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Stark spectroscopy of atomic hydrogen balmer-alpha line for electric field measurement in plasmas by saturation spectroscopy S. NISHIYAMA, K. KATAYAMA, Hokkaido University, H. NAKANO, M. GOTO, National Institute for Fusion Science, K. SASAKI, Hokkaido University — Detailed structures of electric fields in sheath and pre-sheath regions of various plasmas are interested from the viewpoint of basic plasma physics. Several researchers observed Stark spectra of Doppler-broadened Rydberg states to evaluate electric fields in plasmas; however, these measurements needed high-power, expensive tunable lasers. In this study, we carried out another Stark spectroscopy with a low-cost diode laser system. We applied saturation spectroscopy, which achieves a Doppler-free wavelength resolution, to observe the Stark spectrum of the Balmer-alpha line of atomic hydrogen in the sheath region of a low-pressure hydrogen plasma. The hydrogen plasma was generated in an ICP source which was driven by on-off modulated rf power at 20 kHz. A planar electrode was inserted into the plasma. Weak probe and intense pump laser beams were injected into the plasma from the counter directions in parallel to the electrode surface. The laser beams crossed with a small angle above the electrode. The observed fine-structure spectra showed shifts, deformations, and/or splits when varying the distance between the observation position and the electrode surface. The detection limit for the electric field was estimated to be several tens of V/cm.

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