

# Introduction of IHEP



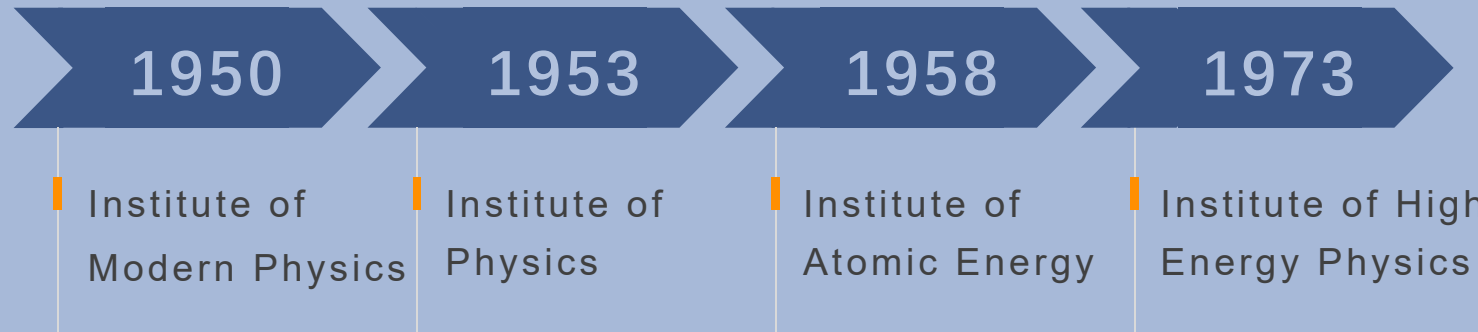
Yifang Wang  
Institute of High Energy Physics  
Sept. 20, 2023

**INTERNATIONAL ASSESSMENT 2023**

# CONTENT

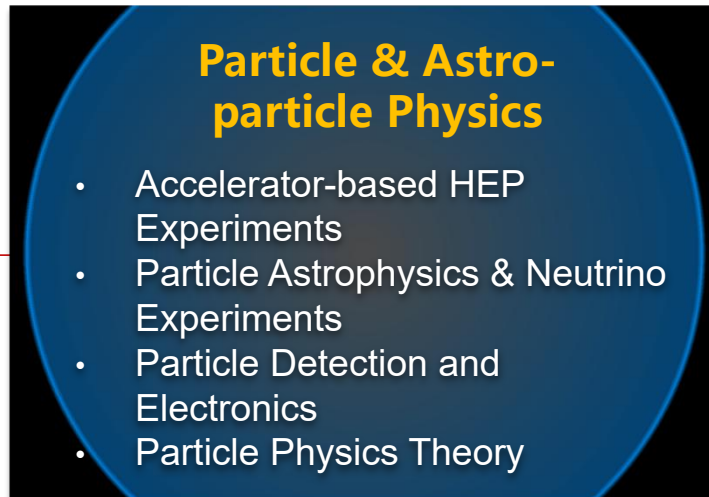


# History



IHEP' real start is from the construction of Beijing Electron Position Collider (BEPC) in 80's, and now is a large and comprehensive center for HEP and multidisciplinary research

## Frontiers of Basic Science



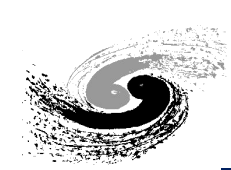
## Strategic High-Tech



## Multi-disciplinary research



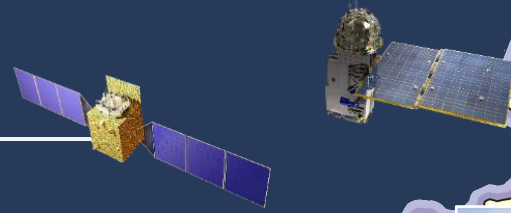
**Three Pillars: Basic science research, Technology R&D, Facility Construction and Management**



- 1** To construct facility and conduct research in particle physics and particle astrophysics, in order to better understand matter and the Universe
- 2** To construct and develop large, multidisciplinary platforms which are highly accessible to external users and provide strong support for science and technology development, and for a better society
- 3** To carry out frontier interdisciplinary research which is well matched to and fully utilizes our major scientific facilities and strengths in nuclear technology
- 4** To promote technology transfer and high-tech industrialization
- 5** To produce highly capable scientists, educate young students, train skilled technical personnel, and engage the public in the understanding of science

# Large Science Facilities

Insight Hard X-ray Modulation Telescope (HXMT)



Gravitational wave Electromagnetic Counterpart All-sky Monitor (GECAM)

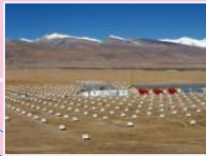


Huairou Campus High Energy Photon Source (HEPS)

IHEP, Beijing Campus Beijing Electron-Positron Collider (BEPC)

Jinan Branch

YBJ International Cosmic Ray Observatory (retirement)

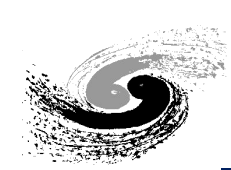


Jiangmen Underground Neutrino Observatory (JUNO)

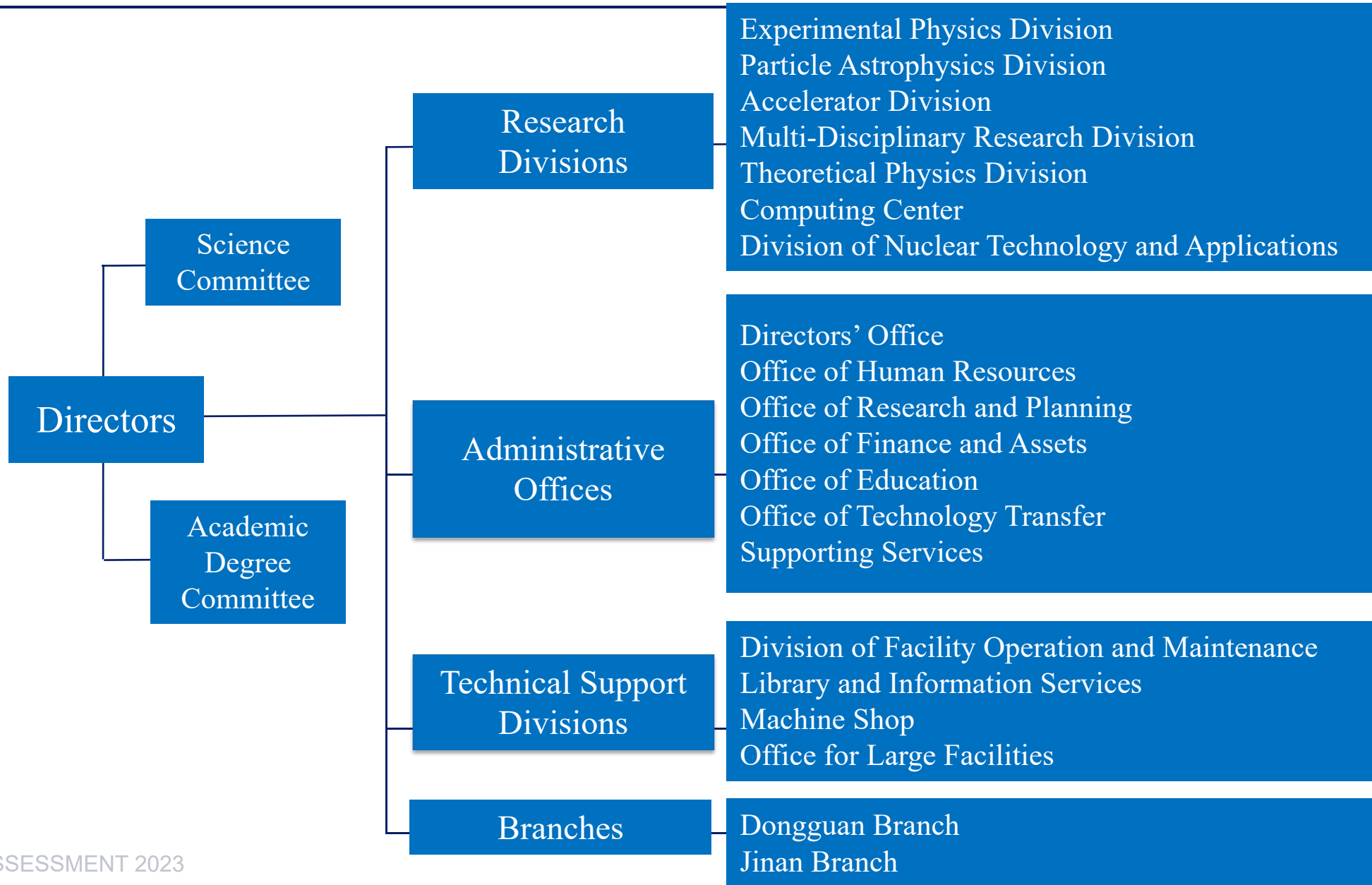
Daya Bay Neutrino Experiment (Daya Bay) (retirement)

