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Backward Raman amplification of intense hard X-ray pulses[1]
VLADIMIR MALKIN, NATHANIEL FISCH, Princeton University — Backward Raman amplification of laser pulses in plasmas can produce intensities far greater than the current state of the art. However, the backward Raman amplification techniques are thought not to extend to the hard x-ray range of wavelengths. The theoretical short-wavelength limit is imposed primarily by the inverse bremsstrahlung absorption of laser pulses in plasmas. This process can either overheat the plasma up to the extinguishing the resonant Langmuir wave branch mediating energy transfer from the laser pump to the seed pulse, or can deplete the laser pump pulse even before it reaches the counter-propagating seed pulse. To overcome the short-wavelength limit, it is proposed here to use laser pump pulses consisting of multiple separate spikes each of which encounters the seed pulse in a separate plasma layer sufficient for the pump depletion, yet thin enough to avoid an excessive inverse bremsstrahlung of the pump. The inverse bremsstrahlung of the seed, amplified to intensities much higher than the pump, is suppressed by higher electron quiver velocities.

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