A quasi-continuous exhaust scenario for a fusion reactor: the renaissance of small edge localized modes

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At ASDEX Upgrade and TCV we have revisited a regime with small edge localized modes (ELMs) in which unacceptable type-I ELMs do not develop [1, 2]. It involves tailoring the plasma into a triangular shape and at the same time providing a high particle density at the plasma edge by fueling. Then instead of type-I ELMs many small filaments appear which distribute the power from the plasma almost continuously to the divertor plates – thus this scenario has been termed the quasi-continuous exhaust (QCE) scenario [3] - without affecting the good thermal insulation of the central plasma. In this talk, we investigate stabilizing and destabilizing effects for the QCE scenario and present a new understanding of its origin, namely a localized unstable region just inside the separatrix [4]. Our interpretation is supported by our experimental findings as well as linear ideal [5] (HELENA Code) and non-linear resistive modelling [6] (JOREK Code). Since the plasma collisionality at the very edge of ASDEX Upgrade and ITER - despite the difference in size of the two devices - are rather comparable in high density discharges, our modelling studies suggest that the QCE scenario will be relevant also for ITER and future power plants.

References

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