Markus Aspelmeyer

Statement

and

Readings

Title

Markus Aspelmeyer
University of Vienna, Vienna, Austria

Abstract

Quantum physics and general relativity are probably the most successful and well-tested theories of modern science. At the same time, their fundamental concepts are so dramatically different that there is even disagreement on the most obvious questions such as „how does a mass in a quantum superposition state gravitate?“ Achieving progress on these foundational questions requires experiments at the interface between quantum physics and gravity.

The number of available experiments that probe this interface is extremely sparse. One type of experiments focuses on observations over astronomical distances, which may reveal imprints of quantum gravity effects. The other type of experiments exploits the availability of continuously improving high-precision lab-scale experiments. The ones that have been performed thus far in this domain fall essentially into two categories: they are either genuine quantum tests in the fully Newtonian limit, where gravity acts as a constant classical background field, or they are tests of genuine gravity effects measured through high-precision quantum experiments.

I will review the current status and prospects of available table-top experiments. I will finally discuss quantum control over levitated masses as an opportunity for simultaneously achieving large mass and long coherence times. In the long run, such levitated systems may provide the ideal test bed for new gravitational quantum experiments, eventually approaching the quantum regime of gravitational source masses.