Higher order corrections to the metaplectic formulation of linear mode conversion

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In previous work [1,2] it was shown that phase space ray-tracing techniques can be used to solve wave problems exhibiting mode conversion. In the vicinity of a mode conversion, the two roots of the dispersion relation det(**D**)=0 (where **D**(*x,k*) is the symbol of the dispersion matrix) have a hyperbolic structure. Linearizing the (*x,k*)-dependence of the dispersion matrix about the center of the hyperbola, and converting this linearized symbol back to an operator, gives a set of coupled equations which can be solved for the local wave fields. Matching these local solutions onto uncoupled WKB far-field solutions gives transmission and conversion coefficients for the incoming and outgoing waves. These coefficients can be used to treat the mode conversion as a ray-splitting process, where amplitude on the incoming ray is split onto the two types of outgoing rays. In this work, we study the effects of higher order terms in the dispersion matrix near a mode conversion. It is shown that the corrections due to these higher order terms gives a better matching between the local solution in the mode conversion region and the far-field WKB solutions for the incoming and outgoing waves. This matching is demonstrated by comparison of the asymptotic solution with a numerical solution for a simple one-dimensional conversion.

[1] A. Jaun, E.R. Tracy and A.N. Kaufman, Plasma Phys. Control. Fusion **49**, 43-67 (2007).
[2] E.R. Tracy, A.N. Kaufman and A. Jaun, submitted to Phys. Plasmas (Feb. 2007).