

# **Organization of Nuclear Physics Community in Asian Countries and region**

**H. Sakai**

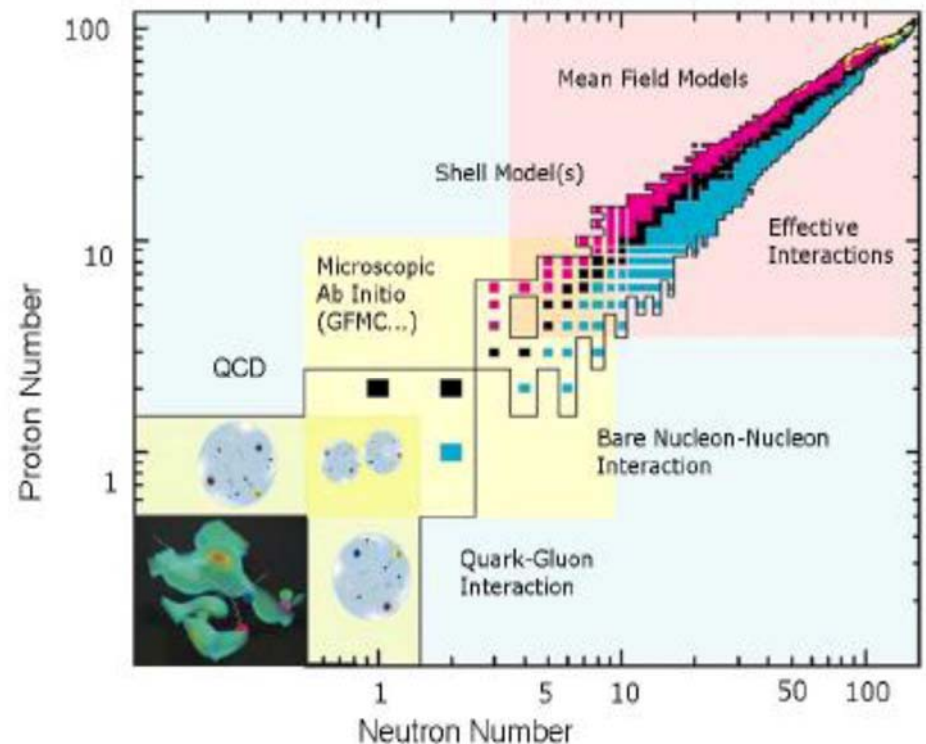
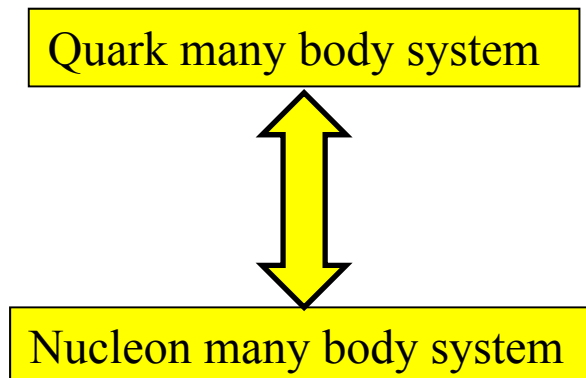
**University of Tokyo**

