Magnetic island structure effect on runaway electron confinement

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In tokamaks, relativistic runaway electrons (REs) are generated during the current ramp-up phase and/or plasma disruptions. The loss of REs can cause severe damage in plasma facing components in the device. Therefore, the study of RE confinement and transport is of significant importance in contemporary fusion plasma research, especially for ITER. In this work, we develop a set of singularity-free relativistic RE guiding-center equations of motion based on the recently reported coordinate transformation technique [1]. To study RE confinement in toroidal geometry, we develop a code which solves the system of relativistic guiding-center equations. Using this code, we perform a computational analysis of the characteristics of RE orbits and confinement in the KSTAR tokamak. Specifically, we perform numerical simulations of RE confinement in the presence of prescribed magnetic islands to investigate the impact of equilibrium magnetic topology on RE confinement. The magnetic islands are shown to have a significant influence on the RE orbit, depending on the initial RE position and energy. A detailed discussion on the physical mechanism leading to change in RE confinement will be discussed in the conference.

References

[1] Burby, J. W. and Ellison, C. L., 2017, Phys. Plasmas **24**, 110703.