(TG3) Spectroscopy Topical Group Report

Feb. 2, 2022 (M. Yoshinuma)

Date: Feb. 1, 2022
Time: 11:55- 14:00, 15:45-18:45
Shot#: 177775 - 177808, 177842 – 177901 (94 shots)

Prior wall conditioning: Hydrogen glow discharge
Divertor pump: ON (w/o 2I)
Gas puff: H, Ne, Ar
Pellet: -

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, D, D)=P(4.6, 1.8, 3.9, 3.1, 2.8)MW

ECH(77GHz)=ant(5.5-Uout (and 1.5U), 2-OUR)=P(703, 792)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(979, 930, 986)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(-)MW
Neutron yield integrated over the experiment = 7.75×10^{11}

Topics

1. Effect of the anisotropy of the electron velocity on the excitation of low whistler frequency waves via the nonlinear wave-wave coupling from the lower hybrid wave originated by high energy beam ions (H.Igami)
2. Study of W erosion, transport, deposition and screening in LHD by emission spectroscopy on neutral and low ionising W transitions (S.Brezinsek, M.Goto)

Effect of the anisotropy of the electron velocity on the excitation of low whistler frequency waves via the nonlinear wave-wave coupling from the lower hybrid wave originated by high energy beam ions

H. Igami

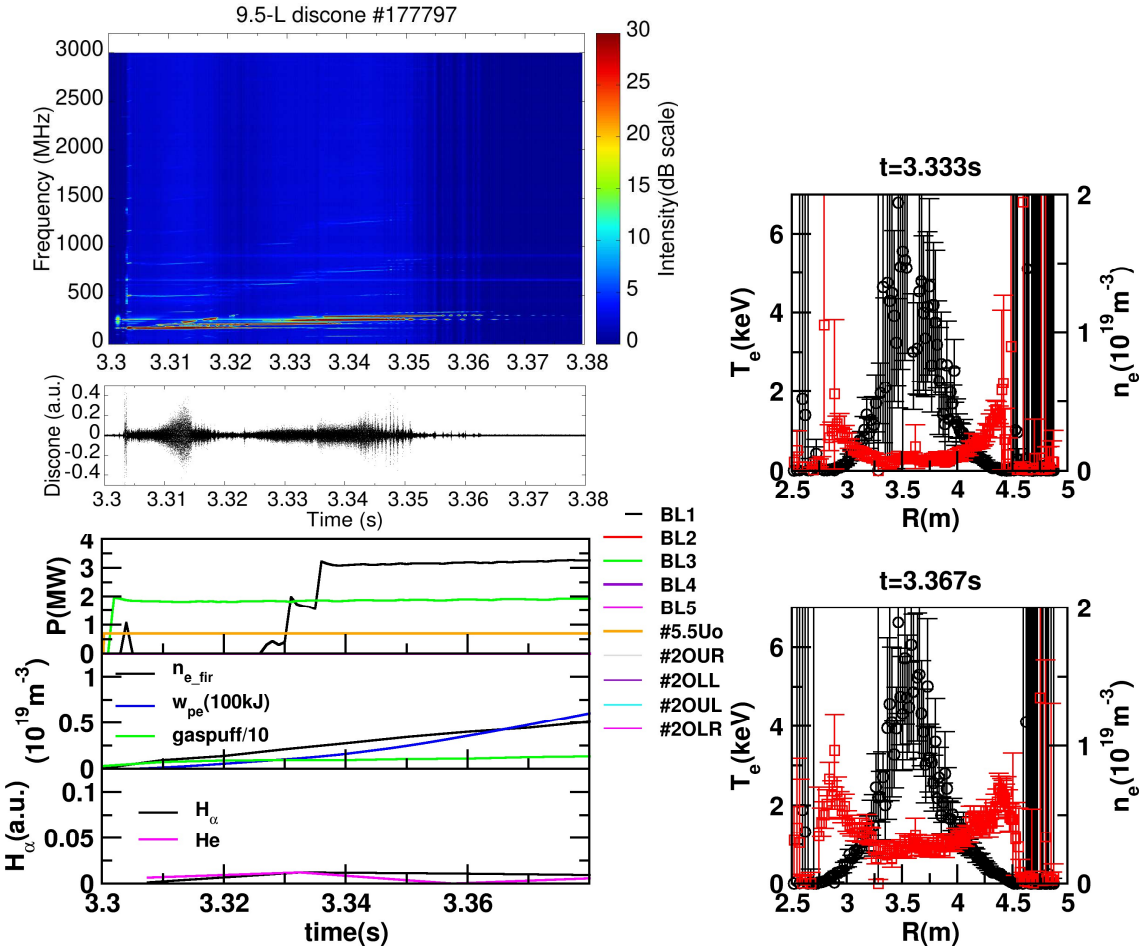
Shot #: 177775 - 177808
Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) =
(3.6 m, CW, 2.75 T, 1.2538, 100.0%)

Purpose:

- To investigate whether the T_e anisotropy affects the excitation of the GHz range waves including whistler waves