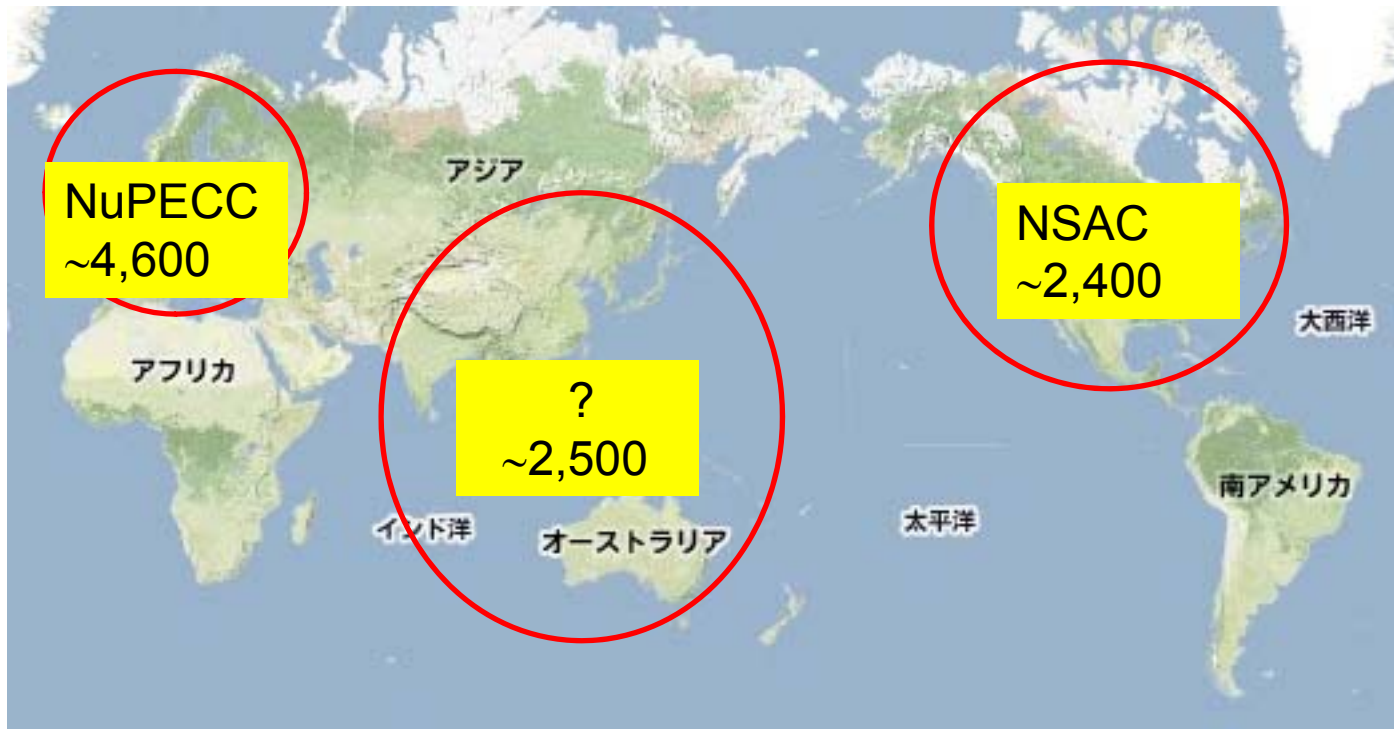
**IUPAP C12 Nuclear Physics, Vice Chair**

**ANPhA, Chair**

## Nuclear Physics

Nuclear physics is the study of atomic nuclei and nuclear matter and of the fundamental forces responsible for their properties and behaviour. It is the quest to understand the origin, evolution, and structure of the matter of the universe that leads to galaxies, stars, and planets, including the Earth, the terrestrial environment, and ourselves. Nuclear physics is important to society because of its extensive applications for energy, national security, health, environmental protection, and industry. Countries have historically supported basic nuclear physics research both in order to advance the scientific field and to develop the expertise, technology, and trained workforce that are needed for their national nuclear-technology related activities.





International Pure and Applied Physics (IUPAP)  
C12 (commission of Nuclear Physics)  
WG.9 (International Cooperation in Nuclear Physics (ICNP))

Strongly suggested to form some  
cooperative organization in Asia  
(May 2008 held at CERN)



Shoji Nagamiya (KEK/J-PARC, Japan),  
Dong-Pil Min (SNU, Korea), Hideyuki Sakai  
(U. Tokyo, Japan), and Wenqing Shen (NSFC,  
China) agreed to launch an initiative to form  
some organization in Asia similar to NuPECC.

# Preparation meetings

## 1st meeting

4th Oct. 2008 : RIKEN Tokyo Office , Japan

## 2nd meeting

21st Jan. 2009 : Seoul National University, Korea

## 3rd meeting → 1st ANPhA Meeting

18th Jul. 2009 Beijing. : Peking University Shao Yuan Hotel : China



ANPhA : Asian Nuclear Physics Association  
亜州核物理協会



# ANPhA launched on 18 July, 2009



# ANPhA Established

## ● 1st meeting

18th July 2009 @Peking University,  
a part of the 3rd preparatory meeting.



