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Evidence and Modelling of 3D Divertor Footprint Induced by Lower Hybrid Waves on EAST with Tungsten Divertor Operations

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Active control of high heat and particle fluxes deposited on the divertor targets is an essential issue for steady-state operations on the experimental advanced superconducting tokamak (EAST) and other future fusion devices, such as ITER. The change of edge magnetic topology is an effective method to exert positive influence on divertor heat and particle fluxes, which has been achieved by lower hybrid waves (LHW) on EAST, similar with the effect of resonant magnetic perturbations (RMP) coils. The 3D divertor footprint patterns induced by LHW have been systematically observed in the EAST 2016 January campaign. By comparing the particle fluxes deposited on the divertor targets in the same poloidal location while different toroidal locations, we find the secondary heat flux peak away from the strike point closely fits the pitch of the edge magnetic field line in different q95, which has also been qualitatively modeled by a field line tracing code. In the simulation of this model, the same starting point and amplitude of the helical current filaments (HCFs) were assumed for each q95 case, with the total current of the group of four filaments taken as 1.5 kA. Steady-state discharges in various LHW power under low-confinement mode (L-mode) has also been carried out recently. As the LHW power increases to a threshold, the heat and particle fluxes in the strike point remain nearly constant while the secondary heat flux peak away from it turns out an significant enhancement, which is attributed to that more LHW power is absorbed in scrape-off layer (SOL) region as LHW power raises up, thus enhancing HCFs in the SOL. Furthermore, in comparison to purely 4.6GHz-LHW heated experiments, we find an extra splitting area away from the main strike point at the toroidal angle of $19\pi/16$ (Port D) and an obvious decrease of particle fluxes at the toroidal angle of $31\pi/16$ (Port O) when 2.45GHz LHW (Port N) are simultaneously added, which may provide a new means in spreading the wetted area and reducing the peak heat flux.

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