Turbulence Diagnostic Simulator - drift-interchange instability and measurement of turbulent fields in helical plasma

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It is important to clarify the role of turbulence on anomalous transport in toroidal plasmas. High-order correlation analyses are useful to clarify the nonlinear structural formation mechanism, which dictates the level of turbulent transport [1]. Progress in experimental techniques enables to make quantitative estimation of turbulence transport by high resolution measurements of fluctuations in space and time [2]. In addition, a numerical simulation can give spatio-temporal variation of turbulent fields, where data analyses as same in the experiments can be made. We have been developing a turbulence diagnostic simulator, which simulates plasma turbulence numerically. Data analyses as same in the experiments can also be made on the simulation data, which aid the development of the data analysis technique to deepen our physical understandings.
We have carried out numerical simulations in cylindrical plasmas, as a minimal model for analyzing the structural formation mechanism in magnetically confined plasmas by mode coupling [3]. Appling our simulation results, we have been developing the turbulence diagnostic simulator in helical plasmas. The spatio-temporal data of turbulent fields are generated by global simulation, using a reduced MHD model describing drift-interchange instability. For the first step, a three-field model including an averaged magnetic helical curvature is adopted. The analyses simulating experimental measurements, such as the microwave interferometer and heavy ion beam probe, are carried out on the turbulent field obtained by numerical simulation to make quantitative comparison between turbulence and observed quantities [4].
The progress in the turbulence diagnostic simulator will be discussed, especially on the development of the nonlinear simulation code, and the characteristic of turbulent fields obtained by simulations.

[1] See reviews, e.g. P.H. Diamond, et al., Plasma Phys. Control. Fusion **47** (2005) R35
[2] A. Fujisawa, Nucl. Fusion **49** (2009) 013001
[3] N. Kasuya, et al., Phys. Plasmas **15** (2008) 052302
[4] S. Nishimura, et al., this conference