**China:~1,000**



**Japan:~1,000**



**Korea:~150**



**Vietnam:~50**

## ● 2nd meeting

17th Jan. 2010 @J-PARC (Tokai)  
in conjunction with the **First ANPhA Symposium**



**Australia:~50**



**India:~300**



**Taiwan:~50**

**Australia is joined to Asia !**



# Bylaws for Asian Nuclear Physics Association (ANPhA)

## Objectives:

### Membership:

5. The Members of ANPhA must be representing organizations in nuclear sciences research in **Asian or Oceanic countries or regions**. In each country/region the representing organization could be different, while the body must be “certain” representing organization which each country/region can authorize.
6. The number of the board members from **one country/region** must be less than five.
7. The representative organizations in some **regions** may also become members of ANPhA, based on mutual agreement related to **the region definition and the names used for the organizations**, which should be consistent with those used by IUPAP.

### Nuclear Science Facilities and Instrumentation in Asia.

### Board:

8. The ANPhA Board is installed with an appropriate numbers of Board members. Initial Board members are Japan (4), China (4) and Korea (3). This number can be added later by the approval of the Board meeting.
9. The Board may select chair, vice chair(s) and secretary. The term of the chair, vice chair(s) and secretary is two years.
10. The Board meetings shall be held on a regular basis, at least annually, at

which all business items shall be discussed.

### **ANPhA Office:**

11. The ANPhA Office shall be located at the RIKEN Nishina Center. The Office is not necessarily permanent and can be changed later.

### **Research Facility Usage of Other Countries/Regions:**

**12. In order to promote collaboration among Asian countries/regions, the ANPhA will create documents for easier access to research facilities.**

**Examples of these are 1) available experimental facilities including major accelerators, 2) major computing resources, etc.**

### **Coordination:**

13. Each country/region must define its own coordinator among the Board members.

**ANPhA web site : <http://ribf.riken.jp/ANPhA/>**

15. The ANPhA supports organizing seminars and workshops, etc. for information exchange among the membership countries/regions.

### **Education:**

16. The ANPhA can organize “Schools” for students. The ANPhA can be instrumental for University- Institution cooperation and exchange programs.

### **Future Planning:**

Eventually, at a later stage of ANPhA, it is useful for ANPhA to create a document for future planning of accelerators and instrumentation in Asian countries/regions.

**ANPhA web site : <http://ribf.riken.jp/ANPhA/>**

## *Asian Nuclear Physics Association (ANPhA)*

Abstract submission to the INPC 2010 Conference is open until **15th Mar.**

The first ANPhA Symposium will be held at Tokai (J-Parc) on January 18-19, 2010.



### **ORGANISATION**

Bylaws

ANPhA Board

Board Meetings

Preparatory Meetings

### **ANPhA ACTIVITIES**

Symposiums

Workshops

Seminars

Schools

### **INFORMATION**

Scientific Events in Asia

Job Opening ( 09 Mar. '10 )

Links

[>>> Contacts for this site <<<](#)

### **Symposiums**

18-19 Jan. 2010

1st. ANPhA Symposium (J-Park/Tokai) [[program/archives](#)]





