High Energy Physics - Theory

Phenomenological Implications of the Generalized Uncertainty Principle

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(Submitted on 13 Jan 2009)

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 \beta p^4 and \beta^2 p^6 respectively, where \beta \sim 1/(M_{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.

Comments:	7 pages. Based on talk by S. Das at Theory Canada 4, Montreal, 4 June, 2008. To be published in the Canadian Journal of Physics
Subjects:	**High Energy Physics - Theory (hep-th)**; General Relativity and Quantum Cosmology (gr-qc); High Energy Physics - Phenomenology (hep-ph); Quantum Physics (quant-ph)
Journal reference:	Can.J.Phys. 87: 233-240, 2009
DOI:	10.1139/P08-105
Cite as:	**arXiv:0901.1768v1 [hep-th]**

Submission history

From: Elias C. Vagenas [view email]
[v1] Tue, 13 Jan 2009 11:48:52 GMT (14kb)

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