

**Plenary Talk** PV VI Wed 10:30 V53.01  
**Laser Spectroscopy of Hydrogen** — •THEODOR HÄNSCH — Faculty of Physics, University of Munich (LMU), Schellingstr. 4, IIIrd floor, D-80799 Munich — Div. Laserspectroscopy, Max Planck Institute of Quantum Optics, Hans-Kopfermann-Str. 1, D-85748 Garching  
Spectroscopy of the simple hydrogen atom has provided the rosetta stone for deciphering the strange rules of quantum physics during the first half of the 20th century. Doppler-free laser spectroscopy opened a new chapter in the exploration of hydrogen 4 decades ago. Recent precision measurements of the absolute frequency of the sharp 1S-2S two photon resonance have reached an uncertainty of 4 10-15. The fre-

quency comb technique is enabling a direct comparison with Germany's primary cesium frequency standard at the PTB in Braunschweig via a 900 km optical fiber link. However, the determination of fundamental constants and stringent tests of fundamental physics laws have long been limited by our insufficient knowledge of the rms charge radius of the proton. Recently, a laser measurement of the 2S-2P Lamb shift in muonic hydrogen has yielded an independent precise new value of the proton radius which is 4% smaller than the presently accepted CODATA value. This "proton size puzzle" remains so far unsolved. Planned future spectroscopy of hydrogen and of hydrogen-like muonic helium may uncover some mistake or reveal a dent in the armor of quantum electrodynamic.