Time-integrated radiation spectra from inert gases excited by a shockwave

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Intense radiations can be generated when a plasma is compressed by a strong shock pressure in a confined region. The strong shock wave can convert a neutral atomic gas into plasma, thus makes it emits copious radiations in visible and ultraviolet (UV) range.

The propagation of shock waves plays important roles in z-pinch plasma, such as an ionization process and appearance of a reversed current structure. The shock pressure can be enhanced in a water-confined metal irradiated by a high power laser, or so called a laser peening system. Understanding the propagation of the shock wave is crucial to achieve an ignition condition in the research of the inertial confinement fusion [1, 2].

In this paper, time integrated radiation from inert gas plasmas which is excited by a shock wave, were numerically investigated. Dynamics of the plasma was evaluated by using one dimensional fluid code (HYADES). The population densities in the atomic levels of inert gas were obtained in thermal equilibrium with the electron temperature of the plasma. Then spectral data in the wavelength range of 200 – 800 nm from the plasma were evaluated by using a radiation transfer code. Atomic levels and transition lines were obtained from the database provided by National Institute of Science and Technology. As shown in Figure 1, we observed that the time integrated radiation spectra from three different inert gases, Ar, Kr, Xe, excited by a strong shock wave are changed from optically thin regime to thick regime as the atomic number of inert gas increased.

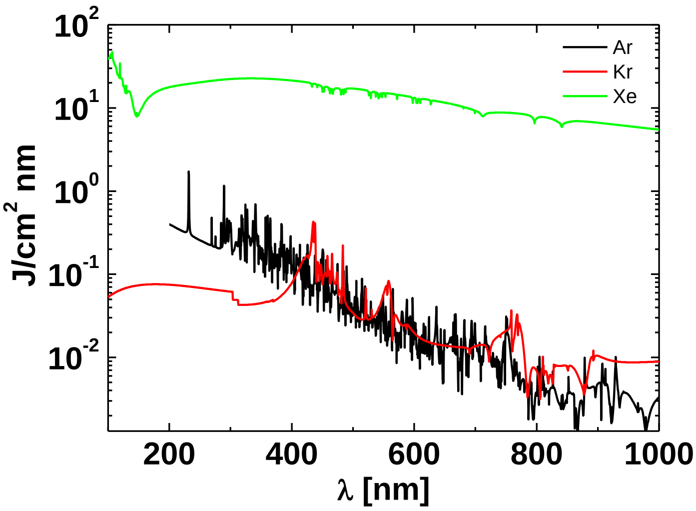

Figure 1. Time-integrated radiation spectra from inert gas plasmas from 200 to 800 nm.

References

[1] J. Barranco and P. Marcus, J. Comput. Phys. 219, 21 (2006).
[2] D. Kaganovich, M. H. Helle, D. F. Gordon, and A. Ting, Phys. Plasmas 18, 120701 (2011).