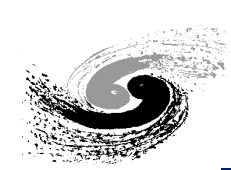
Dongguan Branch China Spallation Neutron Source (CSNS)





# Organization

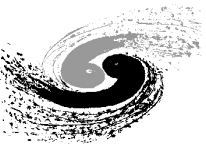




# Minor Reorganizations

- Established a new Branch: Jinan Branch, supported by the local government of Jinan, to enhance efforts for technology transfer
- A few groups are reorganized:
  - CMS & Neutrino groups were moved from PAD to EPD
    - Based on suggestions from 2013 assessment
  - Superconducting magnet group moved from EPD to AD
  - Many reorganization of groups within divisions
- Reorganized some of the administration offices, and refined their responsibilities
  - A new Finance and Assets office
  - Redefined responsibilities of infrastructure (civil) construction, procurement, intellectual property and patent, Post-doc managements ...

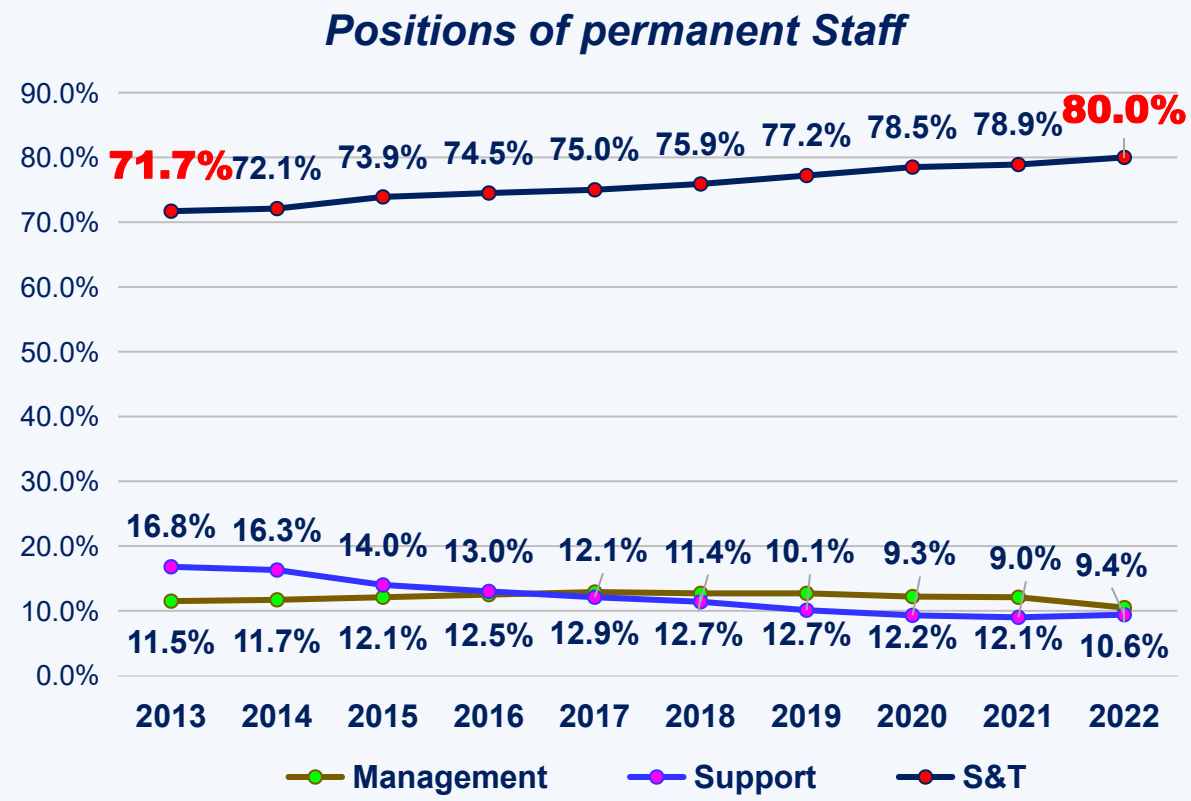
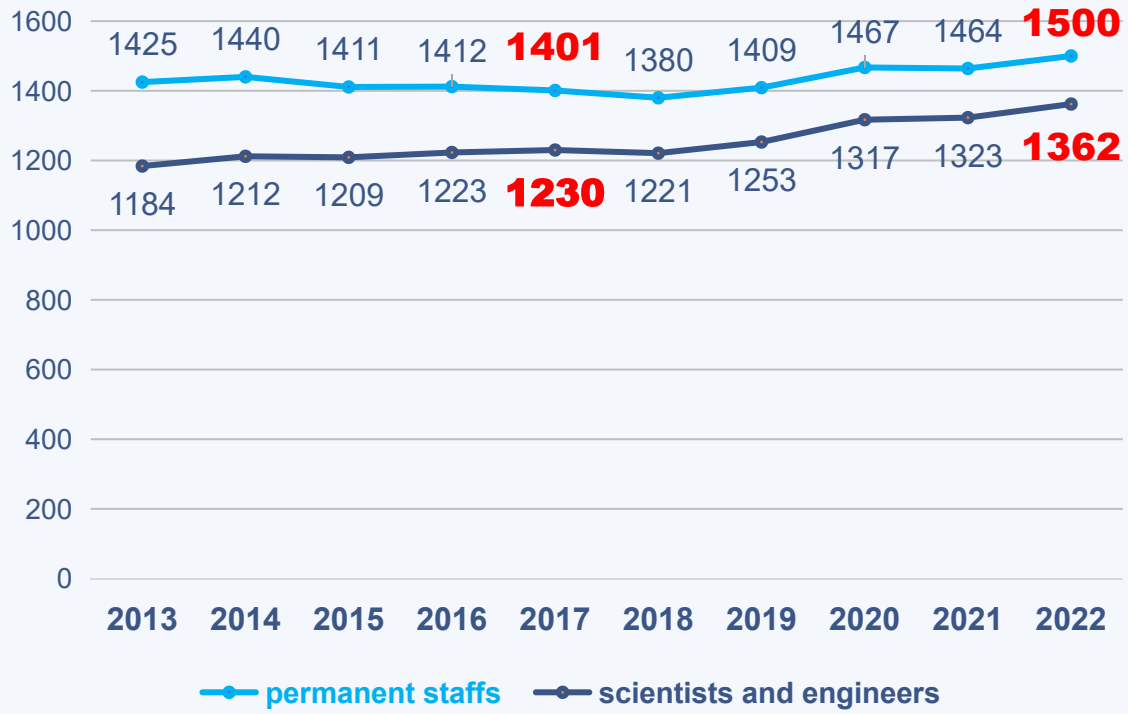




