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Time limit for the efficient coupling of relativistic femtosecond laser pulses into aligned nanowire arrays[1] R. HOLLINGER, C. BARGSTEN, V. SHLYAPTSEV, D. KEISS, A. TOWNSEND, A. ROCKWOOD, Y. WANG, S. WANG, J.J. ROCCA, Colorado State University, A. PUKHOV, V. KAYMAK, Heinrich-Heine-Universität, R. LONDON, R. TOMMASINI, LLNL — Recent experiments at Colorado State University have demonstrated volumetric heating of near solid density plasmas to multi-keV temperatures by intense high contrast femtosecond laser irradiation of vertically aligned nanostructures [1]. A key parameter is the time for the heated nanowires to expand and fill the inter-wire gaps with a super-critical density plasma. After this time the laser light can no longer penetrate deep into the array, effectively terminating volumetric heating. We have gained information on the gap closure time for arrays with different wire spacing by monitoring the intensity of He-like lines from arrays of nickel nanowires while varying the laser pulse width from 50 fs to 250 fs. Experiments conducted at constant laser energy show that He-like α line emission from arrays of 80 nm diameter nanowires separated by 205 nm is observed for pulse widths of 200 fs. It is possible to find an optimal wire separation to match the pulse width of the driving laser. The results are relevant to scaling the scheme to high energy laser facilities that are characterized by longer pulses.

[1] M.Purvis et al. Nature Photonics **7**, 796 (2013).

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