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Enhancing light-matter interaction with nanostructured targets

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In the high-power laser-matter interaction, two main components are the laser pulse and the target. By adjusting one of them, the results can be tailored to a specific application. Nano and micro structured targets are being studied for applications of high intensity laser-matter interaction for more than 30 years and take many forms: gratings, wires, dots, spheres, tubes. With the help of such structured targets, we can modify the laser interaction to improve the particle acceleration, by increasing the surface area and through volumetric heating, resulting in higher proton energies or increased X-ray flux, high energy density matter creation and terabar pressures.

Metallic (gold and nickel) nanowires and nanotubes were fabricated in the Target Laboratory from ELI-NP by electrochemical methods, using porous alumina as a template. These targets were used in 1 PW laser experiment to study the x-ray emission and proton acceleration, with an experimental set-up employing a single plasma mirror for contrast enhancement, and for diagnostics: radiochromic films and Thompson parabola for ion detection, and CsI scintillators for photon detectors. Proton and ion results, as well as photon and electron signals will be presented from the nanostructured targets, in comparison to flat targets.

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