Foreword

The year of 2014 was a productive year for IMP with many remarkable advances in the fundamental researches and heavy-ion applications. We proposed the projects of CIADS (China Initiative Accelerator Driven System) and HIAF (High Intensity heavy ion Accelerator Facility). IMP smoothly passed the International Expert Diagnostic Assessment organized by CAS.

Several research highlights in 2014 are to be mentioned. Masses of 21 atomic nuclei were accurately determined at HIRFL-CSR facility for the first time with the accuracy of 10^{-6}～10^{-7}. The new neutron-deficient isotope ^{205}Ac was synthesized in the complete-fusion reaction ^{169}Tm (^{40}Ca, 4n) ^{205}Ac, its α-decay energy and half-life were determined. Another remarkable success was the investigation of the two-center interferences at atomic-scale in a collision between H_2^+ projectile ions and helium target atom using kinematically complete technique. The work was done in collaboration with MPIK (Max Planck Institute for Nuclear Physics) and has been published in *Physical Review Letters* as a highlighted article.

Important progresses were also made in some Strategic Priority Research Programs of CAS. The first is China ADS project. The prototype of superconducting linac with ECR source, RFQ, and single cavity cryomodule, was installed in the tunnel and commissioned. The first pulsed beam of 2.15 MeV from the RFQ was obtained at the beginning of June, and at the end of the month CW beam of 10 mA was accelerated successfully for 4.5 hours. The first pulsed beam of 2.6 MeV from the RFQ from the single cavity cryomodule was obtained on October 1, and 3.6 mA CW beam for 3 hours was achieved successfully. Some key technologies for the future ADS project were also developed at IMP. The next is the DArk Matter Particle Explorer (DAMPE) project. We finished the design and construction work for the plastic scintillator detector array (PSD), which passed successfully all the tests for space environmental adaptation.

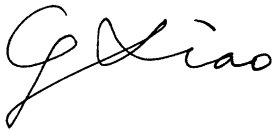
In 2014, HIRFL was operated stably and it provided 25 different species of heavy ion beams for various experiments, and especially 11 kinds of heavy ion beams with different energies were firstly provided for experiments. The total experimental beam time was 5199.5 hours, among which 3749 hours were devoted to nuclear physics, 332 hours for biological experiment and beam test, 883.5 hours for research of material irradiation and single event effect, and 235 hours for the machine study. The slow extraction experiment at CSRm was performed with the ion beam at the top energy when a sinusoidal RF voltage was applied, through which the efficiency has increased about 20%. Other accelerator machine studies were also carried out, such as SSC injection study on the influence of the elements'position, SFC extraction study on the influence of the buncher B02 voltage and the solenoids in the SFC beam line, the study on the electron cooling effect, etc. Additionally, the 320 kV platform delivered about 5 500 hours of low-energy highly charged ions for multi-discipline researches, including 3200 hours for experiments, and 2300 hours for the machine preparation and commissioning. It was the first time for the platform to provide Li, Au, and Ag ion beams. A major breakthrough was made in 2014 for the new concept ECR ion source development that employed the Evaporative Cooling Technology. The new source was named as LECR4. After a successful prototyping test of the magnet in 2013, the first plasma was obtained at the very beginning of 2014. With a maximum of 1.7 kW 18 GHz microwave heating of the plasma, intense beam was produced.

Many progresses were made for technology transfer and industrial development. The compact cyclotron, which is the injector of the Heavy Ion Medical Machine (HIMM), was successfully commissioned. Installation of the demonstration facility of the HIMM in Wuwei city has completed up to 60%. Combining heavy ion radiation mutation and cross breeding techniques, many new varieties or germplasm resources of crops were obtained. Two new varieties of sweet sorghum were certificated by Gansu Crop Variety Approval Committee. About 16 000 hectares cultivation of sweet sorghum was promoted in Gansu province. A new crossing combination marked FK01 of oil-sunflower with ideal agronomic characters

were tested in Gansu regional trails. Two invention patents about yeast fermentation technique were approved by State Intellectual Property Office of China.

Besides these highlights, the Report contains 253 contributions from last year's research in the fields of theoretical and experimental nuclear physics, hadron physics, atomic physics, high energy density physics, accelerator physics and technology, nuclear technology and detector instrumentation, material research, biophysics, space radiobiology, heavy ion cancer therapy, etc.

Finally, I would like to take this opportunity to thank all the staff at IMP and NLHIAL for their efforts, progresses and achievements obtained in the year of 2014. I would also like to express our gratitude to Chinese Academy of Sciences, National Natural Science Foundation Committee, Ministry of Science and Technology of the People's Republic of China for their supports which are crucial for all the achievements reported in this issue.



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