Abstract Submitted
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Gyrosymmetry: global considerations[1] JOSHUA BURBY, HONG QIN, Princeton University — In gyrokinetic theories, the gyrophase is measured with respect to a unit vector field defined on the physical domain that is everywhere perpendicular to the magnetic field. In some cases, such a perpendicular unit vector cannot be defined globally, meaning the gyrophase itself loses its global meaning. I will present the general condition for when this deviant behavior can occur. I will then justify the condition in two ways, first by making a physically appealing analogy to the physics of Dirac monopoles, and then by describing the relevant theorem from the theory of characteristic classes. This will lead to a discussion of assessing global existence of a perpendicular unit vector in a number of examples, including toroidal confinement devices. In particular, I will demonstrate that in tokamaks, global perpendicular unit vectors always exist. Finally, I will discuss why a global convention for measuring gyrophase is unnecessary for the validity of the guiding center expansion of the single particle equations of motion. To emphasize this last point, I will demonstrate how a gyrogauge invariant guiding center Lagrangian becomes manifestly independent of any choice of perpendicular unit vectors upon changing to cartesian position and velocity coordinates.

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