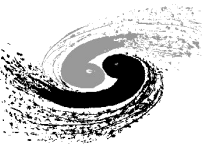
# Human Resources

- Total number of permanent staff has remained stable

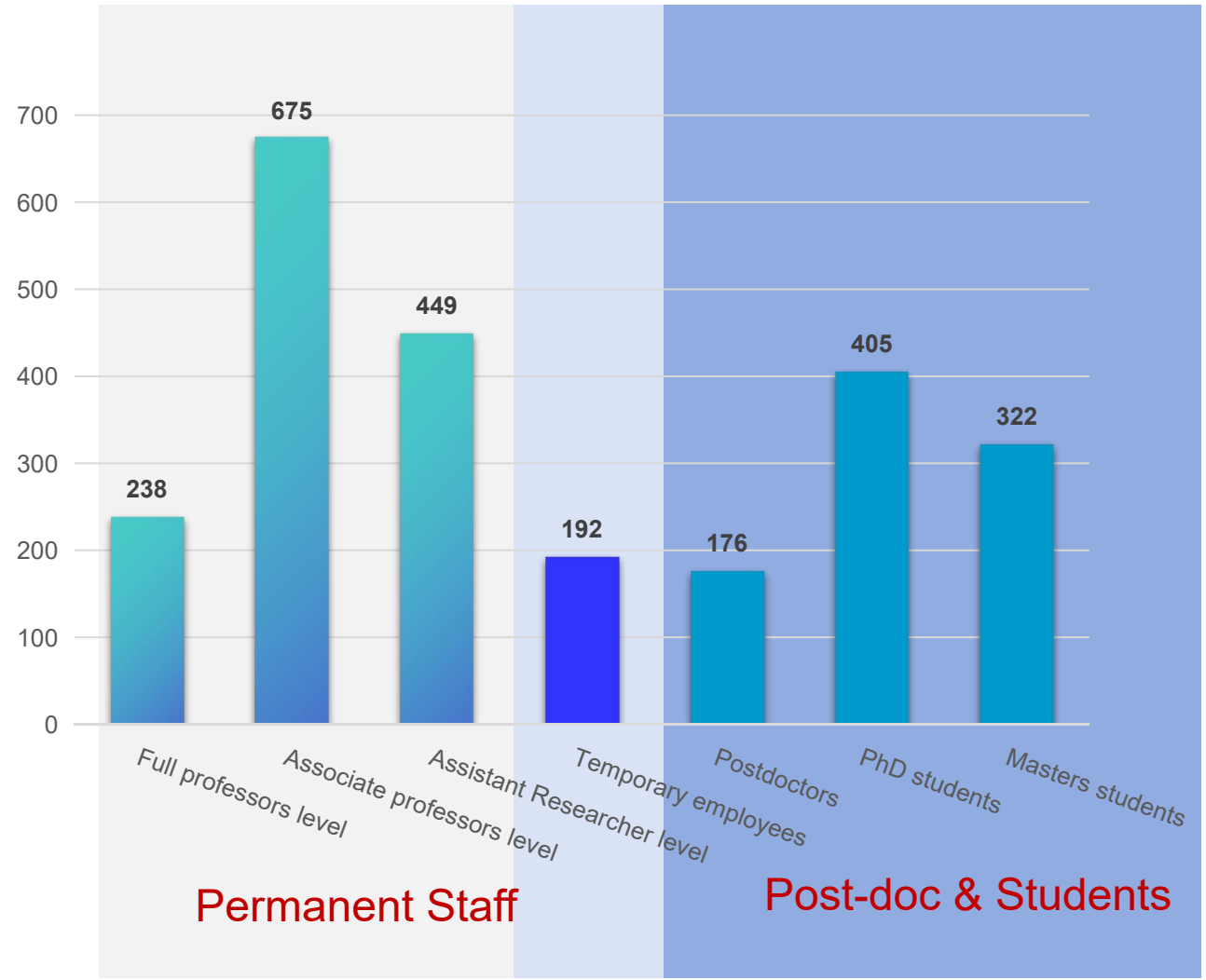
- Optimize the staff structure to develop a more competent innovative team







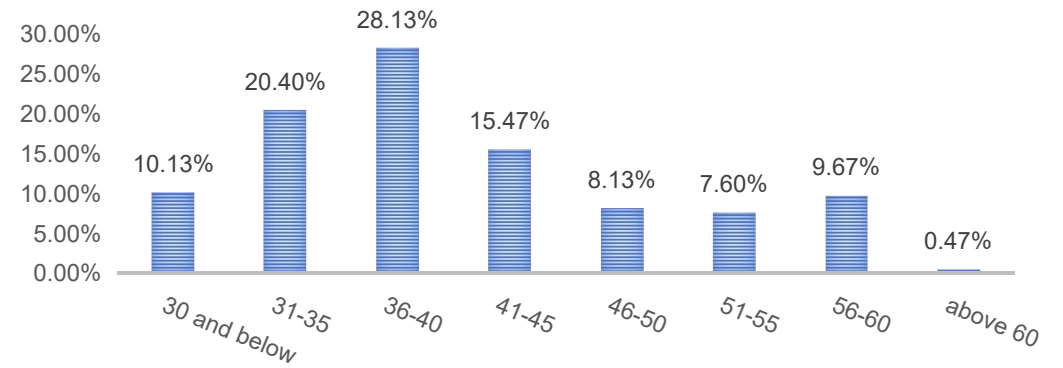
# Human Resources



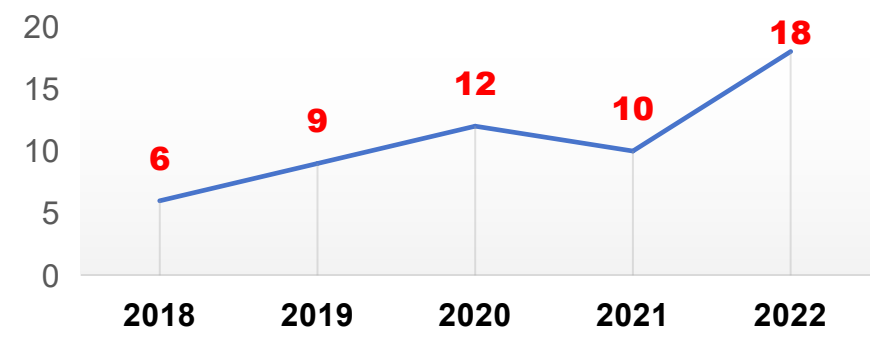
## Permanent Staff

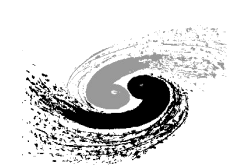
- **~74%** under 45 years old
- **33.4%** Master's degrees, and **51.4%** doctorates

