Dichiarazione sostitutiva atto notorietà
(art. 47 DPR 445 DEL 28.12.2000)
ai sensi dell'art. 15, comma 1, lett. c), D.Lgs 33/2013 e
ai sensi dell'art. 20 comma 5, del D. Lgs. 8 aprile 2013 n. 39

Il/La sottoscritto/a HOLGER MUELLER CF. ______________________
nato a MONACO, GERMANIA Prov (____) il 20/01/1974
consapevole delle sanzioni penali, nel caso di dichiarazione non veritiere, di formazione o uso di atti falsi, richiamate dall'art. 76 del DPR n. 445 del 28.12.2000

DICHIARA

ai sensi dell'art. 15, c. 1, lett. c) del D.Lgs 33/2013 e ai sensi dell'art. 20, c. 5 del D.Lgs 39/2013

in relazione al conferimento dell'incarico di : SEMINARIO

a) ☒ di non svolgere incarichi e di non essere titolare di cariche in Enti di diritto privato regolati o finanziati dalla Pubblica Amministrazione conferente;

ovvero

☐ di svolgere i seguenti incarichi o di essere titolare delle seguenti cariche in Enti di diritto privato regolati o finanziati dalla Pubblica Amministrazione conferente:

1) ______________________
2) ______________________
3) ______________________

b) ☒ di non svolgere attività professionali in Enti di diritto privato regolati o finanziati dalla Pubblica Amministrazione conferente;

ovvero

☐ di svolgere le seguenti attività professionali in Enti di diritto privato regolati o finanziati dalla Pubblica Amministrazione conferente:

1) ______________________
2) ______________________
3) ______________________

c) di non trovarsi in alcuna delle situazioni di inconferibilità di cui al D.Lgs n. 39/2013.

INFORMATIVA RIGUARDO AL TRATTAMENTO DEI DATI PERSONALI (ART. 13 REG.UE 2016/679)

Il/La sottoscritto/a prende atto che il trattamento dei propri dati personali e sensibili avverrà secondo le modalità stabilite dal Regolamento UE 2016/679 (GDPR) relativo alla protezione delle persone fisiche con riguardo al trattamento dei dati personali, al solo fine di assolvere gli adempimenti di natura obbligatoria posti in capo al LENS.

Il/La sottoscritto/a prende altresì atto che il curriculum vitae et studiorum e le dichiarazioni rese per le quali, ai sensi della normativa vigente, è prevista l'ottemperanza ad obblighi di trasparenza, verranno pubblicati sul sito web dell'Amministrazione in apposita sezione di "Amministrazione Trasparente", all'indirizzo https://www.lens.unifi.it, dove è presente una pagina dedicata alla tematica della protezione dei dati personali contenente anche l'informativa per il trattamento dei dati personali dei collaboratori esterni.

Il/La sottoscritto/a si impegna a comunicare eventuali cause di incompatibilità che intercorrano nel corso dello svolgimento dell'incarico.

Firenze, 05/10/2018

IL /LA DICHIARANTE (firma leggibile per esteso)

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The Müller Group

Back to Directory

Research Area(s): Atomic, Molecular and Optical Physics

BIOGRAPHY

Holger Müller successfully applied for his first patent when he was 14. Later, he did his undergraduate thesis with Jürgen Mlynek at the University of Konstanz, Germany. He graduated from Humboldt-University, Berlin, with Achim Peters as advisor. Müller received a fellowship of the Alexander von Humboldt foundation and joined the group of Steven Chu in Stanford as a postdoc. In July 2008, he joined the physics faculty at U.C. Berkeley.

RESEARCH INTERESTS

The basic premise of my work is that precision measurements of fundamental quantities can help to address the great challenges faced by physicists now – for example, how we can find and verify a theory beyond the standard model of particle physics that might eventually unify gravity and quantum mechanics. While the energy scale of such theories is typically beyond the reach of experiments, it is possible to probe for suppressed effects at attainable energies in experiments of outstanding precision. Precision measurements have played a central role in the paradigm shifts of twentieth-century physics, and I am convinced that this will continue to be the case.

My work uses methods from atomic, molecular, and optical physics. It is centered on advancing the experimental technology to push the sensitivity of experiments to new levels, and to perform precision measurements of fundamental quantities. Some examples follow. I also work on the theory required for or underlying this work.

