Frontiers of atomic physics with highly charged heavy ions at HIAF

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Synopsis High Intensity heavy ion Accelerator Facility (HIAF) is a new project currently being under design and construction in China. HIAF will provide beams of stable and unstable heavy ions with high energies, high intensities and high quality. An overview of atomic physics program using highly charged ions and radioactive heavy ions at HIAF is presented.

The High Intensity heavy ion Accelerator Facility (HIAF) is a new project which was approved by the Chinese government on 31 December 2015 [1]. The construction of HIAF is expected to be completed in 2024 and its commissioning is scheduled on 2025. The HIAF locates in the coast area in Huizhou city of Guangdong Province of South China.

As shown in Figure. 1, the HIAF project consists of ion-Linac (iLinac) with a length of 100m, a Booster Ring (BRing), a radioactive beam line of fragmentation type, a spectrometer ring (SRing), and several experimental terminals at low- and high-energy ends as well as setups for in-ring experiments. Some key parameters of each accelerator are summarized in Table 1. The rings will be equipped with electron cooler and stochastic cooling devices. The marked experimental terminals in figure 1 include, ① Nuclear structure spectrometer, ② Low energy irradiation, ③ RIBs beam line, ④ High precision spectrometer ring, ⑤ External target station ⑥ electron-ion recombination spectroscopy, ⑦ Ion-Ion Merging, ⑧ Warm Density Matter Physics, ⑨ High energy irradiation target. At low energy branch together with the nuclear structure terminals, a collinear laser spectrometer will also be built.

New possibilities for atomic physics experiments are foreseen at HIAF [2]. The in-ring experiments include a dedicated electron target for dielectronic recombination studies, an internal target for spectroscopy and relativistic collision dynamics experiment, a setup for laser cooling and laser spectroscopy studies, and a double-ToF detector system for precision mass measurements. Unstable ions far from stability will be used for precision spectroscopy at HIAF. In the meantime, the international FAIR project, which is being built in Germany, will offer unique experimental opportunities for atomic physics [3].

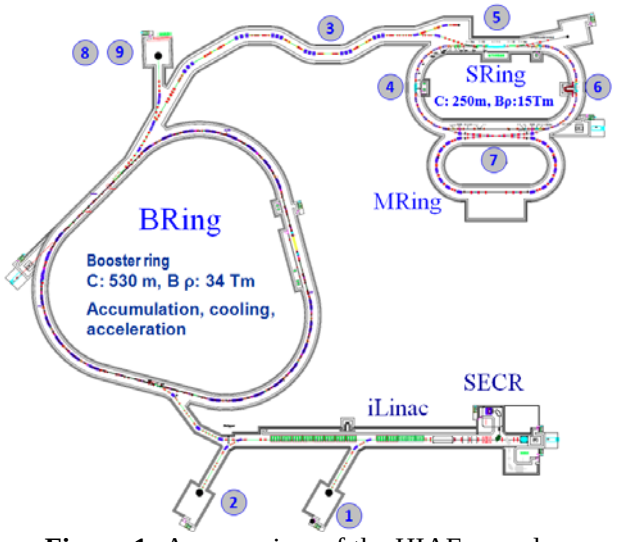

Figure 1: An overview of the HIAF complex.

Table 1 Key parameters of HIAF

	Ions	Energy	Intensity
SECR	U^{34+}	14 keV/u	0.05 pmA
iLinac	U^{34+}	17 MeV/u	0.028 pmA
BRing	U^{34+}	0.8 GeV/u	1.0×10^{11}ppp
SRing	U^{92+}	0.8 GeV/u	1.0×10^{11}ppp

References

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