Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Stochastic Stellarator Coil Optimization[1] JIM-FELIX LOBSIEN, MICHAEL DREVLAK, CAROLIN NHRENBERG, HAKAN M. SCHMITH, YURIY TURKIN, Max-Planck Institute for Plasma Physics, CAOXIANG ZHU, Princeton Plasma Physics Laboratory, MAURICE MAURER, THOMAS SUNN PEDERSEN, Max-Planck Institute for Plasma Physics — Tight construction tolerances have complicated and slowed down construction of recent fusion experiments, eg. Iter, Wendelstein 7-X, and NCSX, the latter eventually canceled before completion primarily due to problems related to tight construction tolerances. Stochastic programming applied to stellarator coil optimization is able to relax coil tolerances, and, somewhat surprisingly, has also led to coil designs that simultaneously produce a better approximation of the target magnetic field. The stochastic optimization process optimizes a cloud of sample coil sets, each slightly deformed away from each other in shape and position. This optimization indeed finds broader minima compared to the standard (non-stochastic) coil optimization process of a single sample. A large number of samples used during the optimization favorably smoothens out the parameter space, while a small number unfavorably flattens it out. These results indicate that earlier coil-finding algorithms, at least in some cases, would get stuck in local optima which were neither as optimal nor as robust against engineering deviations, as the ones found with this new algorithm. We show new results from applying this optimization approach the recent design of a stellarator DEMO power plant.

[1]This work was supported by a grant from the Simons Foundation/SFARI (560651, AB)

Jim-Felix Lobsien
Max-Planck Institute for Plasma Physics

Date submitted: 29 Jun 2020 Electronic form version 1.4