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Advanced-Fuel Burning and Current Drive in a Degenerate **Plasma** SEUNGHYEON SON, NATHANIEL FISCH, Princeton Plasma Physics Laboratory — In degenerate dense plasmas, the rates of electron physical processes, such as bremsstrahlung, inverse bremsstrahlung and Compton scattering, are much reduced due to the Fermi-Dirac statistics. In particular, ion-electron couplings (ionelectron collision and electron-ion collision) are vastly reduced. We apply this fact about ion-electron coupling in a degenerate plasma to two well-known plasma physics problems. First, we show that advanced fuel can be burned in degenerate plasma overcoming the bremsstrahlung losses. We discuss practical obstacles and prospects. Second, we obtain the current drive efficiency formula J/P in degenerate plasma. We investigate whether the current drive efficiency is correspondingly increased by virtue of the reduction of ion-electron coupling. We show that current carried by an electron is smaller in degenerate plasma than in classical plasmas due to ensemble averaging. Curiously, the current drive efficiency formula then does not formally reflect the reduced collision frequency. We also consider the ion beam current generation method and the minority-species current generation method. In these current generation methods, we obtain the current drive efficiency J/P that is considerably larger than that predicted by classical calculation. These finding will have applications in astrophysics, in inertial confinement fusion and in the generation of intense magnetic fields in dense matter.

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