Control of Spatiotemporal Chaos and Transport Reduction in Helical Magnetic Configuration

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Abstract

The effects of multi-helicity confinement magnetic fields on turbulent transport and zonal flows is investigatred by means of gyrokinetic Vlasov simulations of the ion temperature gradient turbulence. The standard and the inward-shifted configurations of the Large Helical Device (LHD) are considered in the model. Analysis of simulation results demonstrates that flucuations of electrostatic potential exhibit spatiotemporal chaos in both configurations. However, the intensity of chaos is considerably decreased in the inward-shifted configuration leading to improved confinement. Enhanced zonal flow generation in the inward shifted case is accompanied by transport reduction which is shown to be a direct consequence of chaos supression.

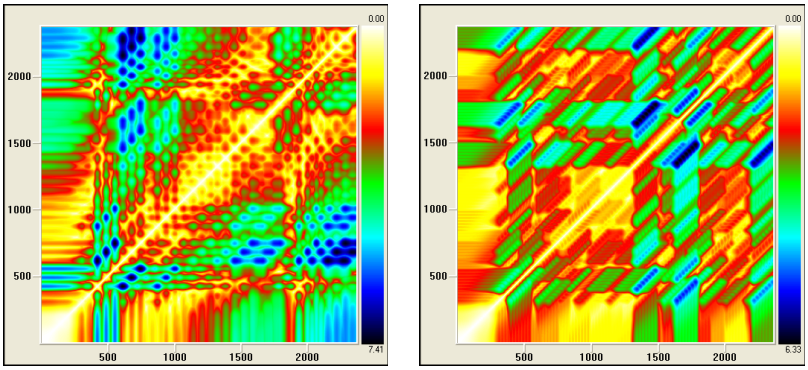

Fig. 1 Chaos supression illustrated with reccurence plots of time series $\phi(t, r = 0)$ recorded at the central radial position of the LHD. The inward shifted case is on the left showing intermittent (less chaotic) dynamics as reflected in horizontal and vertical lines. The standard one is on the right exhibiting strong chaotic dynamics (irregularly positioned lines parallel to the main diagonal).