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Extreme light in nanostructured targets: shaping fields and managing particle flows

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The more intense that laser pulses can be made, the more surprising and extreme are the interaction effects researchers are seeing – effects that are sometimes hard to control. One way to guide or redirect the physics relationships is to manipulate the composition or shape of targets. Nickel nanowires present >95% optical absorption into an effective skin-depth that is very long, greater than 1 µm. Partly this is due to the strong optical anisotropy of these oriented nanostructures: a dielectric in the transverse direction and a conductor along the optical axis. Under intense irradiation, and especially at relativisitic optical intensities, this can lead to transition from dielectric to conductor, strong JxB effects, nonlinear acceleration of electrons and the generation of high harmonic radiation. One remarkable recent result is that we see energy densities as high as 2GJ/cmˆ2, otherwise only available in NIF-compressed cores, and opening new possibilities for radiation and particle generation from modest-size intense ultrafast lasers. I'll outline our new theoretical and experimental results for intensities from small-signal up to very clean relativistic pulses.

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