AAPPS-DPP2020, 26-31,10.2020, Remote e-conference

# AAPPS-DPP2020 Invited/Plenary Nomination Form

0. **Recommender's name, E-mail and affiliation**
   Name: Ke Lan, E-mail: lan_ke@iapcm.ac.cn, Affiliation: Institute of Applied Physics and Computational Mathematics
1. **Session category:** Choose session category
   L
   L: Laser plasma.

2. **Type:** Invited

3. **Speaker: Xing Zhang;**
   **E-mail:** zhangxingjerry@sina.com**;**
   **Affiliation:** Laser Fusion Research Center, China Academy of Engineering Physics;
4. **Rationale**:

The implosion asymmetry and the hot-spot mix are expected as two crucial factors, out of the theoretical expectations, in the laser driven ignition on the NIF. The hot spot has a small size, about 50μm, and some micro-structures. The advanced X-ray microscopy is regarded as a good approach to diagnose the hot spot behaviors. The 100kJ laser facility in China may provide some extra experimental observation of the hot spot, than the OMEGA and NIF facilities in U.S. We have constructed some KB microscopes in this laser facility, and they have been in commission in the 100kJ laser driven implosions. We also proposed two novel KB microscopes for the hot spot diagnostics. One of them may provide a hot spot X-ray emission image with a higher spatial resolution, and the other one may provide the hot spot images in 4 different X-ray energies. They may provide some new abilities in the study the behaviors of the hot spot in the hohlraum driven implosions.

5. **Short abstract for 4$^{th}$ Asia-Pacific Conference on Plasma Physics**

**Authors:** Xing Zhang, Ji Yan, Zhongjing Chen, Yunsong Dong, Yongteng Yuan, Jie Xu, Jianjun. Dong, Baozhong Mu, Feng Wang*, Jiamin Yang and Shao'en Jiang

**Title:** The hot spot diagnostics with the high spatial resolution X-ray imaging techniques in the 100kJ laser driven ICF implosions

**Abstract:** A high quality hot spot is crucial in the laser driven inertial confinement fusion (ICF). But the implosion asymmetry and the hot-spot mix are the challenging problems in the path to the ignition, which will respectively degenerate the areal density and the temperature of the hot spot. When the driven energy increases, the deviations between the real states of the hot spot and the theoretical expectations seem to be more and more. The advanced X-ray imaging diagnostics are regarded to be the good tools to provide the hot spot behaviors in the laser driven implosions. In the Chinese 100kJ laser facility, the multi-channels Kirkpatrick-Baez (KB) microscopes are employed to diagnose the hot spot X-ray emission images. A 4-channels full-reflective KB microscope, with Pt coated mirrors, was already commissioned in the low-mode implosion asymmetry diagnostics. It has a spatial resolution of about 5μm in the center of the field of view. And it has a relatively wide field of view and a spatial flat response. The similarities between the different channel images were about 97%. According to the measured X-ray images, the P2 and P4 asymmetries of the hohlraum driven hot spots were controlled to be less than 5% in this facility, by the shifts of the laser spots positions and some other techniques. Now there are two novel KB microscopes under development, for the study of the hot-spot mix. One of them is an AKB microscope with a STTS mirrors configuration. There are two mirrors in each imaging direction to suppress the imaging off-axis aberration. The spatial resolution is expected to be less than 3μm in a field-of-view over 200μm. The imaging X-ray energy is around 8keV, by the multi-layer reflective films coated on the mirror. It will be expected to get the X-ray emission images with the distinct "spike-bubble" structures, which are resulted from the Rayleigh-Taylor instability growth. Then it may be used to analyze the width of the shell-hotspot mix. The other one is a four-channel KB microscope with four X-ray energy responses. For the 100kJ laser driven implosions, the four X-ray energy bands are proposed in the range of 4-15keV. Every channel contributes to a specified X-ray energy band. The relative throughout efficiency among the four channels will be calibrated. The spatial resolutions of the four channels are expected to be about 5μm. With the hot spot X-ray emission images in the four energy bands, it may extract the electron temperature maps in the hot spot, by the measured local bremsstrahlung X-ray spectrum. In the capsules with undoped gas fuel, maybe the diagnostics of the hot spot electron temperature maps can give us some information of the hot spot mix

6. **List of related published papers (option)**

6.1 X. Zhang, Z. Chen, Y. Li, *et al.*, Journal of Instrumentation, 14, C11010, 2019.
6.2 Ji Yan, Xing Zhang, Jiwei Li, *et al.*, Nuclear Fusion, 58, 076020, 2018.