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New Results in Negative Viscosity Models for Fusion Plasma Dynamics

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Negative viscosity phenomena in which turbulence driven by the heat flux couples its energy to large scale structure, is a familiar and, in fact, necessary element in the success of magnetic fusion. Two prime examples of negative viscosity phenomena are zonal flow formation, where drift wave turbulence drives mesoscale shear flows which regulate large scale eddys, and intrinsic torque, where turbulence with broken symmetry drives toroidal rotation without momentum input. These two negative viscosity phenomena are essential for good confinement and MHD control. Here, we present new results in negative viscosity models, namely condensation of profile corrugations and intrinsic rotation due to dynamical symmetry breaking. These results yield new fundamental insights into zonal flow pattern structure and the origins of intrinsic torque, particularly in weak shear regimes.

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Primary author: Prof. DIAMOND, Patrick (University of California San Diego)

Co-authors: Dr ASHOURVAN, Arash (University of California, San Diego); Prof. TYNAN, George (University of California San Diego); Mr LI, Jiacong (University of California, San Diego); Dr MALKOV, Mikhail (University of California, San Diego); GURCAN, Ozgur (LPP/Ecole Polytechnique/CNRS); Dr HSU, Pei-Chun (University of California, San Diego)

Presenter: Prof. DIAMOND, Patrick (University of California San Diego)

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