

## Theory of fast ion effect on turbulence-zonal flow interaction in magnetized plasma

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We present our theoretical works to construct simple comprehensive model of turbulence-zonal flow interaction in the presence of fast ions in magnetized plasmas [1,2]. The result demonstrates that dilution effect due to fast ions have far-reaching impact on all aspects of the nonlinear dynamics of the drift wave turbulence-zonal flow. Modulational zonal flow growth and corresponding decrease of drift wave turbulence are calculated with dilution effect. The coupled zonal flow and turbulence equations are then reduced to a predator-prey model. This is solved for the fixed points, which represents bistability of the system. The results display a strong dependence on dilution, which leads to greatly reduced levels of the saturated turbulence and turbulent transport. Indications for the KSTAR FIRE mode [3-6] are discussed in detail. This model is perhaps the simplest dynamical one which captures the beneficial effects of fast ions on plasma confinement.

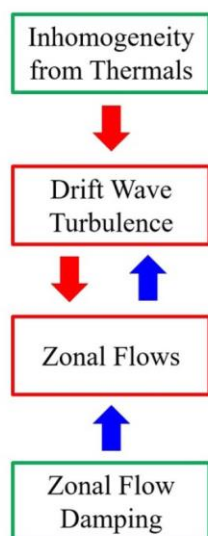
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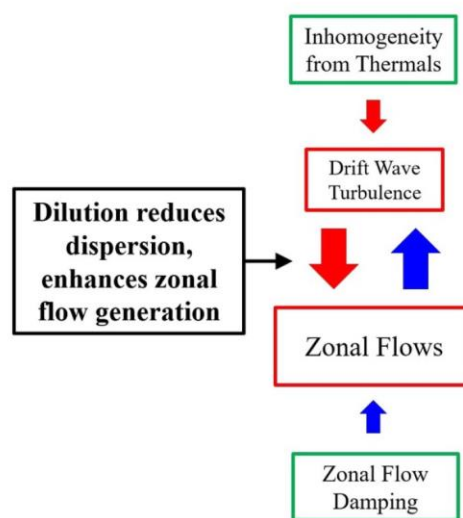
### References

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### Usual Story without Fast Ions



### With Dilution from Fast Ions



**Fig. 1.** Diagram illustrating dilution effect on the drift wave turbulence-zonal flow system [2].