Contribution ID: **740** Type: **Oral (Student, In Competition) / Orale (Étudiant(e), inscrit à la compétition)**

Discreteness of Space in a Weak Gravitational Field

Thursday 18 June 2015 09:45 (15 minutes)

Quantum gravity induced modifications of position/momentum commutation relation brings about a modification of the Heisenberg's uncertainty principle, to what is known as the generalized uncertainty principle (GUP). It has been shown earlier that the GUP-induced corrections to the Schrödinger equation, when applied to a non-relativistic particle in a one-dimensional infinite potential well, gives rise to the quantization of length. Similar corrections to the Klein-Gordon and the Dirac equations, when applied to a relativistic particle in a three-dimensional box, give rise to area and volume quantizations. This not only suggests that the fundamental structure of space is granular, but also affirms the existence of a minimum measurable length which has long been predicted by the candidate theories of quantum gravity. It is quite natural to investigate how gravity, which is considered as a manifestation of spacetime curvature, might influence this discreteness of space. In this work, the above-stated results of length, area and volume quantization have been extended to cases with a weak background gravitational field. By adding the classical form of a linear gravitational potential to the above three quantum equations, we show that the spatial dimensions inside the box are quantized. Although the nature of quantization is quite complex compared to the cases without gravity, not surprisingly it reduces to the quantization in flat spacetime under proper limits. These results show that the discreteness of space holds in flat as well as in slightly curved spacetimes, further indicating the universality of quantum gravity effects.

Author: DEB, Soumen (University of Lethbridge)

Presenter: DEB, Soumen (University of Lethbridge)

Session Classification: R1-5 Quantum Gravity and Quantum Cosmology (DTP) / Gravité quantique et cosmologie quantique (DPT)

Track Classification: Theoretical Physics / Physique théorique (DTP-DPT)