# **ANPhA Board Members**

**Chair: Hideyuki Sakai (Japan)**

**Vice Chair: Yanlin Ye (China) , Dong-Phil Min (Korea)**

**Secretary: Tohru Motobayashi(Japan)**

**China : Weiping Liu**

**Guoqing Xiao**

**Yugang Ma**

**Yanlin Ye**

**Japan : Shoji Nagamiya**

**Tohru Motobayashi**

**Takaharu Otsuka**

**Hideyuki Sakai**

**Korea : Dong-Phil Min**

**Seung-Woo Hong**

**Wooyoung Kim**

**Vietnam : Dao Tien Khoa**

**Australia : Anthony Thomas**

**India : Bikash Sinha,  
Swaminathan Kalias**

**Taiwan : to be confirmed.**



# Results of 2nd ANPhA Meeting

**ANPhA support symposia, workshops, schools for 2010-2011.**

**(ANPhA Symposium)**

**Second ANPhA Symposium : Seoul in relation to KoRIA project in  
October in Korea.**

**(Schools) : under the “ANPhA spirit ”**

**1. ISPUN (Hanoi, 2011)**

**2. CNS-EFES Summer School (Tokyo, 2010)**

**What is the “ANPhA spirit” ?**

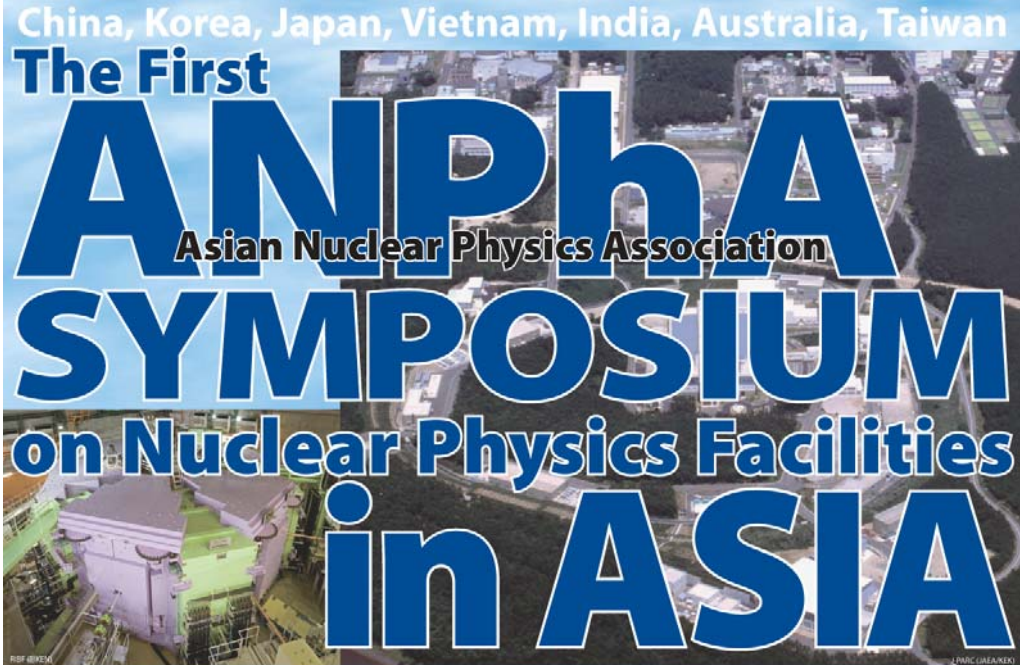
- ANPhA board members should be involved in organization of the symposium / school.
- No direct financial support by ANPhA. Spiritual support only.

**Next ANPhA board Meeting :**

**In conjunction with Second ANPhA Symposium in October.**

China, Korea, Japan, Vietnam, India, Australia, Taiwan

# The First ANPhA Asian Nuclear Physics Association SYMPOSIUM on Nuclear Physics Facilities in ASIA



Ceremony for the Establishment of ANPhA, Beijing, 2009  
亚洲核物理联合会 (ANPhA) 成立仪式, 北京, 2009



**on 2010, Jan, 18(Mon), 19(Tue) at J-PARC (Tokai, Japan)**

## Program

- ◆ Introduction of Asian Facilities
  - Japanese Facilities
  - Korean Facilities
  - Chinese Facilities
  - Indian Facilities
  - Other Countries' Facilities
- ◆ Toward International Collaboration
- ◆ J-PARC Tour

## Advisory Board

Hideyuki Sakai (U.Tokyo, Japan, Chair)  
Tohru Motobayashi (RIKEN, Japan, Secretary)  
Takaharu Otsuka (CNS, U.Tokyo, Japan)  
Dong-Pil Min (SNU, Korea, Vice Chair)  
Seung-Woo Hong (Sungkyunkwan Univ., Korea)  
Wooyoung Kim (Kyungbuk National Univ., Korea)  
Dao Tien Khoa (VAEC, Vietnam)  
Yanlin Ye (PKU, China, Vice Chair)  
Weiping Liu (CIAE, China)  
Guoqing Xiao (IMP, China)  
Yugang Ma (SINAP, CAS, China)  
Anthony W. Thomas (Australia)  
Bikash Sinha (VECC/SINP, India)  
S. Kailas (BARC, India)  
Pauchy W.-Y. Hwang (NTU, Taiwan)

