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Measurement of Gas Temperature in Negative Hydrogen Ion Source by Wavelength-Modulated Laser Absorption Spectroscopy[1] S. NISHIYAMA, K. SASAKI, Hokkaido University, H. NAKANO, M. GOTO, M. KISAKI, K. TSUMORI, National Institute for Fusion Science, NIFS-NBI TEAM
— Measurement of the energy distribution of hydrogen atom is important and essential to understand the production mechanism of its negative ion (H^-) in cesium-seeded negative ion sources. In this work, we evaluated the temperature of atomic hydrogen in the large-scale arc-discharge negative hydrogen ion source in NIFS by wavelength-modulated laser absorption spectroscopy. The laser beam was passed through the adjacent region to the grid electrode for extracting negative ions. The frequency of the laser was scanned slowly over the whole range of the Doppler width (100 GHz in 1s). A sinusoidal frequency modulation at 600 Hz with a width of 30 GHz was superposed onto the slow modulation. The transmitted laser was detected using a photodiode, and its second harmonic component of the sinusoidal modulation was amplified using a lock-in amplifier. The obtained spectrum was in good agreement with an expected spectrum of the Doppler-broadened Balmer-α line. The estimated temperature of atomic hydrogen was approximately 3000 K. The absorption increased with the arc-discharge power, while the temperature was roughly independent of the power.

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