

# Introduction to the Field of Fusion Energy and the role of Turbulence and Disruptions

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## Abstract

Controlled thermonuclear fusion is one of the most promising ways to produce energy beyond 2050 [1]. A large body of technical and scientific challenges remains mainly concerning radial turbulent transport in these devices which strongly degrades the confinement [2]. We are in the process of building a fusion simulator at AUB consisting of a linear plasma device with the goal to initiate a group working on turbulence and doing fusion research. In parallel, we aim at building in-house numerical knowledge by developing code(s) to simulate two-dimensional (2D) turbulence [3,4]. The strong magnetic field ( $B$ ) in magnetic fusion devices leads to almost no fluctuations in its direction, whereas in the direction perpendicular to  $B$  complex motion and turbulence develops often caused by the pressure gradient. The results of the numerical simulations will be compared to the experiment with the purpose to have strong interaction between the two fields. In particular, we want to understand the non-stationary behavior of the instability observed in linear devices [5] and the theory should allow us to have a better understanding of the phenomena involved.

References: [1] <http://www.iter.org/> [2] ITER Physics Expert Groups, 1999, Nuclear Fusion, **39** 2175 [3] Hasegawa A and Wakatani M 1983 Phys. Rev. Lett. **50** 682 [4] Hasegawa A and Mima K 1978 Phys. Fluids **21** 87 [5] G. Y. Antar, J. H. Yu and G. Tynan, 2007, Phys. Plasmas, **14** 022301

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