## Local Committee

Shoji Nagamiya (J-PARC)  
Ken-ichi Imai (Kyoto/JAEA)  
Susumu Sato (JAEA)  
Hiroyuki Sako (JAEA)  
Toshiki Maruyama (JAEA)  
Kazuhiro Tanaka (KEK)  
Shin'ya Sawada (KEK)

# **The First ANPhA Symposium @ Tokai, Japan**

**Symposium: 18-19 Jan. 2010**

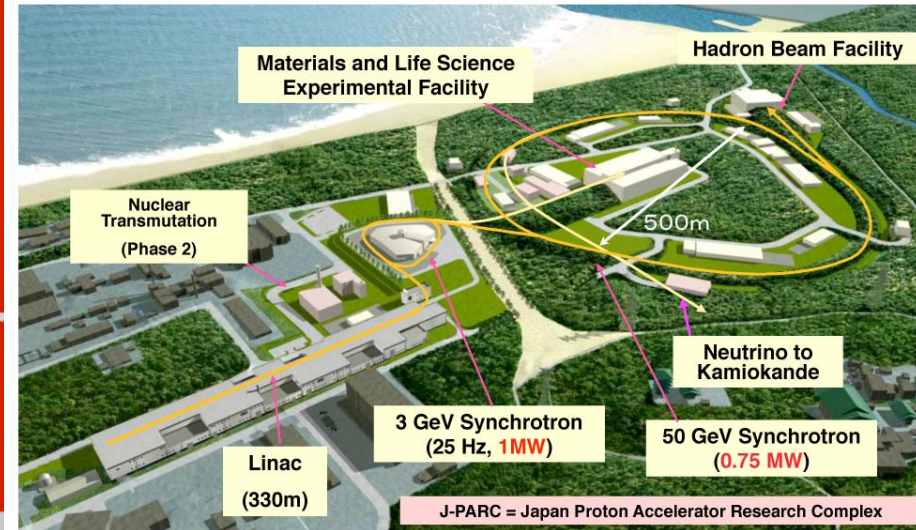
January 18, 2010  
1st ANPhA Symposium

# J-PARC Facility

Tomofumi Nagae  
Kyoto University



## J-PARC Facility

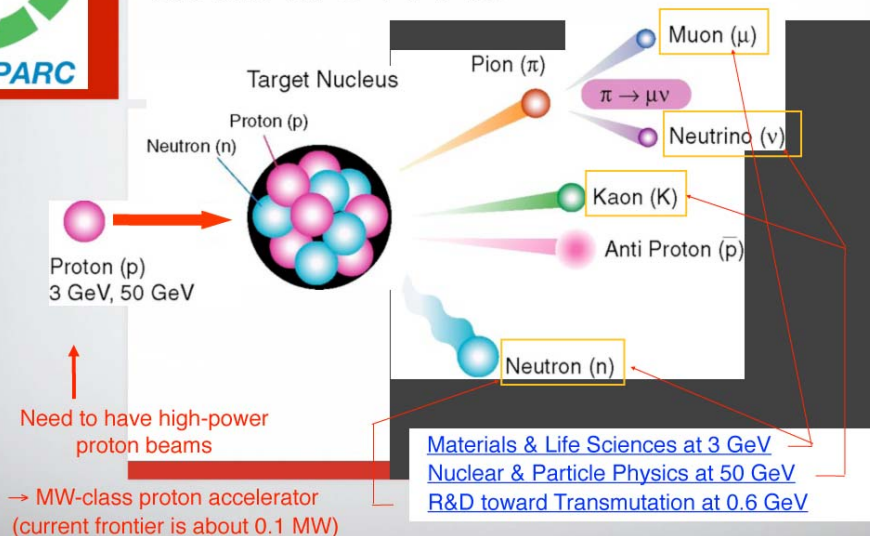


Joint Project between KEK and JAEA

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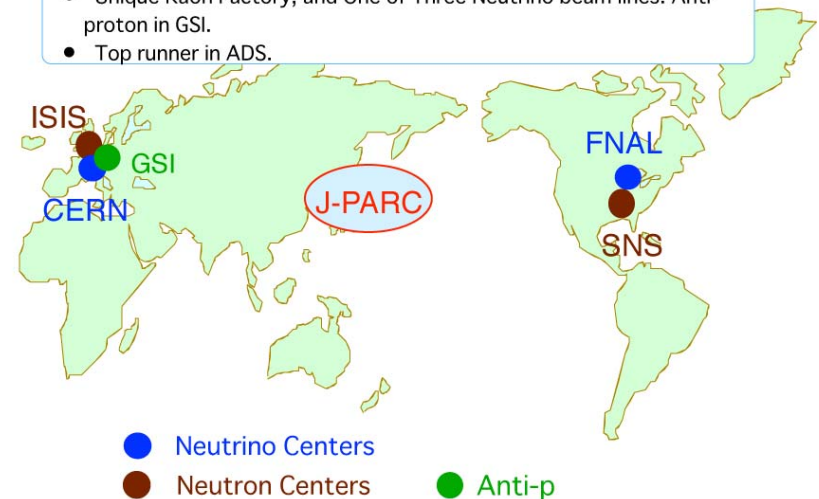


## Goals at J-PARC



## International Research Center

- One of Three major Neutron Sources in Material and Life Science
- Unique Kaon Factory, and One of Three Neutrino beam lines. Anti-proton in GSI.
