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Production of picosecond, kilojoule, petawatt laser pulses via Raman amplification of nanosecond pulses R. TRINES, R. BINGHAM, P. NORREYS, STFC Rutherford Appleton Laboratory, Didcot, UK, F. FIÚZA, R.A. FONSECA, L.O. SILVA, GoLP/Instituto de Plasmas e Fusão Nuclear, IST, Lisbon, Portugal, R.A. CAIRNS, University of St Andrews, Fife, UK — The demonstration of fast-ignition (FI) inertial confinement fusion (ICF) requires the delivery of 40 kJ - 100 kJ of laser energy to the hot spot within 16 ps. In addition, third harmonic conversion to 351 nm is needed to optimize $I\lambda^2$ to obtain the correct hot electron energy. High-energy picosecond petawatt beams at 351 nm are difficult to generate using conventional solid-state laser systems. Previous studies of Raman amplification concentrated on maximizing the intensity and power of femtosecond pulses [Trines et al., Nature Physics (2010)]. Here we present particle-in-cell simulations and analytic theory that confirm that Raman amplification of high-energy nanosecond pulses in plasma can generate petawatt peak power pulses of picosecond duration with high efficiency (up to 60%), even at 351 nm wavelength. This scheme provides a potential new route for the realization of fast ignition ICF in the laboratory, as well as access to wide range of other high energy density physics research applications. This work was supported by STFC's CLF and CfFP, by EPSRC through grant EP/G04239X/1 and by FCT (Portugal) through grants PTDC/FIS/66823/2006 and SFRH/BD/38952/2007.

R. Trines
STFC Rutherford Appleton Laboratory, Didcot, UK

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