

The acceleration of high intensity heavy ion beams at IMP

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The production of low energy high intensity heavy ion beams is challenging for the community. Several high intensity heavy ion beam accelerators for versatile purposes have been developed at IMP, such as LEAF, which is a low energy high intensity heavy ion accelerator complex for multidiscipline researches that features a superconducting ECR source, and a heavy ion beam linac. The major acceleration structure of LEAF is a 4-vane RFQ, which accelerates heavy ions with M/q from 2 to 7 to 0.5 MeV/u. With the support of the energy modulation system based on a DTL and two bunchers, this facility features high intensity heavy ion beam acceleration up to 1 emA, fine tuning of ion beam energy within 0.3 to 1.0 MeV/u with an energy spread of $<0.25\%$ (FWHM) that is favored by high precision experimental investigations such as C-C burning study in nuclear astrophysics. A 4-rod RFQ, which was fabricated 15 years ago, has been recently modified and adopted a laser ion beam source as primary ion beam injector to accelerate high intensity pulsed heavy ion beams, especially for refractory metal ions. In addition, a very compact IH RFQ with frequency of 81.25 MHz has been developed to accelerate H_2^+ ions with currents of several mA. The cavity outer diameter is only 266 mm, which makes it possible that the RFQ could be embedded into a cyclotron and acts as the axial injector of high intensity ion beams. This report will present the latest progress and challenges of the aforementioned work.

Footnotes

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