- Top runner in ADS.

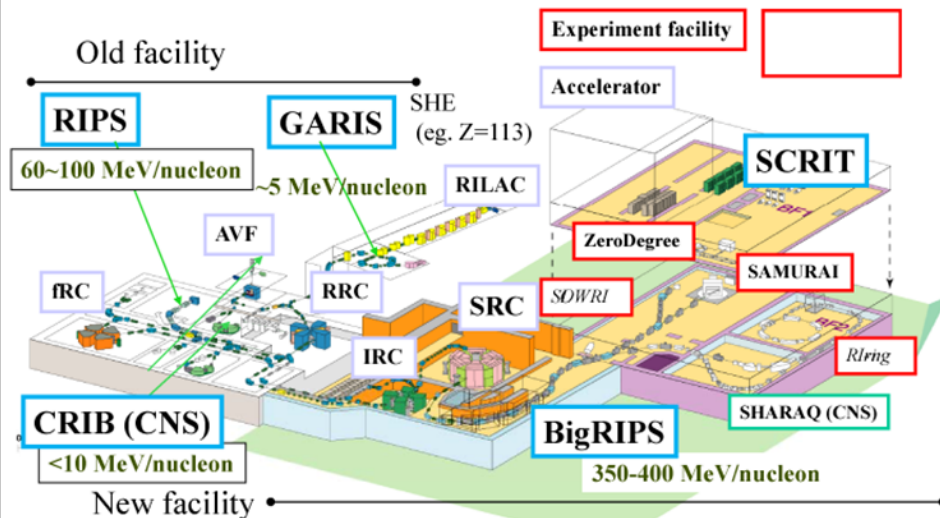




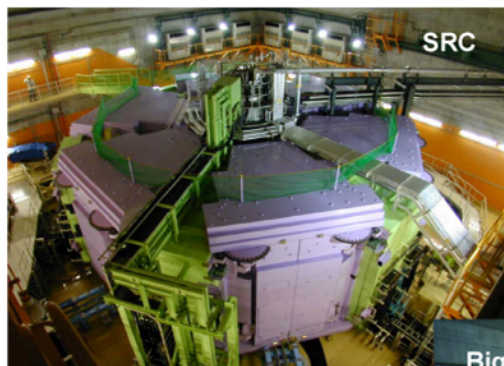
# RIKEN RI Beam Factory

H. Sakurai  
RIKEN Nishina Center

## RIKEN RI Beam Factory (RIBF)



Intense (80 kW max.) H.I. beams (up to U) of 3454 MeV at SRC  
Fast RI beams by projectile fragmentation and U-fission at BigRIPS  
Operation since 2007



**SRC**  
World's First and Strongest  
K2600 MeV  
Superconducting Ring Cyclotron

400 MeV/u Light-ion beam  
345 MeV/u Uranium beam



**BigRIPS**  
World's Largest Acceptance  
9 Tm  
Superconducting RI beam Separator

~250-300 MeV/nucleon RIB

## Promotion of Nuclear Physics Programs Under Domestic/International Collaborations



Co-organization of PAC with CNS, Univ. of Tokyo  
External investment by CNS: SHARAQ, CRIB

