Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Quantum-optical spectroscopy for plasma electric field measurements and diagnostics[1] DAVID ANDERSON, Rydberg Technologies, GEORG RAITHEL, Rydberg Technologies, University of Michigan, MATTHEW SIMONS, CHRISTOPHER HOLLOWAY, National Institute of Standards and Technology — Measurements of plasma electric fields are essential to the advancement of plasma science and applications. Methods for non-invasive in situ measurements of plasma fields on sub-millimeter length scales with high sensitivity over a large field range remain an outstanding challenge. Here, we introduce and demonstrate a method for plasma electric field measurements and diagnostics that employs electromagnetically induced transparency as a high-resolution quantum-optical probe for the Stark energy level shifts of plasma-embedded Rydberg atoms, which serve as highly-sensitive field sensors with a large dynamic range. The method is applied in diagnostics of plasmas photo-excited out of a cesium vapor. The plasma electric fields are extracted from spatially-resolved measurements of field-induced shape changes and shifts of Rydberg resonances in rubidium tracer atoms. Measurement capabilities over a range of plasma densities and temperatures are exploited to characterize plasmas in applied magnetic fields and to image electric-field distributions in cyclotron-heated plasmas.

[1]This work was supported by Rydberg Technologies, the NSF (IIP-1624368 and PHY-1506093), and NIST through the Embedded Standards program.

David A. Anderson
Rydberg Technologies

Date submitted: 23 Jan 2018 Electronic form version 1.4