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Nonsymmetric 3D MHD equilibrium and radial localization of trapped particles[1] WRICK SENGUPTA, HAROLD WEITZNER, Courant Institute of Mathematical Sciences, NYU — Quasisymmetry and omnigeneity are key ideas proposed to ensure radial confinement of trapped particles in a stellarator. These constraints have stringent restrictions on magnetic geometry, some aspects of which are yet to be fully explored. In this work we obtain a local 3D MHD equilibrium expansion by analytically solving the MHD equilibrium equations. This expansion, although local, is sufficient to explore the deeply trapped particle physics, since it is carried out around a region of local minima of the magnitude of the magnetic field. Based on this analytical 3D equilibrium solution, we obtain the aforementioned constraints. We then extend this local analysis to a global one by expanding around the magnetic axis of the stellarator. Effects of curvature and torsion of the axis are treated self-consistently. We demonstrate that due to toroidal mode coupling, the expansion in flux coordinate near the axis is logarithmic and not purely algebraic. These non analytic terms can not be in general neglected. Our results show that it is far easier to satisfy the omnigeneity condition than the quasisymmetry requirement. This implies, that there exists a large class of equilibrium close to quasisymmetry, which are still omnigeneous and allow inclusion of symmetry breaking error fields.

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