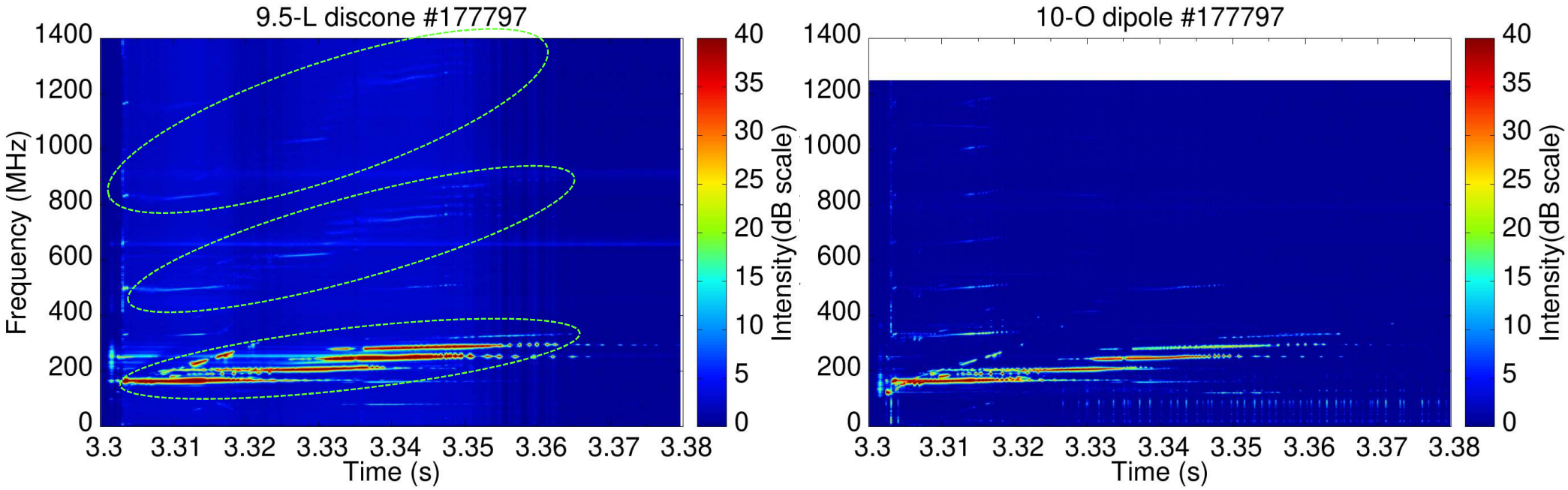
Experimental result:

- During the plasma production phase by ECH and NBI, frequency peaks were observed up to the GHz range (more than 70 times of central IC frequency)
- The wave emissions are bursty not continuous



Effect of the anisotropy of the electron velocity on the excitation of low whistler frequency waves via the nonlinear wave-wave coupling from the lower hybrid wave originated by high energy beam ions

H. Igami, et al



- Periodic intense frequency peaks are observed with ~180MHz gap
- Periodic staircase spectra are observed at 9.5-L
- Possible propagation modes should be identified with solving the dispersion equation
- Dependence of ECH power, T_e anisotropy, T_e in the emission region on the frequency spectra will be examined

Effect of the anisotropy of the electron velocity on the excitation of low whistler frequency waves via the nonlinear wave-wave coupling from the lower hybrid wave originated by high energy beam ions