Atom interferometry: In light-pulse atom interferometers, atomic matter waves are split and recombined using pulses of laser light. The splitting occurs because when an atom interacts with the photons of a laser beam, it exchanges the momentum of a number of photons. The atom may thus continue on either of two spatially separate paths, the interferometer arms. When the paths are recombined, the probability that the atom is found depends upon the phase difference between them, which determines whether the matter waves will add or cancel. This phase is shifted by the atom’s coupling to electromagnetic fields, gravity, inertial forces, and other influences. By selecting the geometry of the interferometer, the atomic species, and its quantum state, one can maximize the wanted influence and minimize others. Advances in the control of the quantum state of atoms and photons have led to an extraordinary sensitivity and accuracy.

I currently work on a measurement of h/M, the ratio of the Planck constant to the mass of the Cs atom. From that measurement and known fundamental constants, a value for the fine structure constant α can be derived. The target accuracy of this work is one part per billion or better. The comparison of such a measurement to other measurements of α would be the most sensitive test of the theory of quantum electrodynamics. Moreover, it can contribute to a precision measurement of Avogadro’s constant and a new definition of the kilogram. It is also a sensitive probe for physics beyond the standard model, such as low-energy dark matter candidates or a possible internal structure of the electron.

On that path, we have reached several milestones so far: We have increased the sensitivity of atom interferometry by a factor of more than 100. This was accomplished by the use of multiphoton processes that transfer the momentum of up to 24 photons at once. By using “conjugate” interferometers, in which the interferometer arms simultaneously move into opposite directions, we have developed a way to strongly reduce many systematic errors. To make this possible, we developed the strongest continuous-wave laser at the particular wavelength required by the experiment. Also, we developed a theory of such multiphoton processes, based on a new method to find approximate solutions to the Schrödinger equation.

In another experiment, we have tested Einstein’s theory of gravity, general relativity, by looking for tiny modulations in the Earth’s gravitational field. We found bounds on seven parameters characterizing “post-Newtonian” deviations from the theory. This test made use of the most sensitive atom interferometry-based gravimeter thus far and is the first laboratory test of post-Newtonian gravity that is competitive with the best astrophysics bounds (from 30 years of lunar laser ranging data).

Precision tests of relativity: A classical example for such tests is the Michelson-Morley experiment, which compares the velocity of light for different directions of propagation. According to the theory of special relativity, no difference should be found. However, theories beyond the standard model, such as string theory and loop quantum gravity, may allow for tiny violations of this principle.

We could improve the precision of the experiment to sixteen decimal places. To do so, we used optical cavities, in which the light ray bounces back and forth a distance several hundred thousand times. The time between bounces is read out by using it as a reference for the frequencies of lasers and measuring the laser frequencies.

In the experiment, the distance is defined by a solid spacer (usually quartz or sapphire). If relativity is violated, the length of the spacer may change, as relativity also governs the equations of motion of the particles that make up the spacer. I have studied these changes and found that, in addition to setting limits on variations of the velocity of light, the experiment can also bound violations of relativity in the motion of electrons. This work constitutes the highest-precision confirmation of relativity for the motion of photons and electrons.

Current Projects

- Development of improved atom optics for interferometry: short grating periods by up to one-hundred photon momentum transfer via resonant enhancement of the intensity of the laser light, and/or ultraviolet (uv) light. UV light will also reduce distortions of the laser beams by optical diffraction. The eventual aim is to build interferometers having 0.1 square meters of area between the arms and a precision of 10 parts per trillion (ppt) or better.

- Laboratory test of gravitomagnetism (Lense-Thirring effect) by Sagnac atom interferometry: General relativity predicts that Earth’s rotation “drags” a local inertial observer to rotate at ~0.04 arc seconds per year, relative to the fixed stars. This has been verified by the Lageos satellites at 5-10% accuracy and the gravity-probe B satellite, which has not yet announced a final result. Atom interferometers with ultra-large enclosed areas will be sufficiently sensitive to provide the first laboratory measurement of it. Compared to using satellites, this project has a lower price tag, less stringent limits on “mission time,” a different set of systematic effects, and it can be repeated to make step-by step improvements.
- Measuring the fine structure constant to a precision that is better than 100 ppt, by atom interferometry. Such a measurement would be sensitive towards the existence of low-energy dark matter candidates and/or supersymmetric particles (“sparticles”) up to the TeV mass range.
- Frequency comb metrology in the deep uv to soft x-ray spectrum (collaboration with Lawrence Berkeley National Laboratory).
- 1,000-10,000 times improved test of Lorentz invariance by monitoring the birefringence of (nearly) isotropic materials (theory and experiment); also by probing electromagnetostatic fields.
- Femtosecond-laser atom optics to address broad spectral bandwidth.

PUBLICATIONS

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