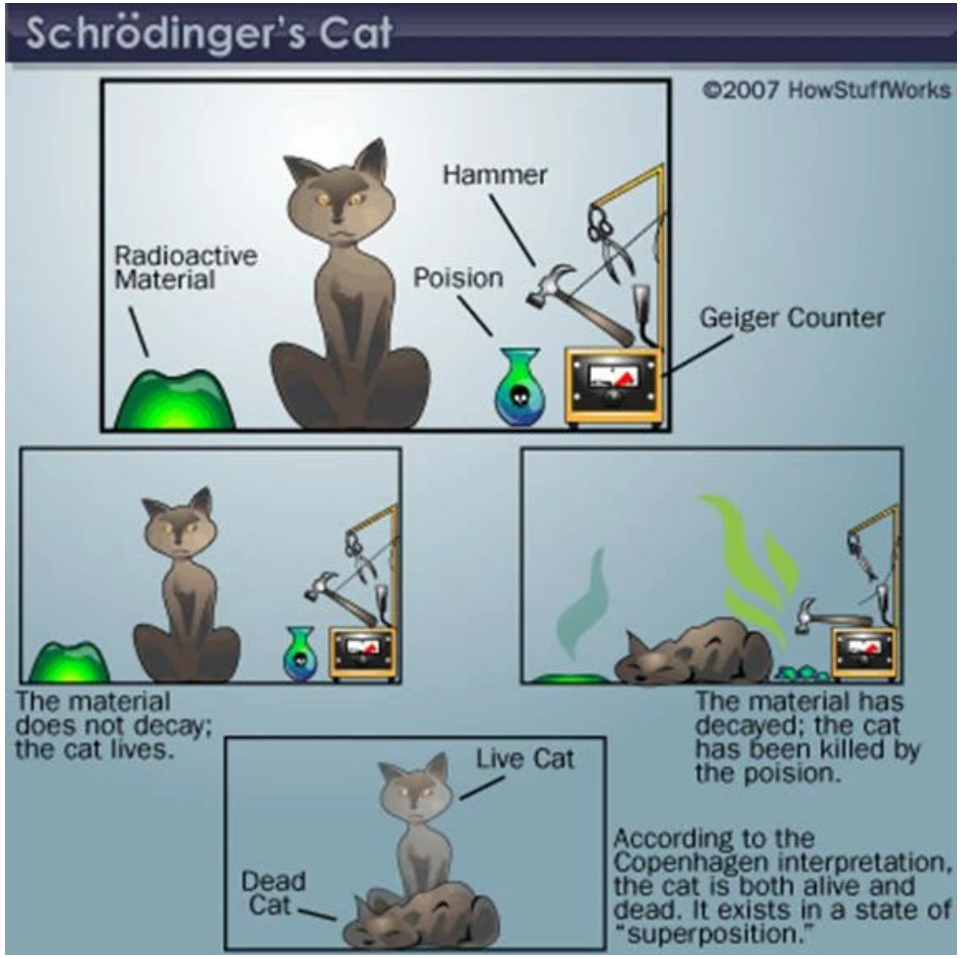
M.Sc. PHYSICS
QUANTUM MECHANICS – 1
TOPIC – INTRODUCTION TO QUANTUM MECHANICS

JERRY JOSEPH
ASST. PROFESSOR
P.G DEPT. OF PHYSICS
DEVA MATHA COLLEGE KURAVILANGAD

SCHRODINGER CAT

HOW DO YOU RELATE THIS CAT AND QUANTUM MECHANICS………..??



WAVE FUNCTION……………………..?????

Ψ

It is one of the postulates of quantum mechanics that for a physical system consisting of a particle there is an associated wave function. This wave function determines **everything** that can be known about the system.

OBSERVABLE……………………?????

An observable is a physical quantity that can be measured. In quantum physics, it is an operator, where the property of the quantum state can be determined by some sequence of operations. For example, these operations might involve submitting the system to various electromagnetic fields and eventually reading a value.

Eg: POSITION, MOMENTUM…

OPERATOR…………………………??????

Operator aids measurement of the system.
Applying operator on a wave function yields eigen values.
For eg: Applying position operator on a wave function gives position eigen values.

MEASUREMENT............???

THE PROCESS OF APPLYING AN OPERATOR TO A WAVE FUNCTION IS CALLED THE MEASUREMENT.

“MEASUREMENT DISTURBS THE SYSTEM..!!!!!!!!!!!!”

HOW&WHY..??

BACK TO OUR CAT..............😊

THE WAVE FUNCTION : THE CAT INSIDE THE BOX AND THE SUPERPOSED STATE OF DEAD OR ALIVE CAT.

OBSERVABLE: WE WANT TO KNOW ABOUT CAT(DEAD/ALIVE)

