

It is known that there is an important interplay between turbulence, magnetic reconnection and magnetic islands in fusion and astrophysical plasmas as micro-turbulence and macro-scales non-linearly interact and exchange energy. A balance mechanism between micro-turbulence and macro-scales can lead to the appearance of large scales structures. As an instance, micro-turbulence can enhance the growth of a magnetic island (macro-scale) until a given threshold is reached. At the same time, micro-turbulence can be a seed for magnetic reconnection. We want to investigate the multi-scale interaction of turbulence and magnetic island in the gyrokinetic framework making use of the 5D gyrokinetic code ORB5 (https://www.epfl.ch/research/domains/swiss-plasma-center/research/theory/codes/research_theory_codes_orb5/). We are particularly interested in two aspects of reconnection: i) the seeding of reconnection by turbulence and ii) the interaction of turbulence with a magnetic island.

We will have frequent interactions with experimentalists from the Max Planck Institute for Plasma Physics tokamak (<https://www.ipp.mpg.de/16195/asdex>) and Princeton University magnetic reconnection dedicated experiments FLARE/MRX (<https://flare.pppl.gov/>, <https://mrx.pppl.gov/>) to get from them indications about the possible scenarios of reconnection. We will also provide them valuable information on the interplay between turbulence and magnetic islands.

Mean-field turbulence models are often used in astrophysical contexts, we will investigate how gyrokinetics can firm the foundation of their transport coefficients and in what manners such models can be used to clarify the interaction/impact of turbulence with magnetic islands/reconnection in the fusion framework.