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# Laser Ablation Ion Source

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In Brookhaven National Laboratory (BNL), several laser ion source (LIS) development projects are in progress. By combining accumulated technologies, a feasible scenario of a LIS for heavy ion fusion is discussed.

As a part of NASA space radiation laboratory (NSRL) program, a low charge state laser ion source (LIS) is being built to provide various species. A laser power density on the source target materials is carefully adjusted to provide the required beam specifications. The target current and ion beam pulse length are several hundreds micro ampere and several hundreds micro seconds. Stable 5 Hz ion beam generations have been demonstrated with good beam emittances. Currently, laser ablation plasma confinement technique by a solenoid magnetic field is being studied intensively. The laser system has twin Nd-YAG 850 mJ Q-switched oscillators. The wavelength and pulse width (laser) are1064 nm and 6 ns (FWHM). It has been proved that a LIS can provide low emittance low charge state beams from heavy materials including bismuth and gold.

Simultaneously, we are developing a high current heavy ion RFQ using direct plasma injection scheme (DPIS). In the DPIS, a laser ablation plasma created by a LIS is transported directly to an RFQ's entrance with neutral plasma state. By avoiding an ion extraction at the source, a severe beam loss in the low energy transport line can be eliminated. The measured currents after our RFQ showed more than 70 mA of aluminum and iron beams. These results indicate a few hundreds mA heavy ion beam acceleration with DPIS is feasible.

In 2011, we started a new program which is to develop high current high charge state heavy ion LIS dedicated to a digital accelerator of KEK. A newly designed ion source chamber is being fabricated in KEK and will be delivered to BNL. For this program, we use a sub-nano second 500 mJ Nd-YAG laser system. A sub-nano second laser system enables to obtain 10E14 W/cm2 of laser power density on the target and may provide highly charged heavy ions. This shorter pulse width laser also may suit to a HIF LIS. We plan to examine low charge state ion beam production using the new laser system. The program is partially funded by RIKEN.

Using the new technologies developed in the above programs, we propose a LIS to realize the HIF.

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