July, 5, 2007
IQOQI Media Alert 4/2007

Institut für Quantenoptik und Quanteninformation
Österreichische Akademie der Wissenschaften

Otto Hittmair-Platz 1 / Technikerstraße 21a
6020 Innsbruck, Austria, Europe
Tel +43 512 507 4701
Fax +43 512 507 9815
iqoqi-ibk@oeaw.ac.at
www.iqoqi.at

Geschäftsführender Direktor
Univ.Prof. Dr. Rainer BLATT
rainer.blatt@oeaw.ac.at

How to Measure Time Ever More Accurately

World's only mobile atomic clock comes to in Innsbruck

Modern technology applications demand ever more accurate time measurements. Currently atomic clocks based on radio frequency measurements define the length of a second. Soon they could be replaced by optical clocks. Recently the experimental physicists at the University of Innsbruck brought the world's only mobile atomic clock to Tyrol to create a standard in their laboratory that will help them research into the principles for developing optical clocks.

The latest caesium atomic clocks are accurate to one second in 300 million years. For some technology applications, however, even this minute deviation is too much. Satellite navigation systems such as GPS or the European navigation system Galileo, which is still in development, use atomic clocks in satellites for increasing the accuracy of their positioning with the help of this exact time measurement. Scientists all over the world are working on making clocks ever more accurate and want to achieve this using frequencies in the optical spectrum. It is hoped that such optical clocks will be a 1000 times more accurate than current atomic clocks. Before you can push developments to such levels, however, you need to calibrate the instruments very precisely with which you want to research the principles of future time measurement.

Exact calibration with the help of an atomic clock

To this end, the quantum physicists in the team of Prof. Rainer Blatt of the Institute for Experimental Physics at the University of Innsbruck brought the world's only mobile caesium atomic clock from Paris to Innsbruck. Philippe Laurent, Daniele Rovera and Michel Abgrall from the Observatoire de Paris (LNE-SYRTE) accompanied the extremely sensitive measuring device on its way to Austria and set it up in the laboratory in Innsbruck. Together with the research group of Mag. Michael Chwalla from the team of Prof. Blatt, the French scientists used a so-called optical frequency comb generator to compare the radio frequency of the atomic clock with the wavelengths of the laser light that the Innsbruck physicists use

ÖAW
Österreichische Akademie der Wissenschaften

for quantum-mechanical experiments in their lab and succeeded in establishing an ultra-accurate standard for further measurements in Innsbruck.

Time measurement specialists

“I must have seen practically all primary atomic clocks worldwide – i.e. the reference clocks that defines our time – ,” recounts Prof. Blatt, whose has dedicated many years of research to the issue of precision spectroscopy, i.e. the exact measuring of electromagnetic waves. “The development of optical clocks is currently a hot topic in international research and we want to make an essential contribution,” Rainer Blatt emphasized. Only last year, Dr. Christian Roos of Blatt’s working group had published the results of an experiment using quantum-mechanically entangled atoms for more accurate time measurements, in the journal Nature.

All experiments are carried out at the Institute for Experimental Physics of the University of Innsbruck and at the Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences (ÖAW). The scientists also receive support from the Austrian Science Fund (FWF) and the European Union.

You can find a picture of the mobile atomic clock on: http://www.iqoqi.at/media/download/

Contact:
Mag. Michael Chwalla
Institute for Experimental Physics
Universität Innsbruck
Technikerstrasse 25, A-6020 Innsbruck
Tel.: +43 512 507- 6312 or 6371 or 6372
Email: Michael.Chwalla@uibk.ac.at
or
Univ.-Prof. Dr. Rainer Blatt
Institute for Experimental Physics
Universität Innsbruck
Technikerstrasse 25, A-6020 Innsbruck
Tel.: +43 512 507-6350
Email: Rainer.Blatt[at]uibk.ac.at
web: http://quantumoptics.at

Dr. Christian Flatz
Public Relations
Tel. +43 650 5777122
E-Mail: pr-iqoqi[at]oeaw.ac.at