Introduction of Nuclear Education & Research Activities in Lanzhou, China

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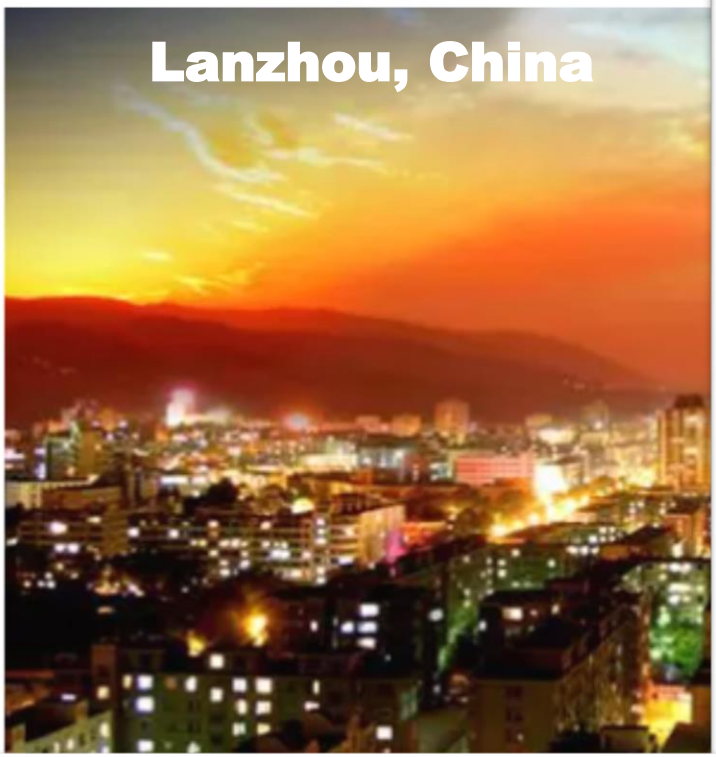
Outline

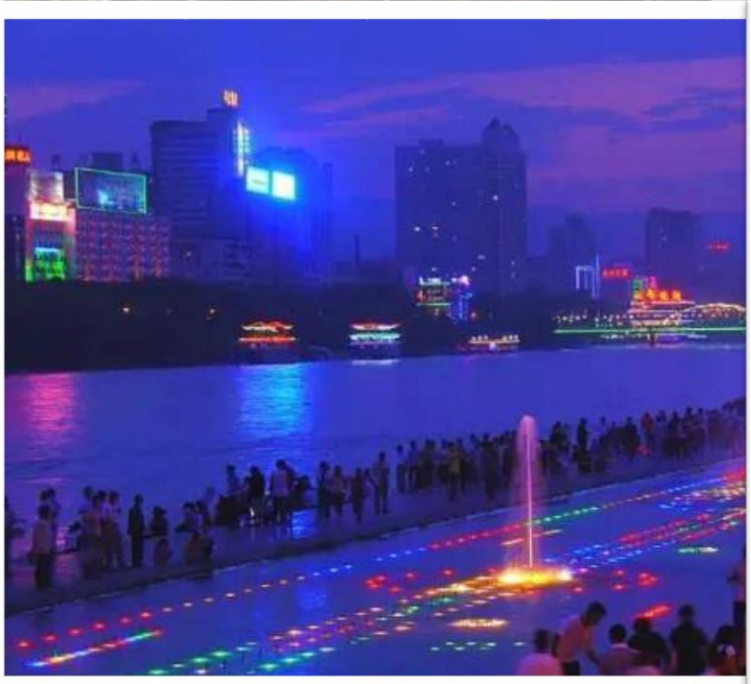
- Brief Introduction of Lanzhou
- Introduction of Chinese High Education System
- Lanzhou University, School of Nuclear Science & Technology and IRPM
- Institute of Modern Physics, Chinese Academy of Science
- Brief Introduction of Chinese Founding System
- Collaboration Possibilities and Proposals

Lanzhou, the capital city of Gansu province, is located in the middle of China. There are 3.5 millions population.

