GR 24: Poster (permanent)

Zeit: Montag 14:00–14:00 Raum: ZHG 002

GR 24.1 Mo 14:00 ZHG 002

qBounce - a realization of the Quantum Bouncer with ultra-cold neutrons — Hartmut Abele[1], Thomas Bittner[1], •Gunther Cronenberg[1], Hanno Filter[1], Peter Geltenbort[2], Tobias Jenke[1], Kevin Mitsch[1], and Martin Thalhammer[1] — [1]Atominstitut TU Wien, Wien, Österreich — [2]Institut Laue-Langevin, Grenoble, Frankreich

We present the observation of a quantum bouncing ball in the gravitational field of the Earth. Quantum states in the Earth's gravitational field can be observed, when ultra-cold neutrons fall under gravity.

In our previous experiment in collaboration with the Institute Laue-Langevin/Grenoble, the lowest stationary quantum state of neutrons in the Earth's gravitational field was clearly identified. In the new experiment qBounce, we use this technique to prepare a neutron in the ground state and then to let it fall and bounce off a neutron mirror. Oscillations in time similar to the harmonic oscillator system described by Glauber states have been observed. Such a quantum particle bouncing in a linear gravitational field is known as the quantum bouncer. The motivation of this activity is also the investigation of quantum phases and quantum decoherence. For that matter we have developed position-sensitive neutron detectors with an extra-high spatial resolution.

GR 24.2 Mo 14:00 ZHG 002

Buch: Spezielle und Allgemeine Relativitätstheorie — •Jürgen Brandes — Karlsbad

Exakt und allgemeinverständlich werden diskutiert [1]: Die experimentellen Beweise der Relativitätstheorie, die Lösungen der Paradoxien, die Thesen zum vierdimensionalen Raum-Zeit-Kontinuum der Speziellen Relativitätstheorie, sowie die Thesen zum gekrümmten, expandierenden und geschlossenen Raum der Allgemeinen Relativitätstheorie. Enthalten sind die allgemein-relativistische Lösungsvariante der Zwillingsparadoxie und die Paradoxien von BELL, EHRENFEST und SAGNAC.

Die sogenannte LORENTZ-Interpretation wurde von LORENTZ, POINCARÉ, BELL, SEXL und vielen Anderen initiiert. Sie verbindet das EINSTEINsche Relativitätsprinzip mit der Vorstellung eines dreidimensionalen Raumes und einer eindimensionalen Zeit.

Ein wichtiger Punkt in [1] ist *die Energieerhaltung.* In der NEWTONschen Theorie gibt es ein negatives Gravitationspotenzial, wegen $E = mc^2$ bedeutet das negative Masse. Negative Massen gibt es nicht. Weder die NEWTONsche Theorie noch die EINSTEIN-Interpretation können erklären, was die negative Energie von im Feld ruhenden Teilchen bedeutet. Die LORENTZ-Interpretation gibt eine klare, experimentell überprüfbare Antwort.

[1] J. Brandes, J. Czerniawski: *Spezielle und Allgemeine Relativitätstheorie für Physiker und Philosophen - Einstein- und Lorentz-Interpretation, Paradoxien, Raum und Zeit, Experimente*, 4. Aufl. 2010

GR 24.3 Mo 14:00 ZHG 002

Is the Speed of Light 'c' a True Constant? — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

At first glance, the Michelson-Morley experiment seems to suggest that 'c' is constant in relation to any system. However, at second glance this constancy turns out to be purely a result of the measuring procedure.

H. Lorentz pointed out that this apparent constancy is the result of well understood field behaviour. Einstein accepted this as a viable explanation, but disliked it because it made necessary an ether, which he didn't want. He insisted on a theory with a constant 'c' with respect to any system. To achieve this, he had to assume that space and time vary depending on the actual conditions of motion.

Einstein extended this principle about 'c' to gravitational fields. Even though it can be shown by direct measurement that 'c' is reduced in such a field, Einstein again asserted that it is constant and explained the result of the measurement through a change in space-time (which is not directly measurable).

It is logically possible to transform Einstein's equations, based on the constancy of 'c' and variable space-time, into a model in which space and time are fixed, as otherwise always assumed, but 'c' is variable. This results in a much simpler understanding of physics with predominantly similar results to those of Einstein.

Further information: www.ag-physics.org/gravity

GR 24.4 Mo 14:00 ZHG 002

Rydberg Atom in Gravity — •Aniket Agrawal — Indian Institute of Technology Delhi, New Delhi, India

Recently, Chiao predicted the quantum incompressibility of a falling Rydberg atom. A Hydrogen-like atom was considered in a very high n, l=m=n-1 state to calculate the effects of tidal gravitational forces on these states. The high values of quantum numbers ensure that gravitational effect is measurable on the *stretch* state. We consider a similar atom and derive the energy of a particular level under the influence of Newtonian gravity. A change in the frequency of observed transition is predicted for a freely falling Hydrogen atom. This change is calculated both in Newtonian gravity and in curved space.

We see that the change in energy of the electron under gravity also depends on its principal quantum number. Thus there will be a shift in the frequency of the photon emitted by an electron making an ordinary transition from the state n=100, l=99, m=99 to the state n=99,l=98,m=98. Though this shift is quite less to be observed on Earth, it is measurable in satellites in a highly elliptical orbit about the earth, by spectroscopic methods. A similar result was derived by Chiao recently using a different argument. We conclude that the effect described by Chiao will be masked to a very large extent by the effect calculated above. Such perturbations might be important in emission spectra of white dwarfs and neutron stars.