



Contribution ID: 586

Type: Poster

EX/P6-26: Experimental Study of Low Frequency Wave Current Drive in the SUNIST Spherical Tokamak

Thursday, 11 October 2012 14:00 (4h 45m)

Alfvén wave is one of the waves that can overcome the density limit and reach the interior of spherical tokamak (ST) plasmas. Therefore, it may be possible to drive plasma current by low frequency waves through Alfvén resonance in STs. This method has been tested in the SUNIST spherical tokamak (R/a : 0.3 m/0.23 m; B_{T0} : 0.15 T; I_P : 30~50 kA; n_e : $\sim 1E19\text{ m}^{-3}$; pulse length: 4~25 ms). Four pairs of antennas, which are made by poloidal folded stainless steel straps, have been installed in the equatorial plane of the vacuum vessel with a uniform toroidal spacing angle of 90 degree. Two pairs of the antennas are protected by side limiters (consist of boron nitride plates) but the two pairs left are not protected by anything. The antenna system is powered by a four phases outputs radio frequency (RF) generator (0.4 ~ 1 MHz, <100 kW per output). The most obvious observation after injecting RF waves from bare antennas was the increased intensity of impurity lines (carbon and oxygen). The boron nitride plates protected antennas have better performance on impurities. The experimentally measured impedance of the antenna system has the similar characteristics as theoretical one-dimension MHD calculations (Figure 1). Since the antenna system was fed in π phasing, both $N=1/-1$ and $M=1/-1$ vacuum modes are excited. From the experimental impedance curve, it seems that the plasma may have responded to both two modes. When the RF waves (~ 40 kW for each phase) were applied to lower density ($n_e < 8E18\text{ m}^{-3}$) and lower current ($I_P \sim 30$ kA) plasmas by bare antennas, we often observe an enhancement of runaway electrons. Hard X ray measurements by CdTe detectors support this observation. However, when the RF waves were applied to the discharges with normal density ($n_e > 1E19\text{ m}^{-3}$) and normal plasma current ($I_P \sim 40$ kA), no obvious differences could be found compared to discharges without RF waves.

Country or International Organization of Primary Author

China

Primary author: Mr TAN, Yi (Tsinghua University)

Co-authors: Mr FENG, Chunhua (Institute of Physics, Chinese Academy of Sciences); Mr XIE, Huiqiao (Department of Engineering Physics, Tsinghua University); Ms XIE, Lifeng (Department of Engineering Physics, Tsinghua University); Prof. WANG, Long (Institute of Physics, Chinese Academy of Sciences); Dr WANG, Wenhao (Department of Engineering Physics, Tsinghua University); Prof. YANG, Xuanzong (Institute of Physics, Chinese Academy of Sciences); Mr LIU, Yangqing (Department of Engineering Physics, Tsinghua University); Mr GAO, Zhe (China)

Presenter: Mr GAO, Zhe (China)

Session Classification: Poster: P6

Track Classification: EXW - Magnetic Confinement Experiments: Wave-plasma interactions; current drive; heating; energetic particles