Contribution ID: **3463** Type: **not specified**

# P4.1087 Effective electron Bernstein wave heating by polarization adjustment of incident microwave for non-inductive formation of spherical tokamak in LATE

*Thursday, 11 July 2019 14:00 (2 hours)*

See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P4.1087.pdf

Non-inductive formation of spherical tokamak (ST) by electron cyclotron heating and current drive (ECH/ECCD) using electron Bernstein (EB) wave is an important issue for realization of a compact and economical reactor without a central solenoid. In order to use EB waves for ECH/ECCD, EB waves have to be coupled from EC waves via mode-conversion (MC) process in the plasma. Improving MC rate to EB waves results in effective heating because EB wave may be strongly absorbed even in low temperature plasma. The MC rate can be improved by adjusting the polarization and the parallel refractive index of the incident EC wave for the density gradient near the upper hybrid resonance (UHR) layer as shown by the linear MC rate theory with cold plasma resonance absorption model in a slab geometry [1].
In the LATE device, overdense ST plasmas are non-inductively formed by oblique injection of the microwaves at 2.45 GHz from low field side on the midplane when the fundamental ECR layer is located in the plasma core and the 2nd ECR layer is outside the UHR layer [2]. To study the polarization effects on plasma production, the polarization of incident microwave is converted from the linearly-polarized one originally generated by magnetrons to three types of elliptically-polarized ones (from O-mode like one to X-mode like one) by the circular waveguide polarizers [3]. The radial density profile on the midplane is reconstructed by Abel inversion from line-integrated density data measured by 4 ch 70 GHz microwave interferometers, and the UHR location and the density gradient are obtained.
When the density gradient near the UHR layer is low, the density and the soft X-ray intensity near the core of the plasma formed with O-mode like polarization are the highest among three types of polarizations. When the density gradient is high, those of the plasma formed with Xmode like polarization are the highest. In both cases, the MC rate calculated with the measured values are also the highest, which means that the plasma heating near the plasma core is brought about by improvement of the MC rate and increase of power deposition via EBW absorption.
References
[1] H. Igami, H. Tanaka and T. Maekawa, Plasma Phys. Control. Fusion 48 573 (2006) [2] M. Uchida, et al., Fusion Energy Conf. 2012, IAEA-CN-197/EX/P6-18. [3] Y. Noguchi, et al., Plasma Phys. Control. Fusion 55 125005 (2013)

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**Session Classification:** Poster P4

**Track Classification:** MCF