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Sommario/riassunto

Turbulence in plasma surface interaction holds crucial uncertainties for its impact on material erosion in the operation of fusion reactors. In this thesis, the design, development and operation of a Thomson scattering diagnostic and its novel implementation with fast visual imaging created a versatile tool to investigate intermittently occuring plasma oscillations. Specifically, ballistic transport events in the plasma edge, constituting turbulent transport, have been targeted in this thesis. With the help of a custom photon counting algorithm, the conditional averaging technique was applied on Thomson scattering for the first time to allow spatial and pseudo-time-resolved measurements. Since plasma turbulence and the emerging transport phenomena are comparable in most magnetized devices, the diagnostic development and the results from the linear plasma device PSI-2 are useful for an implementation of similar techniques in larger fusion experiments. Furthermore, the obtained results indicate a strong enhancement of erosion with turbulent transport and thus underline the importance of dedicated experiments investigating plasma turbulence in the framework of erosion in future fusion reactors.