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CO_2 Laser Beat-Wave Experiment in an Unmagnetized Plasma
FEI LIU, DAVID HWANG, ROBERT HORTON, SEAN HONG, RUSSELL EVANS, University of California, Davis — The ability to remotely generate plasma current in dense plasmas is a basic yet important investigation in experimental plasma physics and fusion energy research. It is even more advantageous if the wave penetration is independent of the electron acceleration process. Plasma current can be generated through beat-wave mixing process by launching two intense electromagnetic waves ($\omega >> \omega_{pe}$) into plasma. The beat wave formation process can be efficient if the difference frequency of the two pump waves is matched to a local resonant frequency of the medium, i.e. in this case the local plasma frequency. Beat wave can accelerate plasma electrons via quasi-linear Landau process, which has been demonstrated in a low-density plasma using microwaves.[1] The CO_2 lasers provide the high tunability for the wave-particle interaction experiment at a variety of plasma densities with plasma frequency in THz range. Two sections of Lumonics TEA CO_2 lasers have been modified to serve as the two pump wave sources with peak power over 100MW. The development of the tunable CO_2 lasers, a high-density plasma target source and diagnostics system will be presented. The initial results of unbalanced beat-wave experiment using one high-power pulsed and one low-power CW CO_2 lasers will be presented and discussed using the independent plasma source to control the ω_{pe} of the interaction region. This work is supported by U.S. DOE under Contract No. DE-FG02-10ER55083.

[1]Rogers, J. H. and Hwang, D. Q., Phys. Rev. Lett. v68 p3877 (1992).

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