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An experimental study of population density distribution of H(n=2) fine structure by laser absorption spectroscopy S NISHIYAMA, T NARUSE, K SASAKI, Hokkaido Univ — Absorption spectrum of H_α line consists of seven fine structure components. The relative intensity of each component depends on the population density distribution of the lower states, $2^2S_{1/2}, 2^2P_{1/2}$, and $2^2P_{3/2}$. The metastable $2S$ state should have larger population than $2P$ states. In most cases, however, observed spectrum can be understood that the $2S$ and $2P$ states are almost same population density. The cause of this phenomenon is explained as relaxation of $2S$ state by Stark mixing or collisional quenching. In this study, we observed absorption spectrum shape of H_α line to evaluate the population density distribution of H(n=2) states. A laser beam oscillated by a tunable diode laser was pass through a hydrogen plasma generated by a ICP source. The intensity of the transmitted laser was measured and the synchronous component with the modulation of the rf power fed to the ICP source was detected by a lock-in amplifier. The observed absorption spectra were fitted to calculated spectrum by non-linear least square method in which the relative population density of H(n=2) states and temperature were free parameters. The observed spectra at 20 mTorr showed that the population density of $2S$ was twice than that of $2P$ states.

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