Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Stability of helical cores in high performance tokamak discharges[1]
ANDREAS WINGEN, ROBERT WILCOX, SUDIP SEAL, STEVEN HIRSHMAN, Oak Ridge National Laboratory, FRANCESCA TURCO, Columbia University —
The threshold for spontaneous growth of m/n = 1/1 helical cores in tokamaks is determined using VMEC. This stability model is based on a DIII-D hybrid discharge with helical core, and it predicts ITER (15MA scenario) to operate far in the helical core unstable regime. Helical cores can only exist in tokamak discharges with monotonic but low, or reversed q-shear and $q_{min} \approx 1$ in the core. The helical core is a saturated internal kink mode; its stability limit is proportional to $(dp/d\rho)/B_t^2$ around q = 1. Below the stability limit, applied 3D fields can drive a helical core to finite size, as in DIII-D. Above it, a random 3D kick excites a large helical core. In the DIII-D hybrid discharge the helical core contributes to flux pumping, but it is unclear, if helical cores are experimentally detrimental, once they grow in size. Helical cores occur frequently in C-Mod due to impurities; modeling shows, they become unstable in these discharges due to a reversed shear q-profile, which lowers the stability boundary.

[1]Supported by US DOE under DE-AC05-00OR22725, DE-FG02-04ER54761, DE-FC02-04ER54698

Andreas Wingen
Oak Ridge National Laboratory

Date submitted: 06 Jul 2017 Electronic form version 1.4