Investigation of radiation and dynamics properties in laser-produced plasma

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The radiation and dynamic properties of laser-produced plasmas are studied both experimentally and theoretically. Firstly, the emission spectra of plasma have been measured by using a spatio-temporally resolved emission spectroscopy technique. Meanwhile, we present a radiation hydrodynamics model based on the conductive heat transfer in the condensed phase, radiative gas dynamics, and laser radiation transfer in the plasma as well as surface evaporation and back condensation at the phase interface. Moreover, calculation of the ionization balance and the charge states is respectively performed within the time-dependent collisional radiative model (CRM).

By using the radiation hydrodynamics model, the contour images of Si plasma temperature at 20-70 delay times are shown in figure 1. The color gradient represents the change of the plasma temperature. It can be clearly seen that with the increase of the delay time, the contour of the plasma gradually decreased, the corresponding plasma temperature from near the target surface 25 eV fast decay to 16 eV. From the plasma core to the edge, there is a clear plasma temperature gradient, it is confirmed that the plasma is highly inhomogeneous and transient.

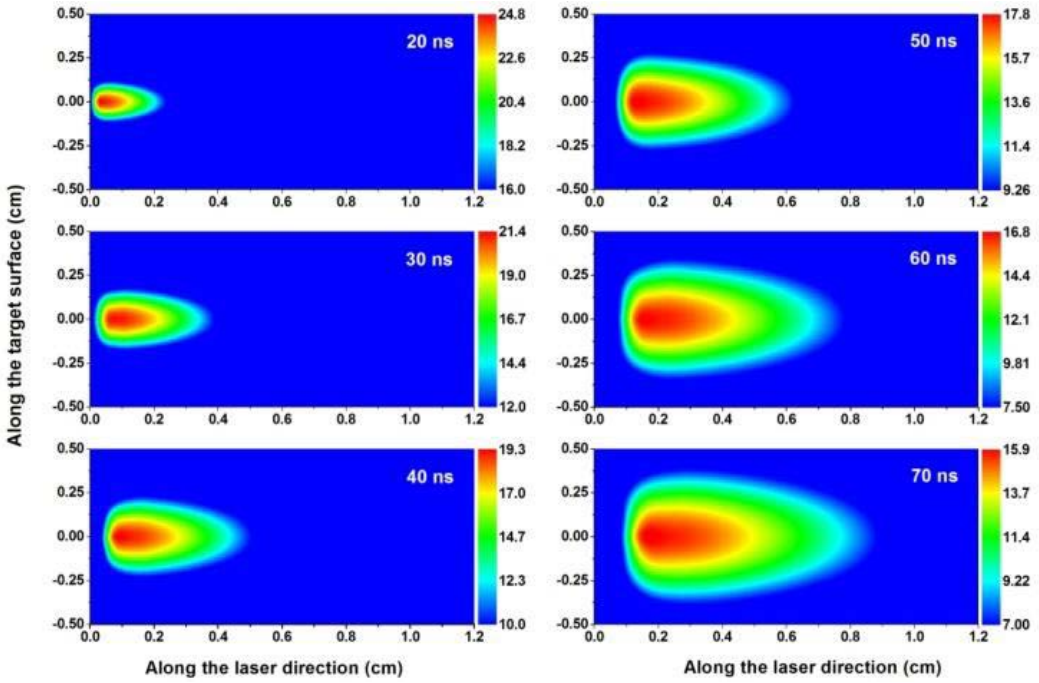

Fig. 1. The temporal evolution of temperature in the silicon plasma

References

[1] Q Min et.al., Optics Letters **41**,5282–5285 (2016).