

## 14.J601 Modeling drift-wave turbulence as quantumlike plasma

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/I4.J601.pdf>

Inhomogeneous drift-wave turbulence with zonal flows (ZFs) can be modeled as effective quantum plasma where the ZF velocity serves as a collective field [1, 2]. This effective plasma can be described, quite intuitively, by a Wigner-Moyal kinetic equation (WMKE), which was originally introduced as phase-space description of quantum mechanics [3]. We report the first explicit application of the Wigner-Moyal formalism to analytic and numerical modeling of ZF physics [4, 5] within the generalized Hasegawa-Mima model. The corresponding WMKE is more delicate and rich in physics than that for optical turbulence, to which a similar approach was applied in the past. The WMKE is also an improvement to the traditional wave kinetic equation for DW turbulence in that it contains “full-wave” effects, i.e., those associated with the finite ratio of the ZF scales to the drift-wave wavelengths. The full-wave effects are found to be essential and can qualitatively alter the formation and stability of ZFs [4, 5, 6]. The quantumlike approach elucidates the nonlinear saturation and oscillatory dynamics of collisionless ZFs [7] and also the physics of propagating coherent structures [8], which can be viewed as drifton condensates (Fig. 1). A systematic procedure for extending the quantumlike Wigner-Moyal formulations to more general turbulent systems is also proposed.

### References

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