UNIVERSITY of WISCONSIN
LA CROSSE

Distinguished Lecture Series in PHYSICS

November 3-4, 2011

2005 Nobel Laureate in Physics

Theodor W. Hänsch

Professor Theodor W. Hänsch is a Director at the Max-Planck-Institute of Quantum Optics in Garching, Germany and is the Carl Friedrich von Siemens Professor in the Department of Physics of Ludwig-Maximilians-University in Munich, Germany. He was born in Heidelberg, Germany, where he received his doctorate in laser physics in 1969. In 1970, he joined Arthur L. Schawlow at Stanford University as a postdoc. Two years later, he accepted a faculty appointment in the Stanford Physics Department, where he worked as a Full Professor from 1975 until he returned to his native Germany in 1986. In 1974, Hänsch and Schawlow made a seminal proposal for laser cooling of atomic gases. 25 years later, Hänsch and his Munich team were the first to realize Bose-Einstein condensation on a microfabricated atom chip. In 2005, Theodor W. Hänsch shared half of the Physics Nobel Prize with John L. Hall for their contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique.

Schedule of Events

Thursday, November 3, 2011

Public Lecture

4:30 p.m. **Reception**
Skogen Auditorium A Room 1400
Centennial Hall
Refreshments served

5 p.m.

Passion for Precision

The Balmer spectrum of atomic hydrogen has provided the Rosetta stone for deciphering the strange laws of quantum physics during the early 20th century. Precise spectroscopy of the simple hydrogen atom can yield accurate values of important physical constants and it can stringently test basic physics laws. The invention of the laser frequency comb a decade ago has given us a tool for accurately counting the ripples of a light wave, so that we are now able to measure resonance frequencies in hydrogen to 15 decimal digits. Recently, it has become possible to perform laser spectroscopy of exotic muonic hydrogen, where the electron is replaced by a 200 times heavier muon. The measured 2S – 2P Lamb shift gives an accurate value of the charge radius of the proton. However, this radius is significantly smaller than the value obtained from spectroscopy of ordinary hydrogen or from electron scattering experiments. This proton-size puzzle is the subject of intense discussions. It may be caused by a mistake, or it may indicate a dent in the armor of quantum electrodynamic theory.

Friday, November 4, 2011

Physics Seminar

3 p.m. **Reception**
Cowley Hall Atrium
Refreshments served

3:20 p.m. **Cowley Hall - Room 100**

What can we do with laser frequency combs?

The spectrum of a mode-locked femtosecond laser consists of several hundred thousand precisely evenly spaced spectral lines. Such laser frequency combs have revolutionized the art of measuring the frequency of light, and they provide the long-missing clockwork for optical atomic clocks. High-harmonic generation with intense femtosecond pulses provides a path to extend frequency comb techniques into the extreme ultraviolet and perhaps into the soft x-ray regime. Laser comb techniques can give control of the electric field of ultrashort laser pulses, and they have become key tools for the emerging field of attosecond science. The availability of commercial instruments is facilitating the evolution of new applications far beyond the original purpose, ranging from fundamental research to telecommunications and satellite navigation. Laser combs are revolutionizing molecular spectroscopy by dramatically extending the resolution and recording speed of Fourier spectrometers. The calibration of astronomical spectrographs with laser combs will enable new searches for earth-like planets in distant solar systems, and may reveal the continuing expansion of space in the universe.

For further information about the lecture contact:

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