



Contribution ID: 29

Type: **not specified**

Prospects of Warm Dense Matter generated by Intense Heavy Ion Beam @HIAF

Wednesday, 21 June 2017 15:20 (25 minutes)

A large scale scientific research platform, named High Intensity heavy-ion Accelerator Facility (HIAF), was proposed by the Institute of Modern Physics Chinese Academy of Sciences in 2007. It was selected as one of the 16 priority national projects for science and technology for the 12th five-year-plan in China. Finally, on 31 December 2015 the HIAF project was officially approved by the Chinese government. Some new experiments become available at HIAF, for instance the research on warm dense matter generated by intense heavy ion beams.

A schematic view of the HIAF complex is shown in Fig. 1 and the main parameters are listed as well. The facility consists of SECR (Superconductive Electronic Cyclotron Resonance) ion source, an ion linear accelerator (i-Linac), a Booster Ring (BRing), a Spectrometer Ring (SRing), a Merge Ring (MRing) and several experimental terminals at low- and high- energy ends. The warm dense matter terminal will be located at external experimental cave of BRing.

A 2D hydrodynamic simulation has been done. The thermodynamic and the hydrodynamic response of a solid lead cylindrical target heated by the $^{238}\text{U}^{34+}$ ions accelerated by BRing of HIAF are studied. The simulated results show a state of deposited energy about 14 kJ/g, temperature about 55000 K, pressure about 60 GPa and density about 9 g/cm³ of matter is produced by the intense heavy ion beam, which means that the ion beam available at HIAF is powerful to carry out the investigations on warm dense matter in the laboratory.

In order to diagnose the dynamic process of warm dense matter, high energy electron radiography (HEER) is introduced. With the collaboration of IMP, THU and ANL, a preliminary and positive result on the application of electron radiography in warm dense matter research has been obtained.

In the workshop, more details on the HIAF project and the development of high energy electron radiography will be given.

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Session Classification: Plasma physics research at other facilities