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Relativistic guiding center orbit simulation of fast electron loss in the EAST tokamak

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Power balance is of great importance for the long pulse steady state operation (LPSSO) of tokamak. But the interaction between fast electron and the first wall severely restricts the realization of the LPSSO, and hot spot is one of the typical manifestations. A relativistic guiding centre orbit code has been developed and used to investigate the loss of fast electron on the first wall in EAST. Benefiting from the calculation of electron motion orbits in cylindrical coordinates, the simulation can take into account the realistic wall geometry outside the last closed flux surface (LCFS), as well as the relative position of the LHW launcher in the toroidal direction, so it can give a more accurate evaluation on the generation position of the fast electron. Hot spot on lower divertor of EAST USN discharges 73993 and 73994 are chosen for the study. It is found that dX (dX=gapout- dRsep) play an important role in the generation of hot spot. Lower hybrid wave (LHW) is an efficient way to heating and drive the plasma current, and is the main source of fast electrons generation on EAST. Heat load analysis of the first wall on the LHW modulation discharge 74864 using infrared camera measurement indicates that fast electron generated and coupled the energy of LHW in the scrape-off layer (SOL) is the main reason for the heat load increasing on the first wall. A better understanding of the fast electron loss and their interaction to the first wall helps to avoid locally excessive heat load and to provide support for LPSSO of tokamak in the future.