## Age Group

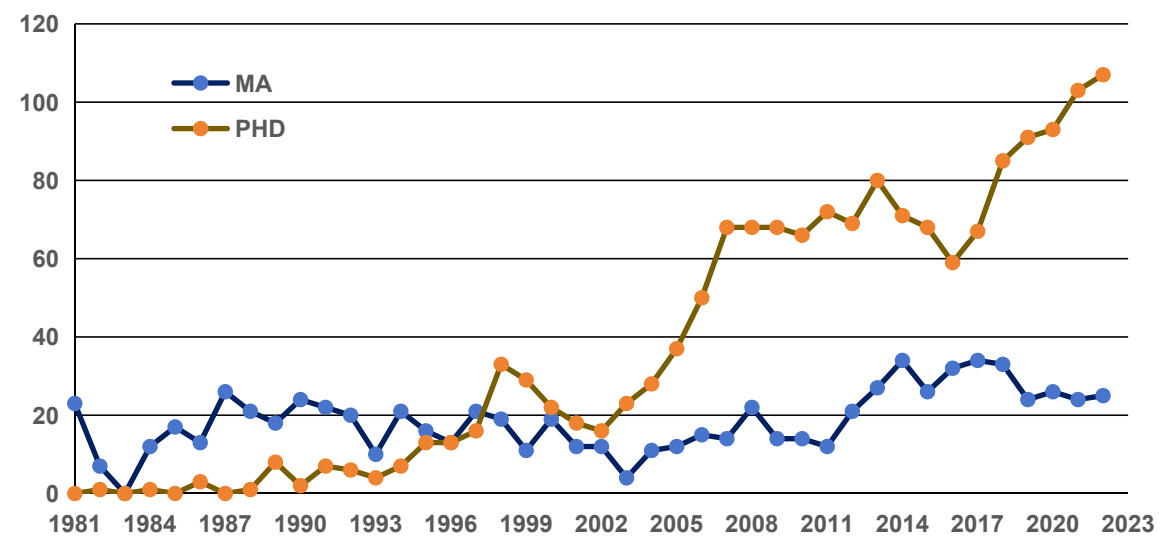


## Recruited by talent programs

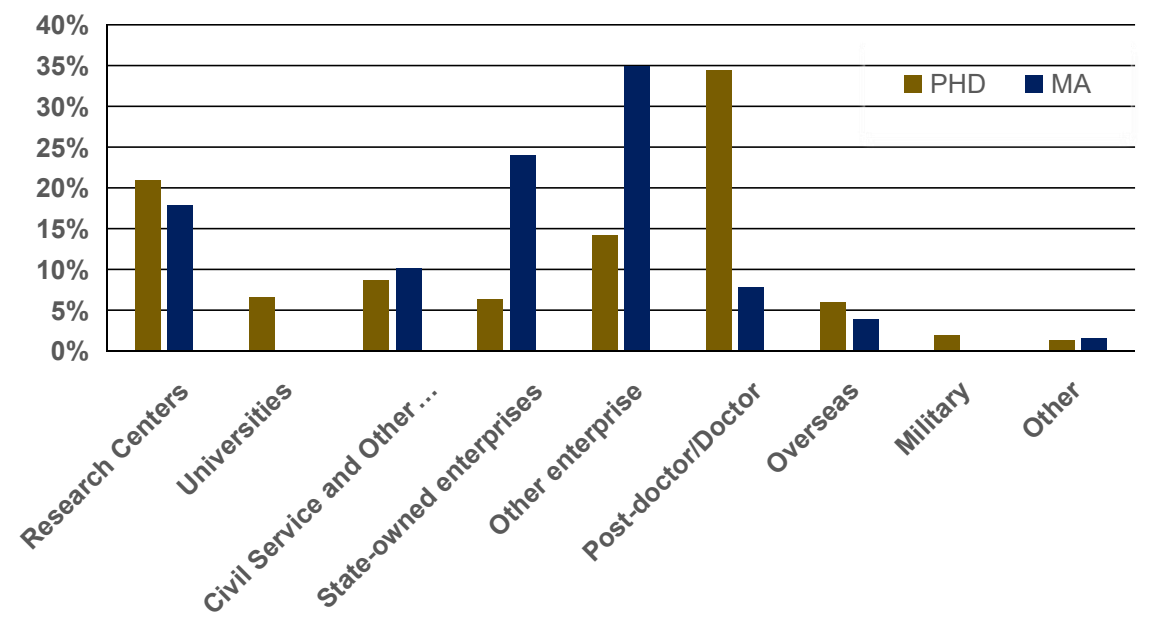




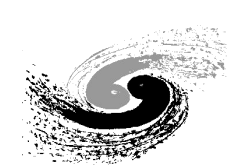
- A total of **611** (2018-2022) [498 (2013-2017) ] postgraduate degrees awarded:  
**479** [345] PhDs, **132** [153] Masters
- Currently (2022), **405** PhD students (including 10 international students) [360 in 2017] and **322** [239] Masters students



