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Current drive with combined electron cyclotron wave and high harmonic fast wave in tokamak plasmas

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The current driven by combined electron cyclotron wave (ECW) and high harmonic fast wave (HHFW) is investigated with the GENRAY and CQL3D package. It is shown that no significant synergetic current is found in a range of cases with combined ECW and FW. This result is consistent with the former study [R.W. Harvey, et al., in Proceedings of IAEA TCM on Fast Wave Current Drive in Reactor Scale Tokamaks (Synergy and Complementarity with LHCD and ECRH), Arles, France, (IAEA, Vienna, 1991)]. However, positive synergy effect does appear with the enhancement of the FW frequency. This positive synergy effect can be vividly explained with the picture of the electron distribution function induced by ECW and the very high harmonic fast wave (helicon). The dependence of the synergy effect on the wave power is also analyzed numerically and physically.

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