ulm university universität ulm

Physikalisches Kolloquium — Physics Colloquium

Einladung — **Invitation**

Monday, 09 November 2020

Format: Online via Webex, at 16:15

~~Coffee and cookies will be served in front of the lecture hall from 16:00~~

Please feel free to grab a coffee and join our “virtual” get-together from 16:00

Atom interferometry and the twin paradox

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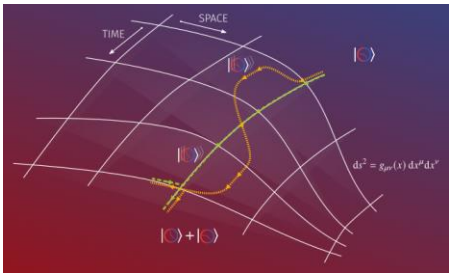
PERSONAL

Proper time determines the phase of matter waves, such that atom interferometers are in principle susceptible to time dilation. However, the kinetic symmetry of the interferometer determines whether proper time differences have an impact on the measured interference pattern. We show which type of light-pulse atom interferometers, performed with a single internal atomic state, are sensitive to time dilation. Only geometries that entail the special-relativistic twin paradox display time dilation, whereas gravitational effects do not contribute in lowest order. In such a configuration, recoil measurements that can be used for the determination of the fine structure constant are sensitive to proper time differences.

When each of the two quantum twins in such a setup carries a superposition of two internal states which constitute a clock, the visibility of the signal is modulated, which can be interpreted as a beating of the interferometers associated with each state. We propose a specific geometry for a quantum clock experiment that displays a genuine implementation of the twin paradox in light-pulse atom interferometry and discuss possible schemes to test the basic principles of gravity.



Host: Prof. Dr. Wolfgang Schleich, Institute of Quantum Physics

Organisation: Prof. Dr. Fedor Jelezko, Institute of Quantum Optics, fedor.jelezko@uni-ulm.de, +49-731-50-23751