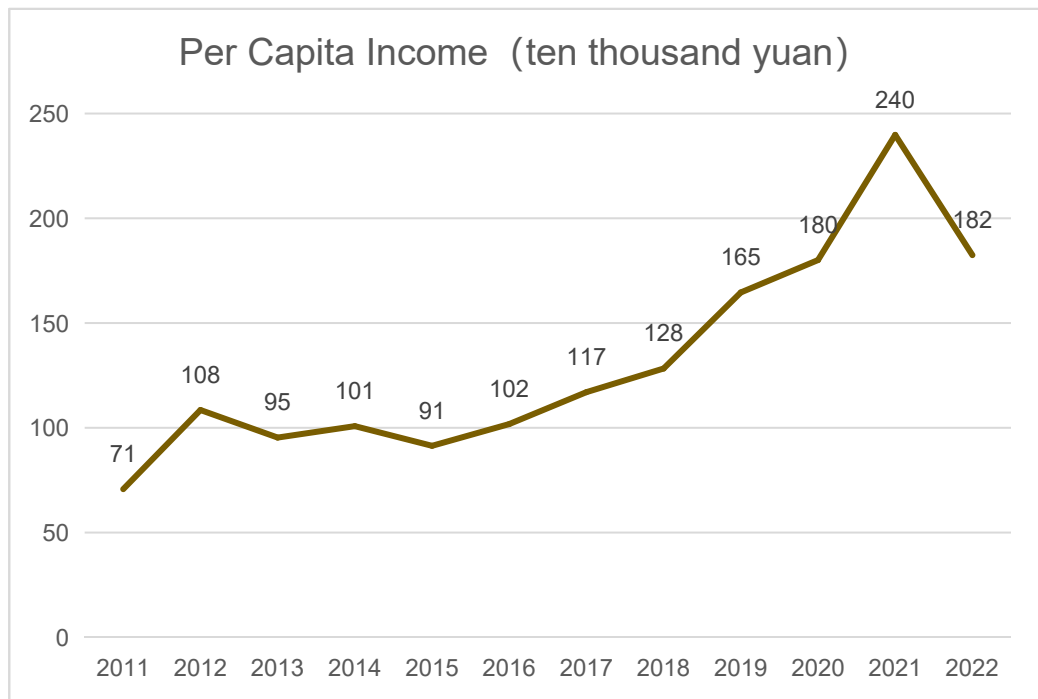
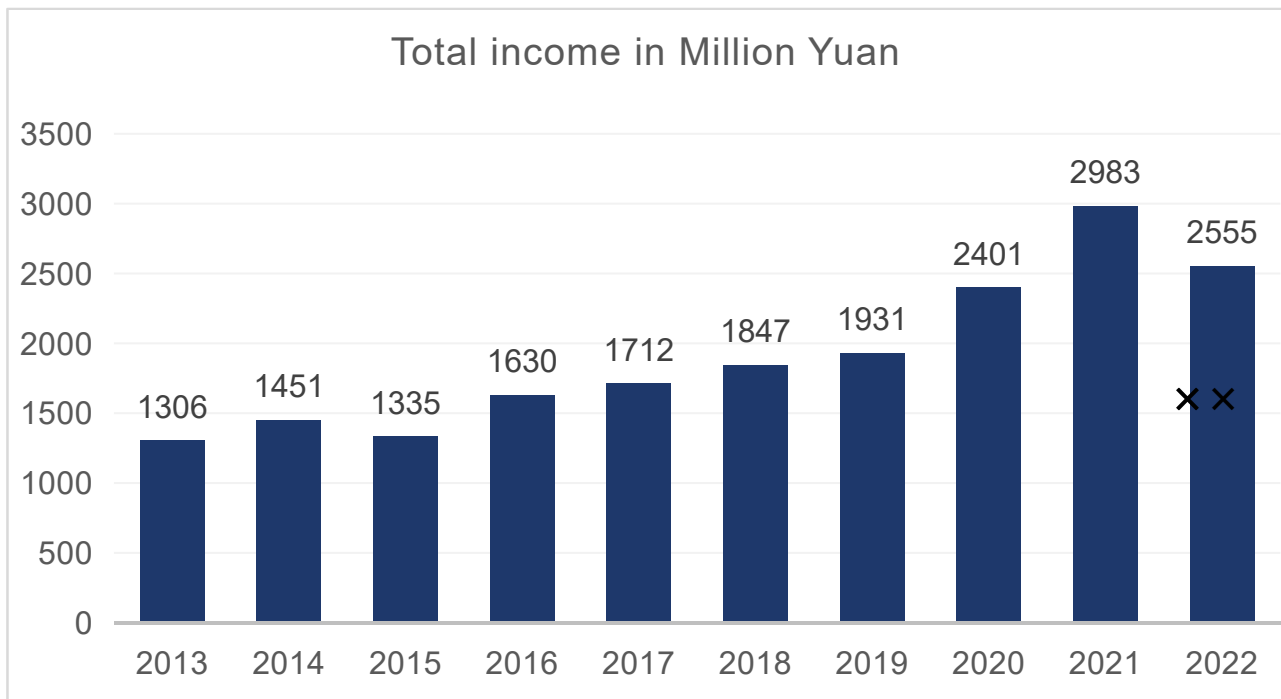
Statistics of Master's and doctoral degrees



Destinations for IHEP postgraduates (2018-2022)



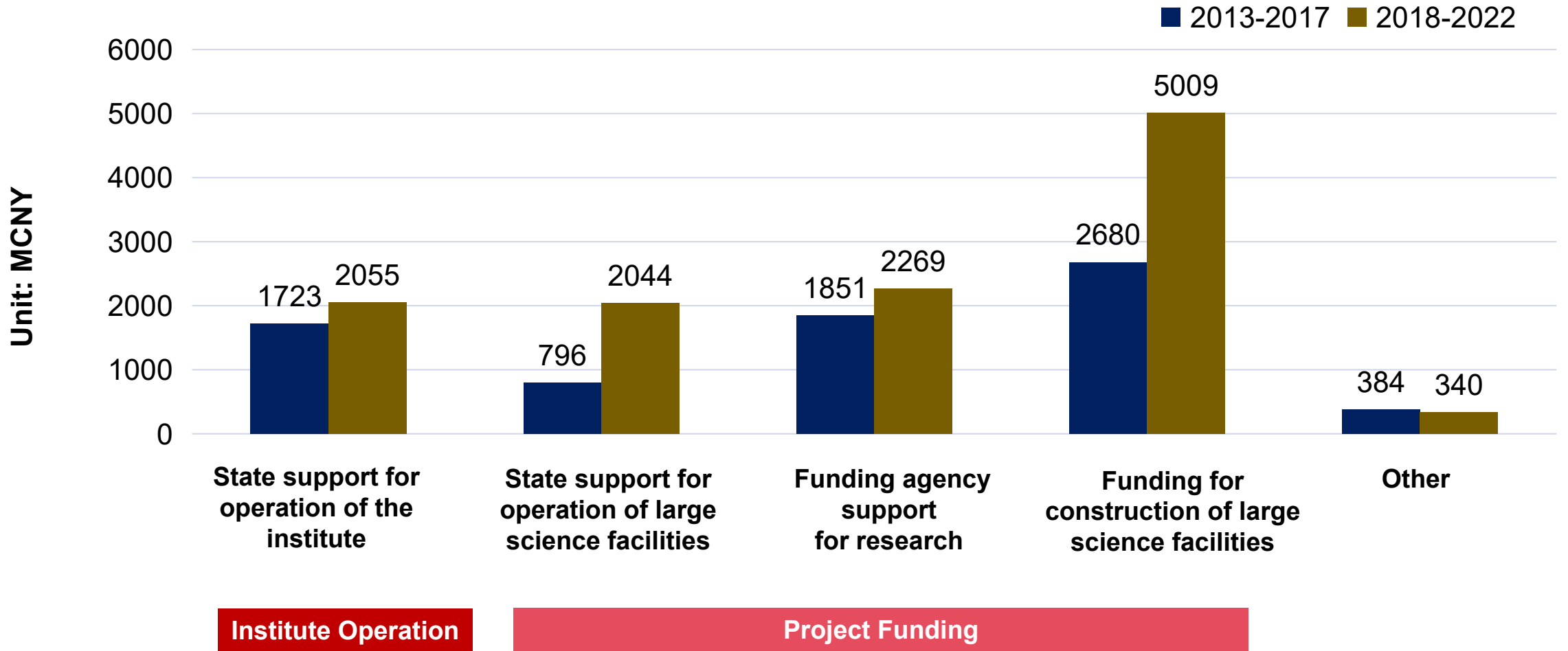
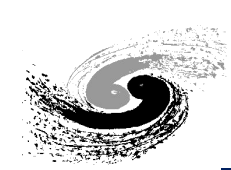
# IHEP Funding

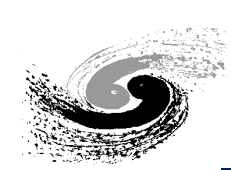


<b>Total</b>	2018-2022	11717	<b>↑ 58%</b>
	2013-2017	7434	

2011-2022, Per capita funding income

**↑ productivity**





# Scientific Output: Publications

Database	Papers	2018	2019	2020	2021	2022
SCI- Indexed	All	1193	1248	1250	1437	1487
EI-Indexed	All	642	757	739	869	872
	Duplicates removed	105	138	67	58	119
ISTP- Indexed	All	92	107	86	16	14
	Duplicates removed	28	28	28	13	5
Other full-text databases	All	240	253	258	313	280
2018-2022 TOTAL	All	1566	1667	1603	1821	1891
2013-2017 TOTAL	All	1322	1470	1338	1519	1262

<b>Total</b>	<b>2018-2022</b>	<b>8548</b>
	<b>2013-2017</b>	<b>6911</b>

 **Five years: 23.7%**

- User articles are not included in the statistics
- ATLAS, etc, only IHEP contribution included

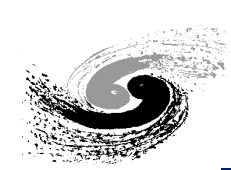
# Highly Cited Articles and international Comparison

InCites Highly Cited Papers	2018	2019	2020	2021	2022	Total
LBNL	166	141	160	130	91	688
ANL	88	101	92	75	51	407
IHEP	57	69	63	54	38	281
SLAC	63	65	68	41	40	277
BNL	60	60	53	47	32	252
FNAL	23	21	16	16	20	96
DESY	21	16	24	13	14	88
KEK	20	18	10	12	10	70

Incites Hot Papers	2021	2022	Total
LBNL	15	20	35
ANL	4	17	21
SLAC	5	15	20
IHEP	5	11	16
BNL	5	10	15
FNAL	1	7	8
DESY	2	2	4
KEK	1	3	4

Exported date Aug 28, 2023.