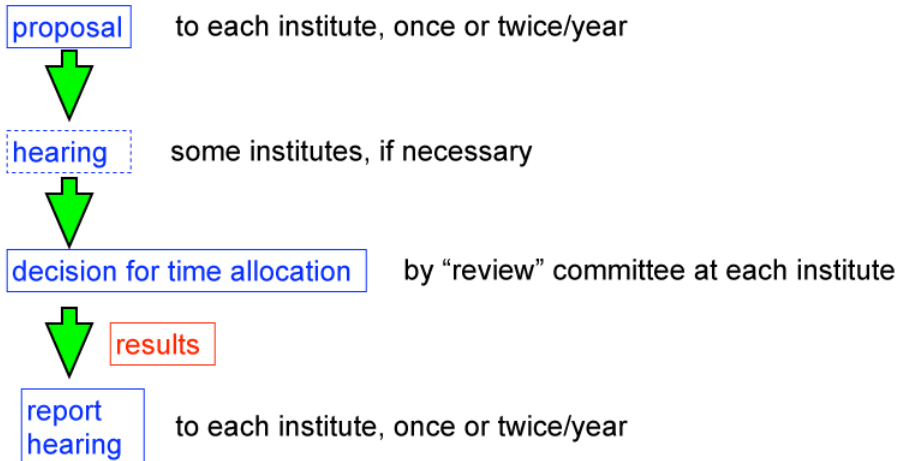
# Computing Facilities in Japan

Sinya Aoki  
University of Tsukuba

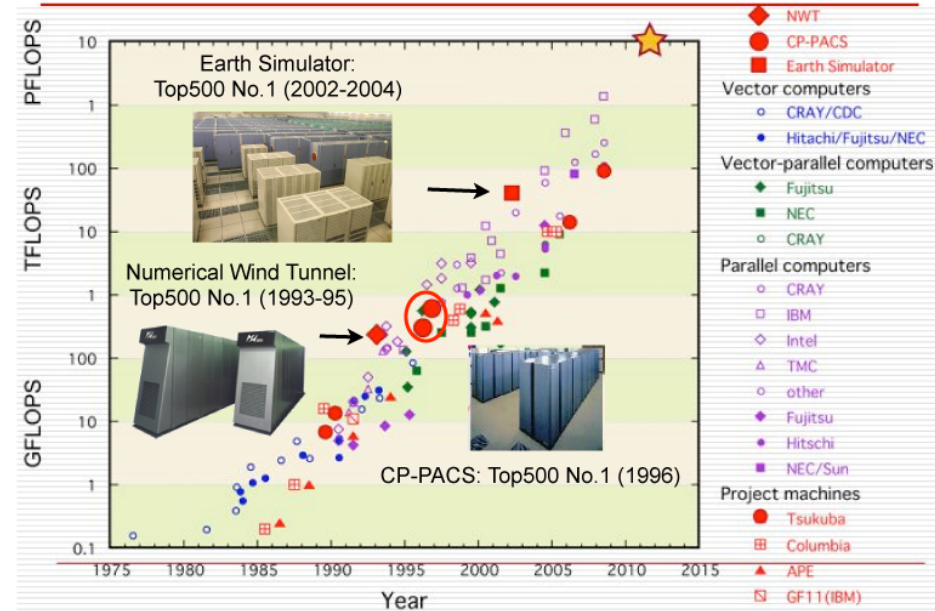
The first ANPhA Symposium  
Jan. 18-19, 2010  
J-PARC, Tokai, Japan

## Nation-wide usage programs

All facilities mentioned so far can be used for physicist in Japan without any charges.



# Development of supercomputers



## Next Generation Supercomputer Project

- development of 10 PetaFlops-class system
- research center in computational science
- Period: Japanese FY 2006-2011
- Budget: 115B¥ (1.25B\$)
- RIKEN is responsible for the project

# Research Center for Nuclear Physics Osaka University

Tadafumi Kishimoto  
Physics Department and RCNP  
Osaka Univ.

