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ATOMIC MATTER WAVES FOR TESTING THE WEAK EQUIVALENCE PRINCIPLE IN
MICROGRAVITY

Abstract

The Weak Equivalence Principle (WEP), that is, the Universality of Free Fall, states that all pointlike neutral particles fall in a gravitational field in the same way. This is the basis of the geometrization of the gravitational interaction. Together with further requirements on the behavior of point particles, light propagation, and clocks one can show that gravity is modeled by a Riemannian geometry.

Since in the quantum domain all objects are extended it is not clear whether the notion of a WEP in the quantum domain makes sense at all. We show that for matter wave interferometry the notion of WEP still can be given a meaning. We give a short overview over schemes which allow a violation of the WEP and emphasize that there are also schemes which suggest that there are violations of the WEP in the quantum regime which are not present classically. This makes test of the WEP with quantum matter necessary.

Finally, we give an outline of the efforts done for testing the WEP with interferometry with cold atoms in the Bremen drop tower.