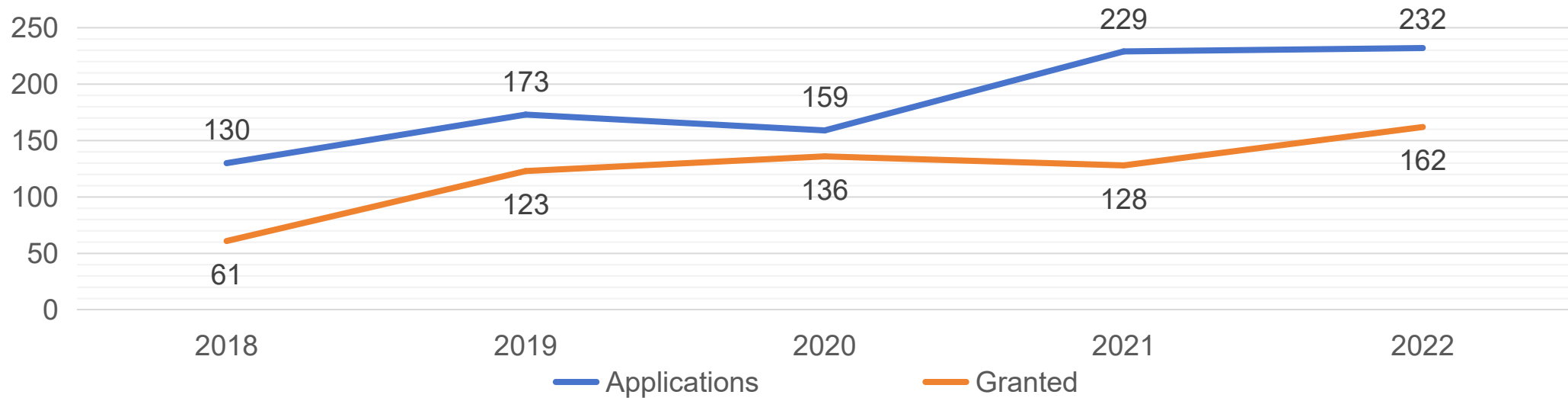
InCites dataset updated 2023-08-25. Includes Web of Science content indexed through 2023-07-31.



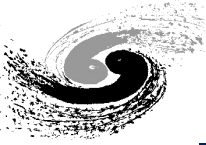
# Technology Output: Patents

■ Patent applications: **923** [2013-2017: 322]

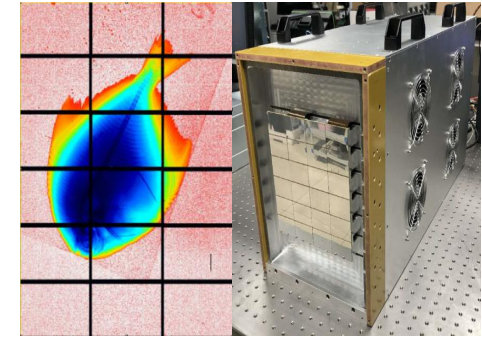
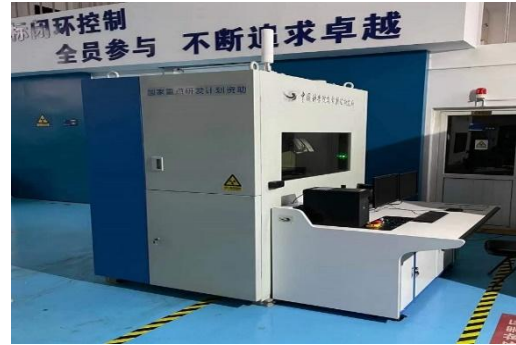
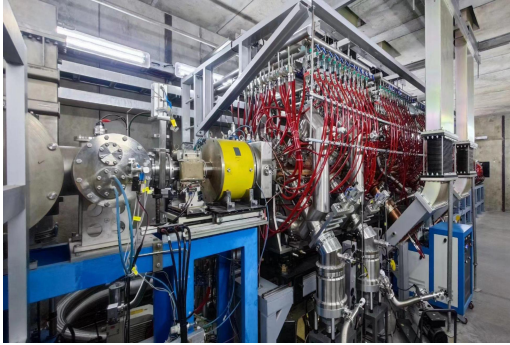
■ Patents granted: **610** [2013-2017: 230]



Numbers of patent applications and patents granted, 2018-2022.



# Technology Transfer: Products



### Application accelerator

### Nuclear medicine and molecular imaging

### Precision testing equipment

### Radiation environment monitoring equipment

### Silicon detector technology

- Boron neutron capture therapy (BNCT)
- Magnet-related Equipment
- a series of industry irradiation accelerators
- a series of superconducting cavities

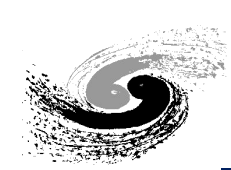
- dedicated breast PET scanners
- micro SPECT/CT scanner
- micro PET/CT scanner

- multiple models of industrial CT equipment
- X-ray three-dimensional micro-CT
- high energy industrial CT
- gamma ray imaging device

- high-speed passive enrichment detection device
- radiation environment monitoring vehicle platforms
- solid-state encoding cameras, channel encoding cameras
- buried gamma neutron detectors

- 2D X-ray silicon pixel detectors





# Campus Development and Improvement



IHEP Yuquan Campus, Beijing City



CSNS & SAPS Pre-Research, Dongguan Campus, Guangdong Province



Jinan Campus, Shandong Province



HEPS & PAPS, Huairou Campus, Beijing City



TIANFU Cosmic Ray Research Center, Chengdu, Sichuan



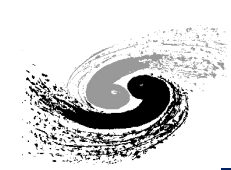
LHAASO measurement and control base



Juno Experiment Campus



AliCPT-1 Experiment Campus



# Major Achievement in Last 5 years

## Large Science Facilities Construction

**LHAASO: successfully built**

**JUNO & HEPS: in progress**

## Particle physics & Particle Astrophysics

**BESIII/DYB/HXMT/LHAASO/GECAM:  
Highly productive and produced some very important results**

## Accelerator physics & technology

**BEPCII/BSRF/CSNS: Efficient and Smooth Operation**

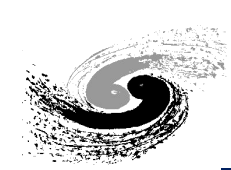
**CEPC: Design and Technology R&D in good shape**

