

Laser plasma – wall interaction: new possibilities for a variation of plasma parameters

A.P. Shevelko

P.N. Lebedev Physical Institute of the RAS, Moscow, Russia, shevelko@rambler.ru

Various aspects of interaction of laser plasmas, contained highly charged ions, with solid surface (wall) are considered. When a solid surface (wall) is placed in the propagation path in a laser - produced plasma a substantial increase in the total emission intensity is observed in the resonance lines of the hydrogen-like and helium-like ions. X-ray spectra of highly charged ions and dynamics of the plasma-wall interaction process are studied in the x-ray and visible range with both spatial and temporal resolution. It is shown that with the use of wall installed on the way of plasma expansion it is possible effectively and purposely change of near wall plasma parameters. Processes responsible for the radiation could be processes of excitation (small laser target – wall distances) and three-body recombination (large laser target – wall distances). In particular there is a unique situation when highly charged ions (ion charge $Z \sim 10$) created in hot core of laser-produced plasmas ($T_e \sim 1$ keV) emit in dense $\{N_e \sim 10^{19} \div 10^{20} \text{ cm}^{-3}\}$ and cold $\{T_e \sim 50 \text{ eV}\}$ near-wall plasmas. This new intense source of x-ray radiation has new radiation characteristics. Study of the source is interesting and important both for fundamental physics and numerous practical applications.

Special interest is interaction of subpicosecond laser-produced plasmas with the wall. Conditions of the direct interaction of highly charged ions with the wall are considered. Under this interaction it is possible to expect hollow ions production in a near-wall layer. High laser pulse energy of the lasers allows the use of well developed methods of x-ray spectroscopy. New experimental x-ray instrumentation (focusing x-ray spectrometers, CCD detectors) can considerably expand experimental capabilities.