Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Backward Raman amplification of laser pulses in mildly undercritical plasmas VLADIMIR MALKIN, NATHANIEL FISCH, ZEEV TOROKER, Princeton University — Next generations of ultrapowerful laser pulses of exawatt and zetawatt powers are feasible now within reasonably compact facilities using the backward Raman amplification (BRA) in plasmas. The output powers hundreds times higher than the input were already observed experimentally in gas-jets plasmas. For higher power BRA, plasmas of larger cross-section and better homogeneity are needed. Such plasmas could be produced by ionization of low-density solids. However, even the lowest density solids, having densities 1-3 mg/cc, are still dense enough for the most energetic laser pulses, like NIF laser pulses having 0.351 micron wavelength, so that the seed pulse frequency cannot much exceed plasma frequency (unless significant expansion of plasmas is allowed which would make resonant BRA more challenging). In such mildly undercritical plasmas, BRA might differ from that in strongly undercritical plasmas, in particular, due to the stronger dispersion of the group velocity of laser pulses and due to the greater sensitivity of laser pulses to plasma inhomogeneities. This work examines these effects and determines the optimal duration and focal distance of the input seed laser pulse which allow to achieve the maximal output fluence and intensity. Supported through the NNSA SSAA Program through DOE Research Grant No. DE274-FG52-08NA28553.

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Date submitted: 15 Jul 2011 Electronic form version 1.4