A Passion for Precision

Theodor W. Hänsch

Max-Planck Institute of Quantum Optics, Garching, and
Department of Physics, Ludwig-Maximilians-University, Munich, Germany

Abstract

Femtosecond laser optical frequency comb synthesizers have become the established tool for measuring the frequency of light with extreme precision. By permitting phase-coherent comparisons of optical and microwave frequencies, they can serve as the clockwork for ultraprecise optical atomic clocks. Applications to laser spectroscopy of atomic hydrogen permit stringent tests of basic laws of quantum physics. Such experiments can yield accurate values of fundamental constants, and they may reveal slow changes of fundamental constants with the evolution of the universe. Laser frequency comb techniques have also become an enabling tool for controlling the light phase of femtosecond laser pulses, thus advancing the frontier of ultrafast science from the femtosecond to the attosecond regime. High harmonic generation with intense femtosecond pulses may extend frequency comb techniques to the extreme ultraviolet and soft x–ray regime, conquering new territory for precision laser spectroscopy and fundamental measurements.