Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Advancing Optimization Algorithms for Reduced Turbulent Transport in Stellarators[1] BENJAMIN FABER, AARON BADER, JOSEPH DUFF, CHRIS HEGNA, IAN MCKINNEY, University of Wisconsin - Madison, M.J. PUESCHEL, University of Texas at Austin, PAUL TERRY, University of Wisconsin - Madison — Drift-wave-driven ion-scale turbulent transport presents a significant barrier for stellarators as a fusion power plant concept. The manifestly three-dimensional nature of the stellarator provides new opportunities for optimizing the magnetic geometry for reduce turbulent transport. An optimization algorithm for reducing turbulence transport is presented that leverages the ability of damped eigenmodes to dissipate turbulent fluctuation energy at the driving scale of the instability. Damped modes play an important role in turbulence saturation in standard tokamak scenarios[1] and in stellarators, the dominant energy transfer channel to stable modes is a function of geometry[2]. A proxy for the nonlinear energy transfer to damped modes is calculated using three-wave correlation times and coupling coefficients computed from linear drift-wave eigenfunctions in fully three-dimensional stellarator geometry. This advanced turbulence transport proxy is coupled with a new package for distributed, multiprocessor optimization to find new stellarator configurations with reduced turbulent transport and optimization calculations will be presented for a quasi-helically symmetric geometry. [1] Whelan et al. PRL, 2018 [2] Hegna et al. PoP, 2018

[1]This work was supported by the University of Wisconsin, UW2020-135AAD3116 and the US Department of energy grants DE-FG02-93ER54222, DE-FG02-99ER54546 and DE-SC0014664.

Benjamin Faber
University of Wisconsin - Madison

Date submitted: 09 Jul 2020 Electronic form version 1.4