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Towards 3D drift-kinetic transport modeling of the electric field in stellarators

We present an iterative algorithm for the self-consistent computation of the electrostatic potential in 3D magnetic fields using the guiding-center tracing code GORILLA. Due to the piecewise linear interpolation of electromagnetic field quantities leading to linear equations of motion within small volume elements, GORILLA has favourable computational costs while still retaining symplectic properties. Its application to transport problems especially in the transition from core to edge plasma therefore seems promising. For the self-consistent electric field computation, we do not address the full Laplace equation but rather solve for the charge neutrality condition in an iterative manner. This is a completely local ansatz avoiding any potentially complicated fitting with smooth functions. The results will be compared to a procedure which has already been demonstrated to work in 1D tests modelling parallel motion or modelling neoclassical perpendicular transport in 1D. Both cases have been shown to lead to ambipolar electric fields.

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