## Multidisciplinary research

**New beamline design for CSNSII, HEPS and SAPS  
Plenty of user results  
In-House research**

## Technology Transfer

**BNCT, imaging and monitoring devices...**



- **No shutdown of BEPC and CSNS, nor the institute**
  - Reduced on-site shift takers, new tools of automation, etc.
  - Onsite shifts mainly by IHEP people, some even have to sleep in the campus
  - Remote shifts for off-site people were arranged, mainly for data quality checks
  - Flexible work plan and schedule, ...
- **Research continued, relying on IT platform services, online meetings, etc.**
- **Construction of large facilities had many difficulties, but no major setback**
  - Delays of schedule, delivery, ...
  - Shortage of manpower, materials, parts, ...
  - No access to work place
- **International collaboration severely affected**

- Many public talks, TV shows, school events, etc.
  - IHEP Colloquium, live broadcast, online >30 million
  - International Year of Basic Sciences for Sustainable Development in 2022
  - Campus Cosmic-ray Observation Collaboration established on 2020
- News appeared in media in five years
  - > 1300 original reports in China's mainstream news media
  - > 200 original reports by overseas mainstream media and journals
- Websites and other social media platforms
  - Views in last five years: website > 173 million, WeChat > 12.8 million, weibo > 30 million, others > 10 million
- Three Science Journals
  - *Chinese Physics C* founded in 1977, 2022 JCR Impact Factor 3.6
  - *Radiation Detection Technology and Methods* founded in 2016, 2022 JCR Impact Factor 0.6
  - A journal for general public: *Modern Physics*
- Books by IHEP scientists in last five years : ~32
- Open Day : ~5000 visitors, ~3 million online annually



International Year of Basic Sciences for Sustainable Development



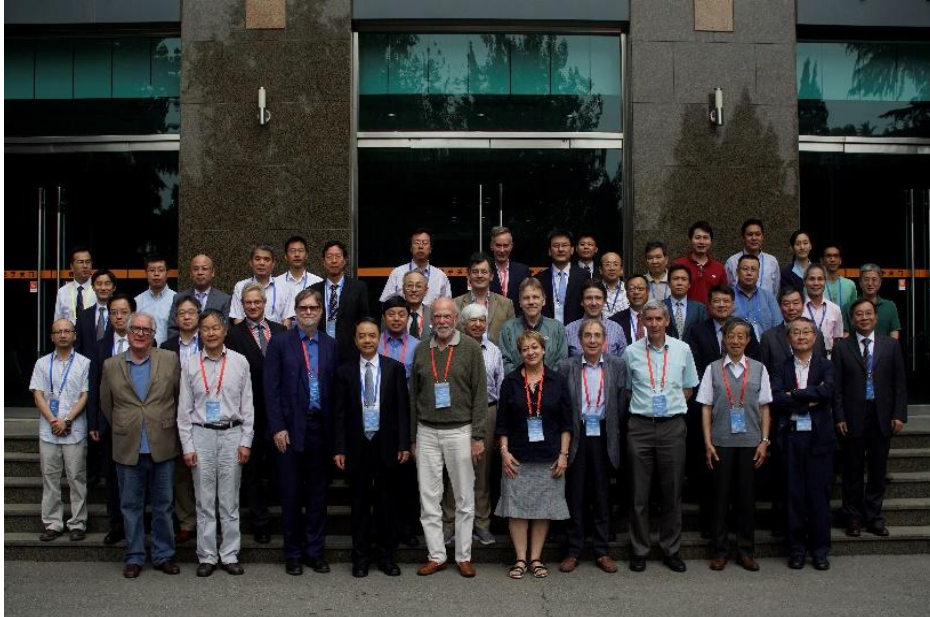
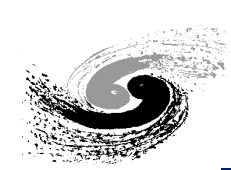
IHEP Colloquium



Open Day

# CONTENT





Expert Diagnostic Assessment  
(Jun. 13-15, 2018 IHEP Beijing)

## 18 experts, 3 Subcommittee

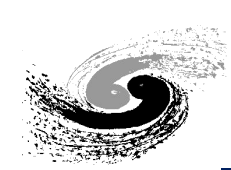
**Subcommittee 1:** Physics

**Subcommittee 2:** Accelerators

**Subcommittee 3:** Multi-disciplinary

Research and Applications

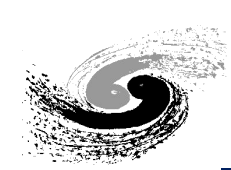
NAME	INSTITUTE	FIELD
Barry Barish (chair)	Caltech (USA)	HEP & Gravitational wave
George Smoot	UC Berkeley (USA)	Theoretical and astroparticle physics
Michel Davier	LAL (France)	Hadron physics
Luciano Maiani	INFN (Italy)	Theoretical hadron physics
Ian Shipsey	Oxford (UK)	Detectors
Chryssa Kouveliotou	GWU (USA)	Gamma ray burst, X ray
Ulf-G. Meissner	Bonn U/F.Z. Juelich (Germany)	Theoretical physics
Katsunobu Oide	KEK (Japan)	Accelerators (5)
Alex W. Chao	Stanford University (USA)	
Peter Ratoff	Cockroft (UK)	
Frank Zimmermann	CERN	
Yoshishige Yamazaki	MSU (USA)	
Tetsuya Ishikawa	RIKEN (Japan)	Photon sources
Lu Yu (于淦)	IoP (China)	Condensed matter physics
Amares Chatt	Dalhousie U (Canada)	Nuclear chemistry, nuclear analysis techniques
Quan Hao (郝权)	HKU (HK, China)	Synchrotron radiation applications
Michel Kenzelmann	PSI (Switzerland)	Neutron applications (2)
Robert McGreevy	ISIS (UK)	



# Recommendations in 2018 and our actions

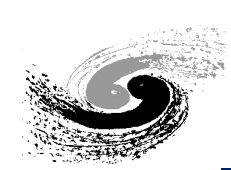
Item	Recommendations	Implementation & achievements
<b>Development plan</b>	“....recommended that IHEP strictly adhere to their already ambitious outlined plan.”	<ul style="list-style-type: none"><li>• Strictly followed the plan</li><li>• Projects and tasks completed in reasonably good shape</li><li>• The 14<sup>th</sup> 5-yrs plan endorsed by CAS</li></ul>
<b>Organizational issues</b>	“....suggest that stronger linkages be developed between the various divisions”; “.... to develop a wise management system (for HEPS).”	<ul style="list-style-type: none"><li>• Cooperation between divisions has been strengthened, cooperation and complimentary works regularly discussed</li><li>• Matrix management scheme to undertake multiple tasks simultaneously: fully utilize existing man power; project &amp; division leaders share responsibilities</li><li>• HEPS management changed, successful</li></ul>
<b>Research programs</b>	“....further nurture and enhance their successful Space Astrophysics and Physics programs”; “....provide well-constructed input on CEPC and JUNO”; “New directions, like CEPC, will have many issues and challenges ....., including the step-up in scale and cost; internationalization; etc.”	<ul style="list-style-type: none"><li>• eXTP and HERD projects are close to be finally approved;</li><li>• Construction of JUNO is delayed but quality in good shape, technical issues mostly resolved. Data taking will start in 2024</li><li>• CEPC design and R&amp;D in good shape, TDR and cost reviewed, to be released this year.</li><li>• internationalization is even more difficult</li></ul>





