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14.53 Nd:YAG laser Thomson scattering diagnostics for laboratory magnetosphere

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Stable confinement of high-beta (local electron beta ˜ 1) is demonstrated with high-energy electrons (T_e > 10 keV) by an X-ray measurement in the RT-1 magnetospheric plasmas. A new Nd:YAG laser Thomson scattering (TS) system has been developed to investigate the mechanism of the high-beta plasma formation in the RT-1. The designed parameters for the TS system is 10 eV < T_e < 50 keV and n_e > 1.0 x 10ˆ{17} mˆ{-3}. In order to obtain the sufficient amount of scattered light for the low-density plasmas, we adopted the long scattered length (60 mm) and a bright optical system with both large collection window (Φ=260 mm) and large collection lens (Φ=300 mm). The system employs a Nd:YAG laser of 1.2 J (oscillation frequency: 10 Hz) with a scattering length of 60 mm (scattering angle: 90 degrees). Scattered light is collected by one set of lens (f/2.0, NA = 0.145) with a solid angle of ˜ 68 m str and guided to an interference filter polychromator through an optical fiber bundle. As a test measurement and calibration, the Raman scattering signals were successfully obtained in N_2 gas. We found that the collection optics realizes a sufficient signal-to-noise ratio above n_e ˜ 10ˆ{17} mˆ{-3}. We also observed that the spectrum of TS light changes with the RT-1 plasma parameters.

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