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The triple helix in two-dimensional linear wave conversion

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Resonant linear wave conversion, in a weakly nonuniform plasma, occurs in a region where the wave-vectors of two wave-types locally match. The evolution of their complex amplitudes is governed by a 2x2 Hermitian dispersion matrix [1], whose determinant is the Hamiltonian for ray tracing. We show that, if the coupling parameter is non-trivially complex, and if the spatial dimension is two or greater, then typically a ray undergoing conversion will not be confined to a plane in phase space, but will have a helical orbit. All three rays (incident, converted, transmitted) will thus be helices.

[1] E R Tracy, A N Kaufman, & A Jaun, Physics Letters A279, 309 (2001)

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