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EX/P6-20: Coupling of ICRF Waves and Axial Transport of High-Energy Ions Owing to Spontaneously Excited Waves in the GAMMA 10 Tandem Mirror

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Ion cyclotron range of frequency (ICRF) waves have been used for plasma production, heating and sustaining MHD stability in the GAMMA 10 tandem mirror. Maximum ion temperature has reached 10 keV and the temperature anisotropy (which is defined as the temperature ratio of perpendicular to parallel to the magnetic field line) becomes more than 10. In such high performance plasmas with the strong anisotropy, high-frequency fluctuations, so-called Alfvén-ion-cyclotron (AIC) waves, are spontaneously excited. The AIC waves are excited as eigenmodes and have several discrete peaks in the frequency spectrum. In addition to magnetic probes installed in the peripheral region, a microwave reflectometer system is introduced for the measurement of spatial structure of density fluctuations owing to the ICRF waves in the core region. Couplings between the ICRF waves for heating and the excited AIC waves are clearly observed in the central cell of GAMMA 10 with the reflectometer for the first time. Parametric decay of the heating ICRF waves to the AIC waves and low-frequency waves are discussed. Waves which have differential frequencies between discrete peaks of the AIC waves are also observed in the region around 0.1 MHz. To evaluate wave-particle interactions, the behaviors of high-energy ions with energies more than 5 keV are measured with semiconductor detectors installed in the central cell and in the east end. Ions escaped across the magnetic field line are detected in the central cell and ions along the field line are detected in the east end. The fluctuations around 0.1 MHz are detected only on the signal of the semiconductor detector installed in the east end. Pitch angle scattering of high-energy ions owing to those low-frequency waves are clearly indicated. Considerable energy transport to the ends owing to the AIC waves is suggested theoretically. Energy flow along the magnetic field line is one of the important subjects when the ICRF power is injected in the perpendicular direction to magnetic field line.

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