GR 6: Experimental Tests

Time: Tuesday 15:45–16:25 Location: HBR 14: HS 2

GR 6.1 Tue 15:45 HBR 14: HS 2

A gravitational metrological triangle — •Claus Lämmerzahl[1] and Sebastian Ulbricht[2] — [1]ZARM, University Bremen, Germany — [2]PTB, Braunschweig, Germany

From gravitational analogues of the Josephson and the quantum Hall effect it is possibe to derive two gravitational analogues of the electric metrological triangle. This leads to a direct connection between the Planck constant and the mass of elementary particles. We also get an additional consistency relation for the electrical and gravitational definition of mass and also of Planck's constant. This provides a test of the uniqueness of $\hbar$ or of the universality of quantum mechanics, a quantum test of the equivalence principle, and may give, in principle, an alternative approach to a quantum definition of the kg.

GR 6.2 Tue 16:05 HBR 14: HS 2

Reaching the Planck scale with muon lifetime measurements and muon accelerators — •Christian Pfeifer[1] and Iarley Lobo[2] — [1]ZARM, Uni Bremen, Germany — [2]Department of Chemistry and Physics, Federal University of Paraíba, Brazil

A prominent effective description of particles interacting with the quantum properties of gravity is through modifications of the general relativistic dispersion relation. Such modified dispersion relations lead to modifications in the relativistic time dilation. A perfect probe for this effect, which goes with the particle energy cubed over the quantum gravity scale and the square of the particle mass would be a very light unstable particle for which one can detect the lifetime in the laboratory (lab) as a function of its energy measured in the lab to very high precision.

In this talk I discuss how a modified dispersion relation leads to modified time dilations and thus to modified lifetime of particles $t(E, M)$ in the detector frame as function of their mass M and their energy in the detector frame E. It will become clear that the usual special relativistic time dilation, which leads to a linear dependence of the particle lifetime on the particle energy, could just be the first order lienar approximation of a more general functional dependence of $t(E, M)$.

Furthermore, I discuss that a muon collider or accelerator would be a perfect tool to investigate the existence of an anomalous time dilation, and with it the fundamental structure of spacetime at the Planck scale.