A New Model to Explore the Quarks’ Inner Structure in the Proton State Using the 3D Isotropic Harmonic Oscillator

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A new model has been developed to prove that elementary particles are not point-like, but inner-structured. In particle accelerators, it was found that elementary particles like quarks are decaying into smaller particles, so there should be some inner structures that would make the decay possible. To prove the hypothesis, the developed model showed the existence of energy eigenfunctions between the proton state, a bound state of three quarks, and its vacuum state. Since the vacuum state is not accessible, Planck state was chosen instead. Each eigenfunction can be considered as one inner particle existing between the proton and Planck states. Their number is calculated with the 3D Isotropic Harmonic Oscillator (HO) by applying the creation operator several times on the ground state of the Proton till to attain Planck state. As a confirmation, the time-independent Schrödinger equation for 3-dimensions with quadratic potential has been used. The calculations showed that there could be 32 eigenfunctions/inner particles inside the proton’s three quarks. This model approach showed that quarks are structured with a framework that doesn’t disagree with the known experimental evidence compared to what has been presented in the preon model and it can be easily generalized to other elementary particles as well. Surprisingly, this model has conceptual support to the big bang theory and will help in measuring the quarks' masses and the proton’s radius more precisely to understand the quantum world better.

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