Lanzhou, China


Lanzhou, China


乐活兰州

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Introduction of Chinese High Education System

National Universities (154)	• 75 under Ministry of Education • 3 under Chinese Academy of Science • 37 under some ministries • 39 under military system
Provincial Universities (~1600)	• ~200 Universities for graduate education • ~600 Univ./Colleges for bachelor degree • ~1000 Colleges for professional education
Private Universities (~1000)	• a few universities for graduate education • ~100 colleges for bachelor degree • ~900 for professional education

Total number of university and colleges: ~2800

Total number of full time students: 30 millions

Undergraduate	• ~12 millions
Graduate students	• Master course: ~2 millions • Doctoral course: 200 k
Professional education	• 15 millions

Chinese Academy of Science is also a graduate education agency: ~15 k (Master and doctor students)

Introduction of Lanzhou University (LZU)

National University (one from 75s), the most important comprehensive national university in northwest China.

Introduction of Lanzhou University (LZU)

1909~, one of the eldest universities in China;
32 schools/departments:

- Science
- Engineering
- Art
- Law
- Foreign language
- Medicine
- Agriculture
- Literature
- Economics
- Education
- Administration
- ……
- Four hospitals

→ All disciplines except military science

→
- 91 majors for undergraduate course
- 235 majors for master course
- 116 majors for doctor course

→ Employee: 4204;
Faculty member: 2025; (507 Profs; 697 Ass. Prof.)

→ Full time students: 32661
Undergraduate: 20710
Graduate (11951): Ms: 9682, Dr: 2269
Part time students: ~38000

Introduction of Lanzhou University (LZU)

Research highlight:

- Nature science: very strong, ~11th in China, 94th (nature Index, 2018) in global.
- Humanities: strong , ~50th in China
- Engineering: fair, ~150th in China

Institutions	CAS China	HAS Hungary	LZU China	BME Hungary	IMP CAS	Wigner RCP, HAS
WFC factor (2018)	1197.05	33.38	103.69	5.99	7.77	8.17
Ranking in global (2018)	1	332	94	970	~840	~812

Introduction of Sch. of Nucl. Sci. & Tech., LZU

Found in 2006.06 on the base of former dept. of modern physics (1955~), which is one of the eldest department on nuclear science in China.

Five institutes:

- Inst. of nuclear physics
- Institute of Radiation physics & material
- Inst. of fast neutronics & application
- Institute of nuclear technology
- Inst. of radio chemistry & environment

Staff: 88

16 Profs. + 21 Assoc. Profs. + others

Students: ~900

- Undergraduate: ~650
- Master: ~160
- Doctoral: ~90

Fundamental:

- Nuclear physics
- Theoretic physics
- Atomic physics & cluster physics
- Laser physics

Applications

- Ion beam physics and material
- Nuclear instruments and technology
- Ion source and low energy accelerator
- Fast neutronics
- Radiochemistry and environment
- Treatment of nuclear waste and pollution

Facilities/Equipments

- 2x1.7MV tandem accelerator
- 300KV neutron generator ($2x10^{12}$n/s)
- 25KV ion +15KV electron duo-beams platform
- 50KV ion implanter
- FS laser facility

Facilities under construction and in plan:

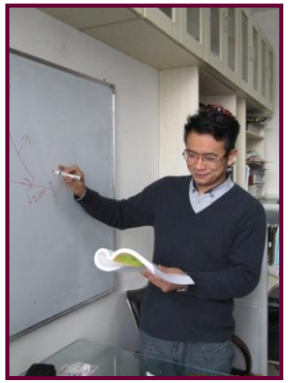
- 400KV neutron generator ($6x10^{12}$n/s)
- Ion + electron + Laser tri-beams experimental platform
- 20KV cluster ion implanter
- Zero power reactor

General analytical and characterization equipments in the analytical center of Lanzhou University and in the Chinese Academy of Science.

Graduation photo in 2017

Professor/director

Assoc. Professor



Lecturer


天行健
己欲達而
蘭州大學

Institute of Radiation Physics & Material, SNST, LZU

Researches:

- Sub-Low Energy Fusion Reaction and Related Problems
- Radiation Damage of Materials
  - ✓First wall material: Be, W, Mo
  - ✓Structure materials: Steels (ODS, CLAM)
  - ✓Glass and ceramics for nuclear waste forming
  - ✓Semi-conductors: GaN, GaInN, SiC
- Interaction of highly charged ions and solid surface
- Ion beam modification of function material

Collaborations:

