## non-commutating character of the p and q, there are many forms in which the ON THE EQUATIONS OF MOTION BND THE QUANTUM MECHANICAL COMMUTATION RELATIONS

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## ABSTRACT

Choosing units in which h = 1, equation (3) can be written as The Commutator of the Hamiltonian with the operator corresponding to a physical quantity gives the operator which corresponds to the time derivative of the quantity. We apply this principle to the Hamiltonian for a free particle and harmonic oscillator. We also attempt to investigate the postulate, that the quantum mechanical operators obey the classical equations of motion and that they uniquely ers evilied determine the commutation relations. Is language of or H animuseA

 $H = \{(x^1 + y^2)\}$ 

## denoted by Zo; Zt, Zz, ..... NOITOUCTION

Schrodinger obtained his wave mechanical equation by assuming that the wave motion correspond to the classical motion of a particle if the force of field in which the wave is moving changes slowly with position. Assuming that the

Hamiltonian has the simple form 
$$H = \begin{pmatrix} p^2 \\ 2m \end{pmatrix} + V(x)$$
 ...(1)

The above statement can be summarised by observing that the operators in the Heisenberg relation satisfy the classical differential equations:

It shows that 
$$x_{n,m}$$
 can be fining only if  $Z_n - Z_m = \pm 1$ . It is also clear that (2) equation (8)  $v_{n,m}$  vanishes if  $x_{n,m}$  variebes. = I'que the  $m$  variebes are connected by

a matrix element of either x or v form an arithmatical series Since the time derivative of any operator is its commutator with the Hamiltonian, so that (1) is equivalent to (2) and thus

This also imply 6 that we have 
$$(\frac{i}{\hbar})^{\frac{1}{2}} = [p, H] \left(\frac{i}{\hbar}\right)^{\frac{1}{2}} = [p, H] \left(\frac{i}{\hbar}\right)^{\frac{1}{2}}$$

The matrix element 
$$x_{max}$$
 only  $x_{max}$  and  $x_{max}$  are different from zero. (4)  $\frac{i}{\hbar}$  ) [ $\frac{i}{2}$   $p^2$ ,  $q$ ] =  $p$ ;  $\left(\frac{i}{\hbar}\right)$  [ $V$ ,  $p$ ] =  $\frac{1}{2}$   $\frac{\partial V_{en}}{\partial x_{lo}}$  are different from zero. (4)

We know that Dirac's equation of the electron does not lead to the classical

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