マルチピコ秒ペタワットLFEXレーザーによる 高密度プラズマの加熱領域の可視化
Visualization of heating region of high energy density plasma by multi picosecond petawatt LFEX laser

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Recently we have demonstrated enhancement of laser-to-core energy coupling by relativistic electron beam (REB) guiding with several hundred Tesla magnetic field in inertial confinement fusion scheme.

To visualize such a highly efficient heating, we imaged the two-dimensional distribution of the heated core using a Fresnel Phase Zone Plate (FPZP). The experimental layout is shown in Fig.1. The spherical target containing titanium as a tracer was compressed with nanosecond GEKKO-XII laser in the magnetic field and then heated with REB produced by a multi picoseconds LFEX laser. REB can heat the center of the core efficiently in the magnetic field.

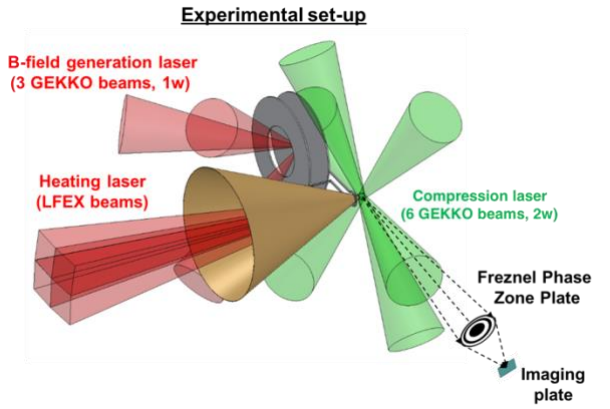

Fig.1 : Experimental setup. The geometrical positions of the target ,and the diagnostics instruments are illustrated. FPZP to measure two-dimensional heated core profiles of compressed titanium doped spherical target under an external magnetic field was installed at 90 deg from the LFEX incident axis.

When the REB passing through the cold plasma, Ti-*Kα* is emitted. Titanium is rapidly ionized when the temperature exceeds 500 eV, and can emit He-like X-ray such as Ti-*Heα*. At the center of the core,
Ti-*Heα* X-ray was visualized which imply heated region and titanium Ti-*Kα* X-ray was visualized at the edge of the core which imply cold region as shown in Fig.2.
We succeeded in measuring the two-dimensional heating distribution of the heated high energy density plasma. A heavy hydrogen target containing titanium as a tracer was compressed with nanosecond GXII laser and then heated with picosecond LFEX laser. Ti-*Kα* and Ti-*Heα* X-ray generated from the target were imaged using a FPZP. The two-dimensional distribution of the imaged Ti-*Kα* and Ti-*Heα* X-ray characterized the heated high energy density plasma.

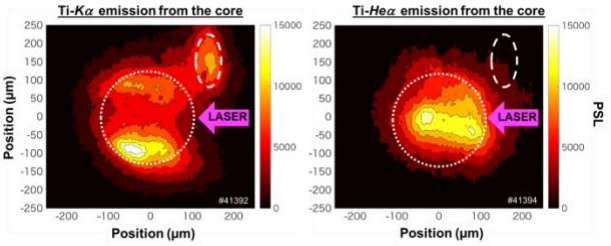

Fig.2 : The target doped with titanium was heated with the LFEX laser and the Ti-*K*α line and the Ti-*He*α line emitted from the core were respectively imaged. When the REB passing through the cold plasma, Ti-*K*α is emitted. Titanium is rapidly ionized when the temperature exceeds 500 eV, and can emit He-like X-ray such as Ti-*He*α. Ti-*He*α emission was strongly observed along the laser axis.