Institute of Modern Physics, CAS, China
HZDR, Technical University Dresden, Germany
Tohoku University, Hokkaido University, Osaka University, Kobe University, RIKEN, Okayama University, Japan
Pacific Northwest National Laboratory, Oak-Ridge National Laboratory, University of Michigan, Georgia State University in USA
National University of Singapore
……

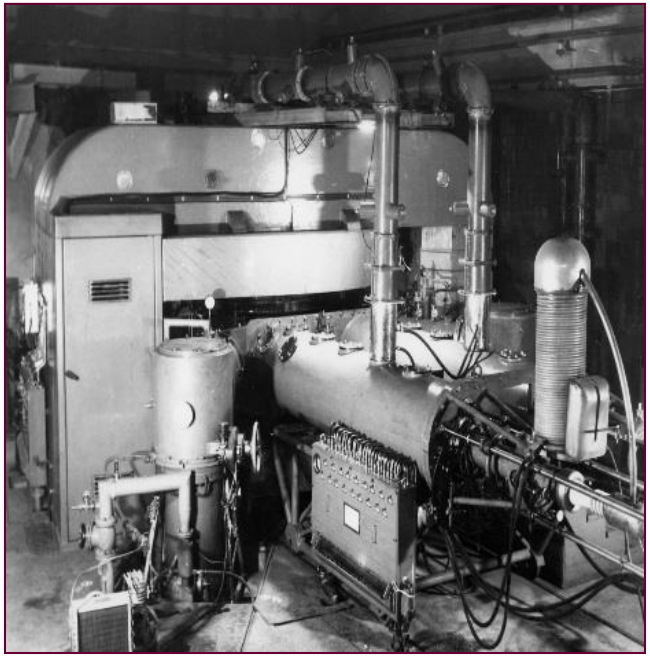
Institute of Modern Physics, CAS

Institute of Modern Physics (IMP) is founded in 1957.

National laboratory of heavy ion accelerator——the largest heavy ion accelerator complex in China.

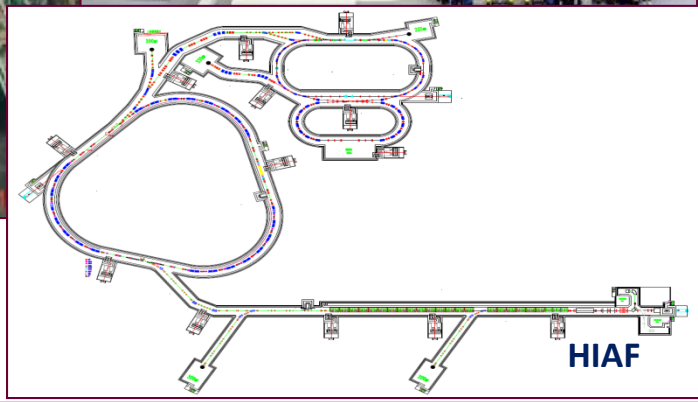
~ 1000 Employees

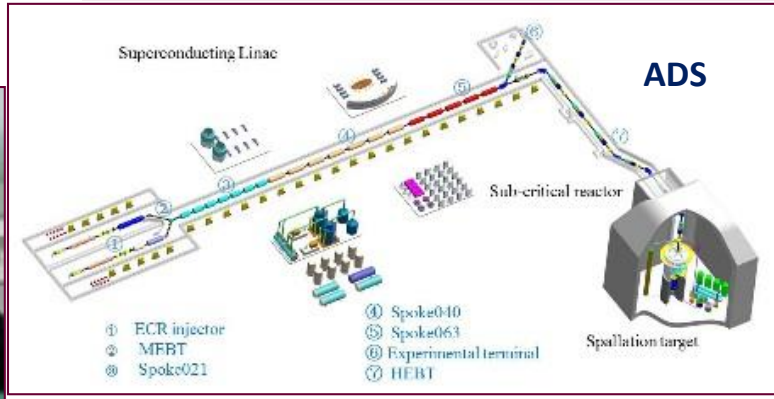
~ 300 Postgraduate Students



1.5m cyclotron K=69 Collaboration with former Soviet Union

SSC , K=450 Collaboration with GANIL and RIKEN





CSR (Cooling Storage Ring) Collaboration with GSI,GANIL,RIKEN

IMP main campus
National Laboratory of Heavy Ion Accelerator in Lanzhou (NLHAL)