# Recommendations in 2018 and our actions

Item	Recommendations	Implementation & Achievements
<b>Human resources</b>	“the human resources may not be adequate to support such an ambitious program....for the future”; “....concerned about the lack of diversity at IHEP....”.	<ul style="list-style-type: none"><li>• Since 2017, the institute has attracted 65 top-level staff, 9 from within China, and 56 from abroad; Maintaining relationships with outstanding candidates;</li><li>• Further improved matrix management system for personnel, annual evaluation system, the performance reward and recognition system</li><li>• Refined project planning, implementation and progress control; staggered project schedule helped to have a smooth manpower needs</li><li>• Implemented a Youth Talent supporting and elevation Plan</li><li>• Developed IT service platform to improve work efficiency</li><li>• Hired research assistants to reduce the administrative burden to scientists and engineers</li><li>• Contract external companies for services and utility operation</li><li>• Still lack of academic leaders, internationally known experts, ...</li></ul>

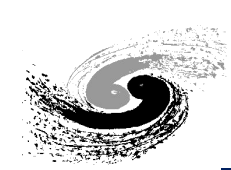


# Recommendations in 2018 and our actions

Item	Recommendations	Implementation & Achievements
<b>Guidance for students and early career personnel</b>	“....short-term bilateral exchange programs be created to other international labs”; “....a student mentoring and advising system be implemented to help students with issues beyond their research.”	<ul style="list-style-type: none"><li>• Cooperative relationships have been established with many universities and research institutions worldwide;</li><li>• Encourage young staff to participate in international academic cooperation, conference and workshops, etc., but severely affected by Pandemic</li><li>• Maintained oversight over all aspects for students, provided necessary support and guidance, in particular during the Pandemic</li></ul>
<b>Others</b>	“.... suggest the word ‘Space’ be added to the title of the Astrophysics Division title and vision/mission description.”	<ul style="list-style-type: none"><li>• The title of Astrophysics Division has not been changed, but the word “space” is emphasised in their vision/mission description.</li></ul>

# CONTENT





## One Development Strategy (Vision)

One of the world’s leading particle physics research centers, and a world-class, large-scale, comprehensive, multidisciplinary research base.

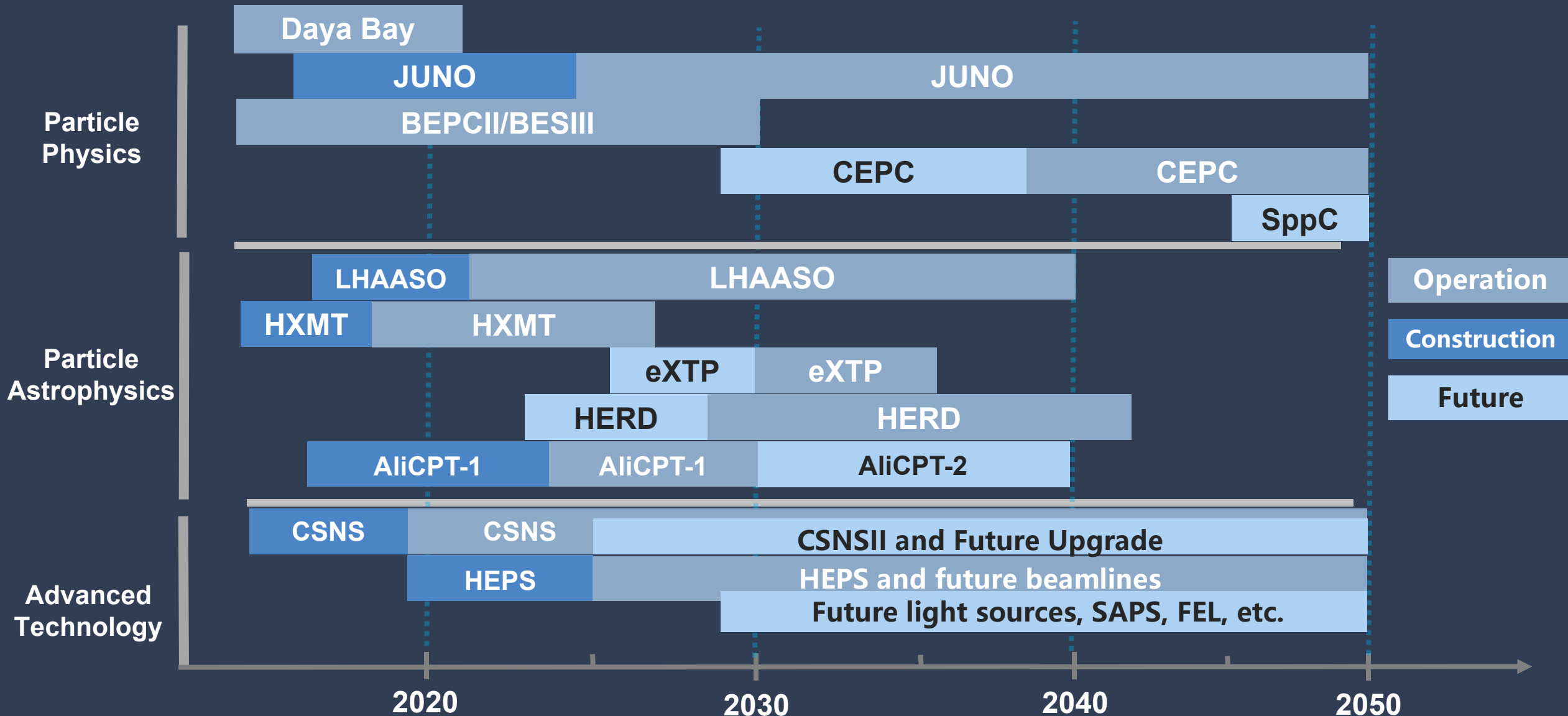
## Seven Areas with Priorities

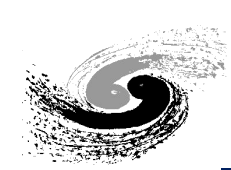
- Charm physics
- Neutrino physics
- Particle Astrophysics
- High Energy Photon Source (HEPS)
- China Spallation Neutron Source II (CSNS-II) and Southern Advanced Photon Source (SAPS)
- Key technologies of large-scale research infrastructures
- Development and application of radiation technologies

## Five Emerging and Frontier Areas

- High Energy Colliders and Collider Physics
- Extreme universe and high energy cosmic rays
- Applications of quantum computing and artificial intelligence in high energy physics
- Physics and technology of plasma wakefield acceleration
- Electronic technology for "wireless detectors"

# Roadmap of IHEP



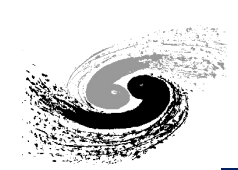


## 2018

- Innovative, home-grown technologies
- Balance different projects given limited resources
- Funding and optimal allocation of resources
- Construction of large facilities, some at remote sites
- Teams of internationally competitive personnel

## 2023

- **Maintain the ambition to be a world leading institution**
- **Original innovative technologies**
- **Funding for future projects and R&D, in particular CEPC**
- **Important achievements in basic and applied sciences**
- **Internationally competitive leaders and teams**
- **International cooperation and internationalization**



- **International assessment is very important and helpful for IHEP and its projects**
- **With all the challenges, we managed to achieve most of our last 5-years goals**
- **The future 5-years are critical, but ambitions and opportunities should not be missed**
- **Looking forward to your evaluation, comments and suggestions**

**Thanks !**