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Quasi-symmetry in magnetic fusion energy confinement devices[1]
ANDREW WARE, KATHLEEN MCGARVEY, University of Montana — Quasi-symmetry in three-dimensional magnetic confinement devices provides a path for external control of the confining magnetic field while achieving confinement comparable to axisymmetric configurations. In a quasi-symmetric toroidal configuration, magnetic field strength in magnetic flux coordinates depends primarily on two coordinates, $B(\psi, \theta, \zeta) \approx B(\psi, M\theta + N\zeta)$ where M and N are integers. Here, ψ is the flux coordinate (analogous to a toroidal radial coordinate) while θ and ζ are the poloidal and toroidal angles in magnetic flux coordinates (a coordinate system in which the magnetic field lines are straight). In this work, different classes of quasi-symmetric configurations are compared from quasi-axisymmetric ($M = 1, N = 0$) to quasi-helically symmetric ($M \neq 0, N \neq 0$) to quasi-poloidally symmetric ($N = 1, M = 0$). This is a numerical investigation in which equilibria are optimized for different quasi-symmetries but with other parameters such as average field strength, major radius, and aspect ratio, equivalent across the configurations. Equilibrium and transport characteristics will be compared across the configurations.

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Andrew Ware
University of Montana

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