Center of Heavy Ion Therapy at Wuwei city

R&D Center of Heavy Ion Applications, New Campus in Lanzhou

Center of Heavy Ion Therapy at Lanzhou

WuWei

288km

BaiYin

76km

LanZhou

2420km

HuiZhou

Industrialization Pilot Base

Laboratory of Superconducting Technology

Laboratory of Spallation Target

Center of Heavy Ion Science Branch of IMP at Huizhou

Research Center of Advanced Energy and materials at Huizhou

National Laboratory of Heavy Ion Accelerator in Lanzhou (1991)

1962

SSC (K=450)
100 AMeV (H.I.), 110 MeV (p)

SFC (K=69) 1962
10 AMeV (H.I.), 17~35 MeV (p)

1988

RIBLL1
RIBs at tens of AMeV

2007

CSRe

RIBLL2
RIBs at hundreds of AMeV

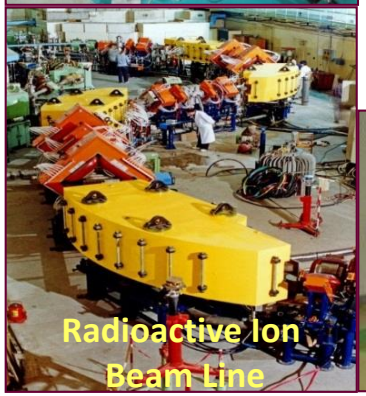
CSR(Cooling Storage Ring)

CSRm
1000 AMeV (H.I.), ≤ 2.8 GeV (p)

2007

2015

Institute of Modern Physics, CAS



ABOUT 20 APPARATUSES FOR HEAVY - ION PHYSICS AND APPLICATIONS

tswang@lzu.edu.cn SCHOOL OF NUCL. SCI. & TECH., LANZHOU UNIVERSITY, CHINA

- **Fundamental researches on nuclear & atomic physics**
  - Reactions with exotic nuclei: elastic scattering, total cross-section, …
  - Nuclear spectroscopy: mass measurement, γ-spectroscopy, β-delayed neutron(proton) emission, …
  - Nuclear matter: properties of asymmetric nuclear matter
  - Chemistry of super-heavy elements, and synthesis of new isotopes
  - Key reactions in stellar evolution
  - Spallation & nuclear data for ADS project
  - HED physics, and hadronic physics
  - HCI interaction with laser, electron, molecular, and s

Highest Priorities
- Mass measurement
- Key technique R&D related to ADS and HIAF
- Tumor therapy & mutation breeding

- **Applications with heavy ions**
  - Material: nano-tech., nuclear energy structural material, …
  - Radio-biology: tumor therapy, mutation breeding, …

- **Detector development**
  - Si detectors: Si(Au), Si(Li), Si-strip
  - Scintillator detectors: CsI, LaBr, plastic sci., liquid sci. …
  - Gaseous detectors: IC, TPC, PPAC, MWPC, MWDC, MicroMeGAS, GEM, …

- **Key technique development related to HIAF and ADS**

Brief Introduction of Chinese Founding System

Central government	• Natural Science foundation (NSFC) • Ministry of Science & Technology (MoST) • Ministry of Education (MoE) • Foundations for military and defense researches • Other ministries • Chinese Academy of Science • Chinese Academy of Engineering Physics • Other ministries • Fund of state key laboratories
Local governments	• Foundation of province • Foundation of cities
Industry	• Foundation of national companies • R&D projects of companies
Others	• University fund • Private donation

Collaboration possibilities and proposals

Inter. collaboration projects **China-EU (400k Euro)** **China-Hungary (100k Euro)**	• Natural Science foundation (NSFC) • Ministry of Science & Technology (MoST) • Ministry of Education (MoE) • Foundation of One Belt and One Road
Joint laboratory/Institute on application of nuclear technology	• NSFC + HSF • MoST + ? • MoE + HAS • Province + ? • University + Wigner Center
Joint graduate education **Students/scholars exchange**	• Chinese Scholarship • Joint project • Project fund
Technology innovation and transfer **Joint company**	• Chinese market + Hungary technology • Chinese manpower and manufactory • One belt and one road

Thank You for Attention!

You are welcome to visit Lanzhou University