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P5.1068 Study of runaway electron transport with the fractional diffusion model and comparison with experiments on COMPASS

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Runaway electrons (RE) represent one of the main obstacles to the successful operation of ITER [1]. During plasma diruptions, the structure of magnetic surfaces is broken and large regions of stochastic magnetic field are created; however, the rapidly reforming magnetic flux tubes are able to trap RE for a long time [2]. The magnetic configuration inside the plasma volume consists of intact magnetic surfaces alternated with magnetic islands and stochastic layers, which make the usual diffusive approach inadequate to the study of transport. When different degrees of magnetic stochasticity are present in the plasma volume, the fractional diffusion model should be used instead. The generalization of the diffusive model leads to a fractional order time derivative, which introduces a temporal non-locality in the system [3]. The average over the finite drift orbits of the electrons introduces an energy-dependent factor in the diffusion coefficient [4]. The fractional diffusion model can be used to study RE transport in tokamaks, by calculating the diffusion coefficient corresponding to the magnetic configuration and by solving the fractional diffusion equation. This model has been applied to the study of RE transport in COMPASS, to evaluate the effect of MHD perturbations, with a particular focus on magnetic islands, on the RE beam confinement. The evidence of a coupled dynamics of runaways and magnetic islands has been observed [5], and the use of resonat magnetic perturbations (RMP) has proved to affect RE losses [6][7], but a complete understanding of this complicated dynamics is missing. The purpose of this study is to provide an interpretation of these phenomena within the framework of the fractional diffusive model.

References

[1] T.C. Hender et al., Nucl. Fusion 47 S128 (2007)
[2] A.H. Boozer, Phys. Plasmas 23 082514 (2016)
[3] D. del-Castillo-Negrete, Phys. Plasmas 13 082308 (2006)
[4] T. Hauff & F. Jenko, Phys. Plasmas 16 102308 (2009)
[5] O. Ficker et al., Nucl. Fusion 57 076002 (2017)
[6] J. Mlynar et al., Plasma Phys. Control. Fusion 61 014010 (2018)
[7] M. Gobbin et al., Plasma Phys. Control. Fusion 60 014036 (2017)

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