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Turbulence suppression by supra-thermal ions: New physical insights from gyrokinetic simulations ALESSANDRO DI SIENA, University of Texas at Austin, TOBIAS GRLER, EMANUELE POLI, ALEJANDRO BANN NAVARRO, ALESSANDRO BIANCALANI, NICOLA BONANOMI, IVAN NOVIKAU, ROBERTO BILATO, FRANK JENKO, Max Planck Institute for Plasma Physics Garching — Anomalous transport generated by plasma turbulence is linked to the performances of present-day and future fusion reactors. Any mechanisms able to reduce the radial propagation of particles and energy is crucial in view of experimental scenarios optimization. In this context, energetic particles, generated through external heating – have been proved to be a surprisingly efficient way to reduce ion-temperature-gradient (ITG) driven turbulent transport. The underlying physics of the interplay between fast ions and micro-turbulence has been shown to involve different mechanisms. In strong electromagnetic regimes, energetic particles have been observed to destabilize marginally "MHD" modes via nonlinear coupling, reducing the bulk ion energy content and enhancing zonal flow activity. The key parameters for this nonlinear interplay to occur are identified on a particular JET discharge and the applicability to future machines discussed. By applying sophisticated energy diagnostics, we show that fast ions provide a finite amplitude for linearly stable MHD-type of modes, to which the bulk ITG turbulence can nonlinearly couple. This energy redistribution depletes the ITG drive reducing the overall transport levels. If the energy injected into these MHD-type of modes is sufficiently large, an increase in the zonal flow amplitude is observed, further decreasing the transport levels.

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