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Double structure of ions in 2D particle in cell laser plasma simulation

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Plasma used for fusion fast ignition composed of carbon and hydrogen. Therefore, the plasma generated from this fuel is mainly composed of C and H. When simulating laser incidence to this plasma, a single composition plasma composed of an intermediate material between C and H is widely used. On the other hand, in our simulation of this time, we created individual particles for C and H, and set conditions that are thought to better reproduce the plasma containing two kinds of elements.

As a result, we have observed a plasma channel with a double structure like Fig.1. The inner and outer walls of this channel are each composed of a single H ion, a mixture of C ions and H ions. In addition, it can be seen that the return current for high-speed electrons running in the plasma channel flows mainly through the inner wall portion composed of H ions (Fig.2). Comparison was made from the viewpoints of plasma channel diameter, channel entry length, high-speed electron collimation, and the like in the case where such a structure is generated and the case where it is not generated, and factors which dominate in those are considered.

When observing the magnetic field, a strong magnetic field is observed near the channel. In plasma channel formation, it is thought that such a strong magnetic field is responsible for size determination, especially focusing on this magnetic field strength.

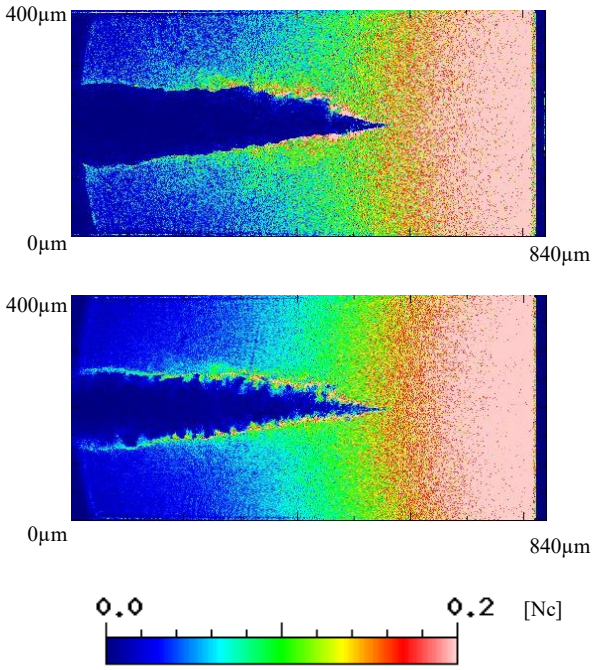

Fig 1. Pictures show density profile of (a) H ion, (b) C ion.

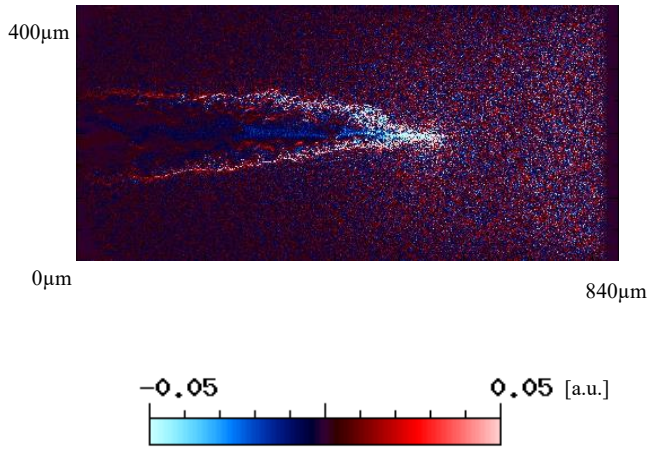

Fig 2. Pictures show electric current density forward to x direction. Silhouette of high density area almost much to H ion density.