Laser spectroscopy of simple atoms at short wavelengths

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ABSTRACT:

In addition to facilitating many of the advances in modern physics during the 20th century, the study of atomic hydrogen and other simple two-body systems remains a fresh and exciting topic. In this talk, I will discuss ongoing experiments being conducted both at The Max Planck Institute of Quantum Optics in Garching, Germany and at JILA in Boulder, which aim to increase the precision of laser spectroscopy of simple atoms at short wavelengths. I will first present our efforts to measure the hydrogen 1S-3S transition at 205 nm, which could shed light on the ongoing proton-size puzzle and provide a stringent test of QED. I will then discuss work on the generation of extreme-ultraviolet frequency combs through the use of intracavity high-harmonic generation. This work has allowed for high-resolution spectroscopy of Ar at 82 nm and demonstrated that laser spectroscopy of ground state hydrogen-like ions is within grasp. Finally, I will discuss a possible route to laser cooling hydrogen – a longstanding goal in the atomic physics community, which has so far proved elusive.