Foreword

The year 2016 ends with great progresses in the fundamental researches and heavy-ion applications at IMP. The project feasibility study reports of the large-scale scientific facilities, CIADS (China Initiative Accelerator Driven System) and HIAF (High Intensity heavy ion Accelerator Facility), were finished in 2016, and IMP foresees her bright future with CIADS and HIAF, and may achieves great success in the fundamental researches and heavy-ion applications within the next decade or two.

Several research highlights of the heavy-ion science in 2016 are to be mentioned. Precision mass excess values for ^{52}Co and its low-lying (2^+) isomer have been measured for the first time with an accuracy of ~10 keV. Combining the new results with the previous β-γ measurements of ^{52}Ni, the $T = 2$ isobaric analog state(IAS) in ^{52}Co was newly assigned, questioning the conventional identification of IASs from the β-delayed proton emissions. 3 new neutron-deficient actinide nuclides ^{219,223,224}Np were discovered at the SHANS(Spectrometer for Heavy Atoms and Nuclear Structure) gas-filled separator in IMP. Sharp nanocones were produced in ion-track membranes, oxidation kinetics process of nanowire was illustrated, the new irradiation effects in graphite was found and the new characteristics of irradiation damage in graphene was obtained.

A series of advances and breakthroughs were also made in the Strategic Priority Research Program of CAS to meet the national needs. The installation of ADS Superconducting Proton Linac– Injector II was complete, and the highest record of continuous wave proton beam power at IMP was created among all the continuous wave proton linacs worldwide. The program successfully passed the standard test by Bureau of major R&D Programs of CAS in 2016. After hard works for more than two years, the first principle prototypes (prototype I and II) of a granular flow spallation target in the world for ADS was successively developed and commissioned in 2016, the experimental measurement and related device technology verification were completed. The VENUS-II zero-power reactor facility, which consists of light water core and lead core, initially started successfully to the critical state in December, 2016 with the co-operation of IMP and CIAE(China Institute of Atomic Energy). Many verification experiments have been carried out on VENUS-II facility to validate the theoretical codes, nuclear data and experiment technologies.

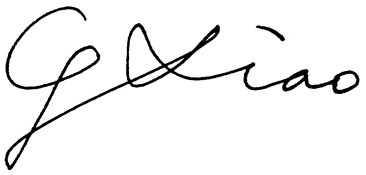
In 2016 several great research progresses were made in the national economic and social development. The registration and certification testing of the hospital-based tumor therapy facility, *i.e.* the HIMM (Heavy-Ion-Medical-Machine) Wuwei facility, were pushed forward quickly, its GMP quality management system was established, and clinical trial proposal passed expert evaluation. The beam tuning and terminal test for 5 energy points in range of 120~400 MeV/u were carried out, its beam current reached the goal. The installation of HIMM Lanzhou facility was also nearly finished in 2016. The intention agreements for some new hospital-based tumor therapy facilities were signed too. In one word, the steady progress was made in industrialization of the hospital-based tumor therapy facility in 2016.

In 2016, the facility HIRFL total operation time was 7 488 h, target beam time was 5 547 h. HIRFL provided 26 different types of heavy ion beams for more than 150 experiments, among which, 11 kinds of heavy ion beams with different energy were first time commissioned. The first high current heavy ion

IH-DTL linac in China was commissioned with the $^{16}O^{5+}$ beam, which reached the design specifications by the outlet energy 293.1 keV/u, and the transmission efficiency over 80%. SECRAL-II as a backup of present superconducting ECR ion source(SECRAL) passed process testing, the 6 emA O^{6+} beam reset the new world record of very intense highly charged ion beam produced.

Besides these highlights, the Report contains 225 contributions from the researches at 2016 in the fields of theoretical and experimental nuclear physics, hadron physics, nuclear chemistry, atomic physics, high energy density physics, reactor 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 2016. 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.



Director of IMP

Vice Director of NLHIAL