

High Energy Physics - Theory

Phenomenological Implications of the Generalized Uncertainty Principle

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Various theories of Quantum Gravity argue that near the Planck scale, the Heisenberg Uncertainty Principle should be replaced by the so called Generalized Uncertainty Principle (GUP). We show that the GUP gives rise to two additional terms in any quantum mechanical Hamiltonian, proportional to βp^4 and $\beta^2 p^6$ respectively, where $\beta \sim 1/(M_{\text{Pl}}c)^2$ is the GUP parameter. These terms become important at or above the Planck energy. Considering only the first of these, and treating it as a perturbation, we show that the GUP affects the Lamb shift, Landau levels, reflection and transmission coefficients of a potential step and potential barrier, and the current in a Scanning Tunnel Microscope (STM). Although these are too small to be measurable at present, we speculate on the possibility of extracting measurable predictions in the future.

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