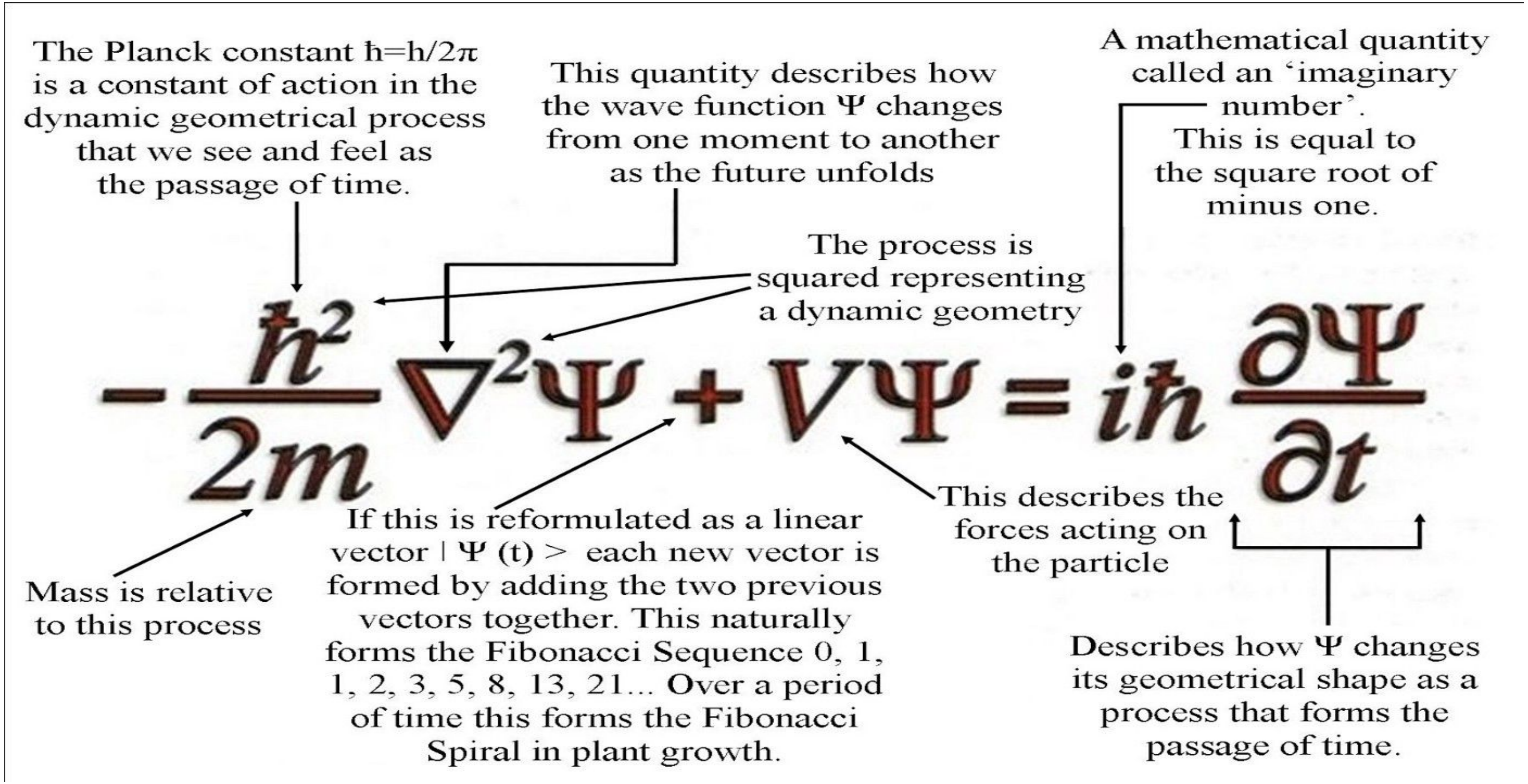
MEASUREMENT: OPENING THE BOX.

OPERATOR: PROCESS OF OPENING THE BOX

EIGEN STATES : 1)DEAD..2)ALIVE

ON MEASUREMENT LETS ASSUME WE FIND THAT THE CAT IS ALIVE, SO **THE MEASUREMENT DISTURBS THE SYSTEM…ie, FROM SUPERPOSED STATE OF DEAD/ ALIVE TO ALIVE STATE**

SCHRODINGER EQUATION



PROBABILITY………..??

shutterstock.com · 1756695563

- When squared, the wave function is a probability density (Max Born – 1926). The probability P(x) dx of a particle being between x and x+dx was given in the equation:

$$P(x)\,dx = \Psi^*(x,t)\Psi(x,t)\,dx$$

- The probability of the particle being between x_1 and x_2 is given by

$$P = \int_{x_1}^{x_2} \Psi^* \Psi \, dx$$

NORMALIZATION…..

Normalization of the Wave Equation

Since $|\Psi|^2$ represents the probability of finding a partical in a particular location.

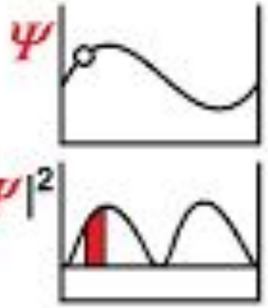
$$\int_{-\infty}^{\infty} |\Psi|^2 \, dV \quad \left(= \text{total probability of all possible locations} \right)$$

To normalize: set = 1)

$$\int_{-\infty}^{\infty} |\Psi|^2 \, dV = 1$$

For 1-D:

$$\int_{-\infty}^{\infty} |\Psi|^2 \, dx = 1$$



EXPECTATION VALUE...........

EXPECTATION VALUE = EIGEN VALUE X PROBABILITY OF THE STATE TO OCCUR IN THAT EIGEN STATE.

$$\langle Q \rangle = \int_{-\infty}^{\infty} \psi * Q_{operator} \psi dV$$

integral over all space

The Postulates of Quantum Mechanics

●	1. Associated with any particle moving in a conservative field of force is a wave function which determines everything that can be known about the system.
●	2. With every physical observable q there is associated an operator Q, which when operating upon the wavefunction associated with a definite value of that observable will yield that value times the wavefunction.
●	3. Any operator Q associated with a physically measurable property q will be Hermitian.
●	4. The set of eigenfunctions of operator Q will form a complete set of linearly independent functions.
●	5. For a system described by a given wavefunction, the expectation value of any property q can be found by performing the expectation value integral with respect to that wavefunction.
●	6. The time evolution of the wavefunction is given by the time dependent Schrodinger equation.

THANK YOU…………