Quantum Physics and Multivariable Calculus Research Report

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 The study of Quantum Physics did not come about until the beginning of the 20th century. Before its birth, physicists had believed they had discovered everything there was to physics. Maxwell’s equations, which formed the foundation of classical electrodynamics, classical optics, and electric circuits, were the latest development in the study of physics.

 However, experiments carried out by physicists after the development of Maxwell’s equations baffled everyone in the scientific community. For some reason, the results of these experiments did not correlate with predictions made by Maxwell in his equations. Among these experiments were the photoelectric effect, which stated that light shined on metal would eject an electron in a quantized nature, and the Compton Effect, which provided undisputable evidence for the particle nature of photons. Through multiple theories and experiments, the scientific community was able to develop the fundamentals for what is called Quantum Physics today.

 The Schrödinger Equation, as shown below, was one of the first developments in Quantum Physics. The following equation refers to the wave-like nature of extremely small particles such as electrons.

$$-\frac{ħ^{2}}{2m}\*\frac{∂^{2}ψ}{∂x^{2}}+V\left(x\right)ψ=Eψ$$

 (Note: $ψ$ is the wave function that describes the system.)

 Taking a closer look, it is seen that the Schrödinger Equation could be considered roughly as the Quantum Mechanics version of describing the total energy of a system. Notice that the when both sides are divided by $ψ$, the equation looks similar to the following equation used in classical mechanics.

$$\frac{1}{2}mv^{2}+ V\left(x\right)=E\_{total}$$

 The Schrödinger Equation is the cornerstone of Quantum Physics. From this partial differential equation, one can predict the events of the system at any time after the initial condition through understanding how the wave function changes.