Ignition Conditions Relaxation for Central Hot-Spot Ignition with an Ion-Electron Non-equilibrium Model

Zhengfeng FAN[1], Jie LIU[1, 2], Bin LIU[1], Chengxin YU[1] and Xiantu HE[1, 2]

1) Institute of Applied Physics and Computational Mathematics, China

E-mail: fan_zhengfeng@mail.iapcm.ac.cn

2) Center for Applied Physics and Technology, Peking University, China

In this talk, we present an ion-electron non-equilibrium model, in which the hot-spot ion temperature is higher than its electron temperature so that the hot-spot nuclear reactions are enhanced while energy leaks are considerably reduced. Theoretical analysis shows that the ignition region would be significantly enlarged in the hot-spot ρR-T space as compared with the commonly used equilibrium model [1], refer to Fig. 1. Simulations show that shocks could be utilized to create and maintain non-equilibrium conditions within the hot spot, and the hot-spot ρR requirement is remarkably reduced for achieving self-heating [1, 2].

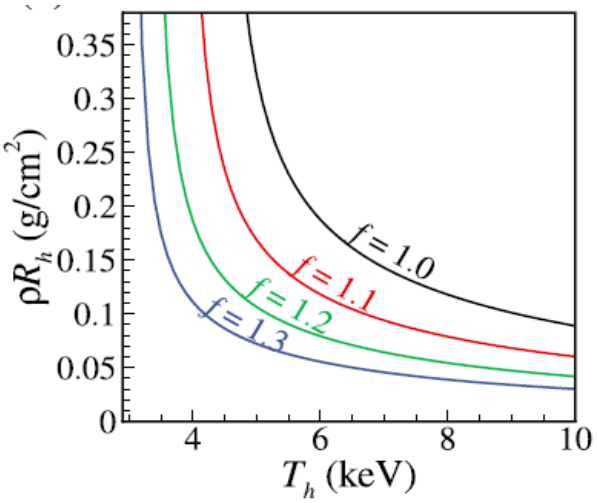

Figure 1: the hot-spot ignition conditions in the ρR-T space

In NIF high-foot implosions, it is observed that the x-ray enhancement factors are less than unity, which is not self-consistent and is caused by assuming $T_e = T_i$. And from this non-consistency, we could infer that ion-electron non-equilibrium exists in the high-foot implosions and the ion temperature could be ~9% larger than the equilibrium temperature [3].

References

[1] Z. F. Fan *et al.*, Phys. Plasmas **23**, 010703 (2016)

[2] Z. F. Fan *et al.*, Phys. Plasmas **21**, 100705 (2014)

[3] Z. F. Fan *et al.*, Matter and Radiation at Extremes **2**, 3-8 (2017)