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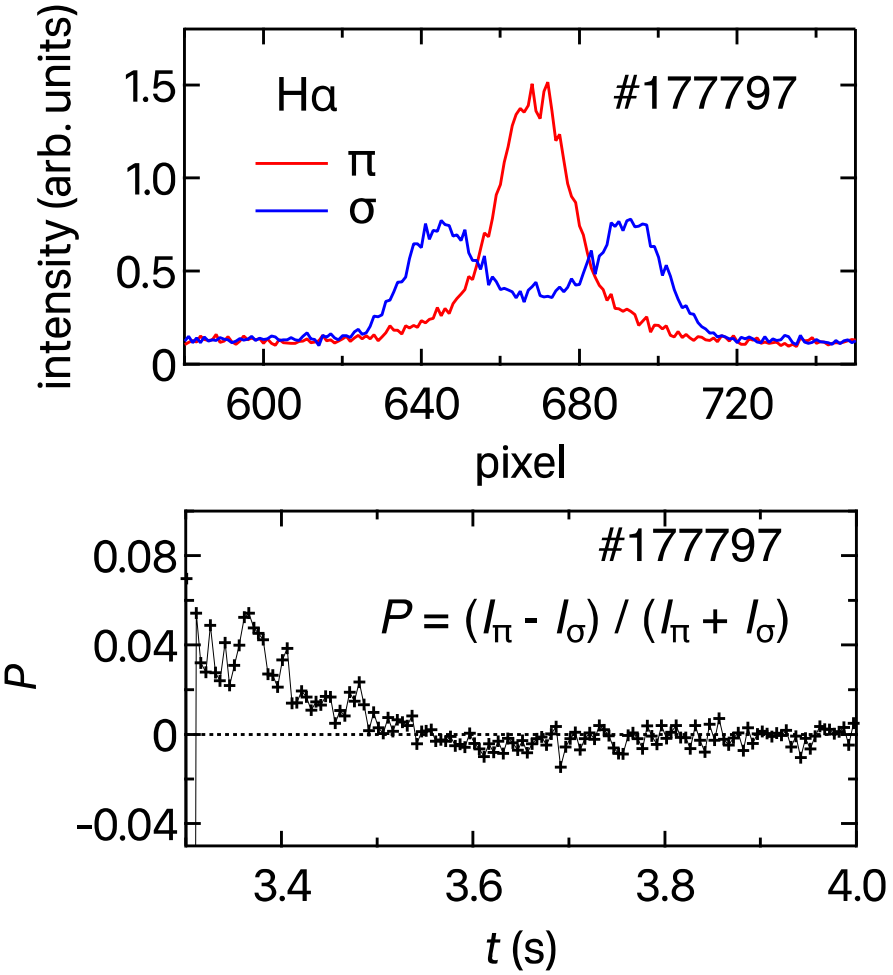
- Anisotropic EVDF could induce polarization in the atomic line radiation
- Polarization-resolved measurement is attempted for Hα line with a Glan-Thompson prism
- π and σ components of Zeeman split line profile are clearly separated
- Polarization is detected in the initial phase of discharges and P > 0 suggests $T_{\perp} > T_{//}$
- Quantitative analysis will be made with a population-alignment collisional-radiative model



Study of W erosion, transport, deposition and screening in LHD by emission spectroscopy on neutral and low ionising W transitions S. Ertmer, S. Brezinsek (FZJ), M. Goto, M. Kobayashi, T. Oishi et al.

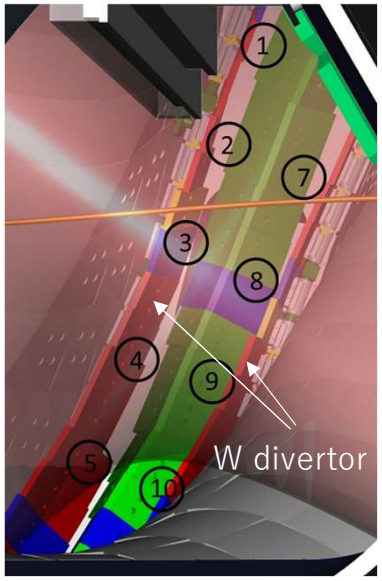
Background & motivation:

As W is a candidate for divertor armor tile for a future reactor, it is important to understand the sputtering (erosion) of W and subsequent transport in plasmas. The experiment was aimed at obtaining the W emission spectra in various charge states to study the processes of sputtering and transport in LHD plasmas.

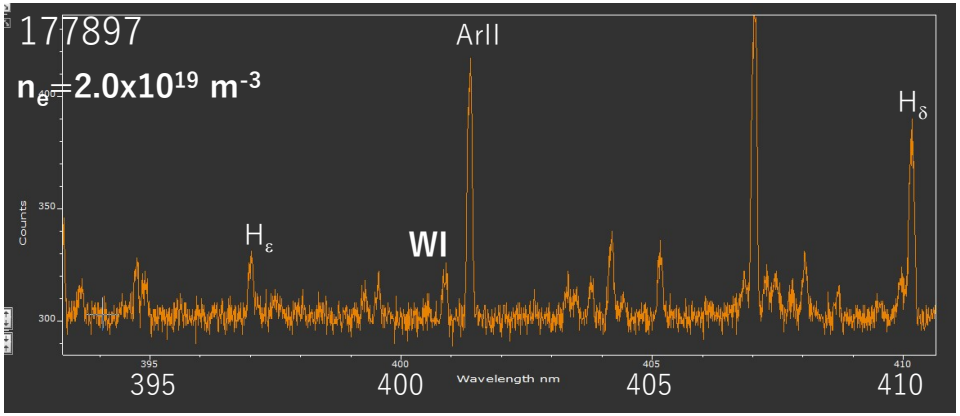
Results: R_{ax}=3.60m, 2.75T, γ=1.254, Bq=100%

- The heating scheme (ECH, NBI) and density were scanned to change plasma parameters, and spectroscopy data were obtained. Especially, WI spectra in various wavelength range were systematically acquired by the divertor spectroscopy that views the W divertor tiles.
- Ar and Ne were seeded to enhance W sputtering. It is found that **Ar is most effective to enhance WI emission.** (Without impurity seeding, almost no WI spectra observed.)
- WI becomes stronger with lower density with same hearting power, especially in e-ITB plasmas with dominant ECH, as shown in the figure. The results indicate that **acceleration of impurity ions in the sheath potential drop (~3*Te) is important**.
- Detailed analysis will be conducted for various W spectra.

FOV of spectroscopy



ch4



Wavelength (nm)