**X-ray imaging based temperature estimates of warm dense matter of a thin Ti wire heated by laser-accelerated relativistic electrons**

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In a recent experimental campaign at the PHELIX laser facility at GSI (Darmstadt, Germany), we isochorically heated a thin titanium wire to a warm dense matter (WDM) state using laser-accelerated relativistic electrons. To characterize the temperature profile and emission properties of the WDM, we used an approach based on radiographic "imaging" of the expansion and "traditional" X-ray emission spectroscopy. Here we discuss this approach and obtained results.

We performed an experiment in which we irradiated a 50 μm thick titanium wire with a 0.5 ps laser pulse with an intensity of ~1019 W/cm2 and a power of 0.1 PW. This resilted in acceleration of hot electrons (HE) at laser-matter interaction area. These HE propagated along the wire isochorically heating it. We also irradiated a 5 μm W wire with a 0.5 ps laser pulse. The resulting plasma served as a “backlighter” to obtain X-ray images of the hydrodynamic expansion of the target.

To estimate the temperature profile, we used a 1D radiation hydrodynamics code, HELIOS. This showed that WDM temperature at a depth of 100 µm from the laser-matter interaction point was about 30 eV and at a depth of 500 µm was about 5 eV. We also used a 3D macroparticle-based hybrid particle-in-cell simulation code, ZEPHYROS, to support our experimental results and draw conclusions about the heating mechanisms. This work continues our previous research on this topic [1,2].

[1] A. Schönlein, G. Boutoux, S. Pikuz, L. Antonelli, D. Batani, A. Debayle, A. Franz, L. Giuffrida, J. J. Honrubia, J. Jacoby, D. Khaghani, P. Neumayer, O. N. Rosmej, T. Sakaki, J. J. Santos, and A. Sauteray, EPL (Europhysics Lett. 114, 45002 (2016).

[2] A. S. Martynenko, S. A. Pikuz, L. Antonelli, F. Barbato, G. Boutoux, L. Giuffrida, J. J. Honrubia, E. Hume, J. Jacoby, D. Khaghani, K. Lancaster, P. Neumayer, O. N. Rosmej, J. J. Santos, O. Turianska, and D. Batani, Opt. Express 29, 12240 (2021).