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**Helical Chandresekhar-Kendall (CK) Modes and 3D Relaxation States**[1] XIANZHU TANG, ALLEN BOOZER — CK modes are eigen-solutions to the force-free equation with homogeneuos boundary conditions. These force-free eigen-solutions are uniquely determined by the chamber geometry, and play an essential role in determining the relaxed states of a driven plasma, which may or may not be a Taylor state. Previous work on the relaxation theory have demonstrated that resonant coupling be the physical mechanism underlying the formation of spherical tokamak, spheromak, and reversed field pinch by helicity injection. Although much of the design constraint and optimization for laboratory applications have been understood using only the axisymmetric CK modes in an axisymmetric chamber, as the target magnetic configurations are axisymmetric, helical CK modes can play a subtle role in determining the operating boundary and the degrees of intrinsic non-axisymmetry in the experiments. Here we present the numerical computation of these helical CK modes and elucidate the two physical mechanisms by which 3D relaxation states are determined in toroidal experiments with a special emphasis on reversed field pinch.

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Xianzhu Tang
Los Alamos National Laboratory

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