2010/1/18 ANPHA

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## What is RCNP

- Founded in 1971
  - **User based** “Research Center for Nuclear Physics”
- 1973 AVF cyclotron
- 1991 Ring cyclotron
- 1997 Oto Cosmo Observatory
- 2000 LEPS@SPring8
- 2010 Research Center for Subatomic Science (6 years)
- 19 scientific members, 6 technical staffs
- About 10 post doctors
- About 30 graduate students

2010/1/18 ANPHA

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### Osaka University Cyclotron Facility (Suita campus)

Neutron TOF 100m tunnel



1m × 1m × 10cm × 6  
scintillators



RI beam, UCN

Ring cyclotron K=400 MeV



p to Kr

AVF cyclotron  
K=140 MeV



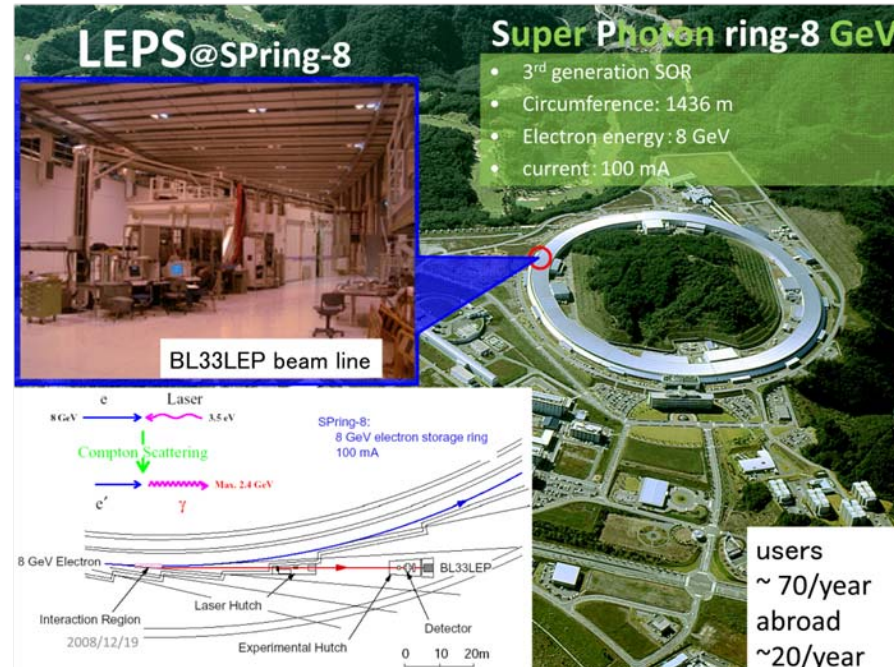
High resolution  
Magnetic spectrometers



users  
~ 300/y  
abroad  
~ 40/y

2010/1/18 ANPHA

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# Progress in HIRFL-CSR

Guoqing Xiao for CSR team

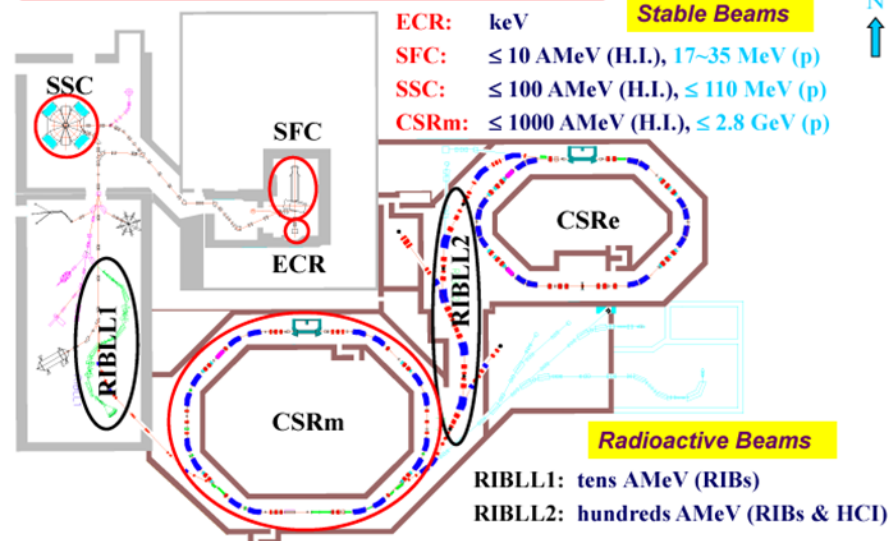
xiaogq@impcas.ac.cn



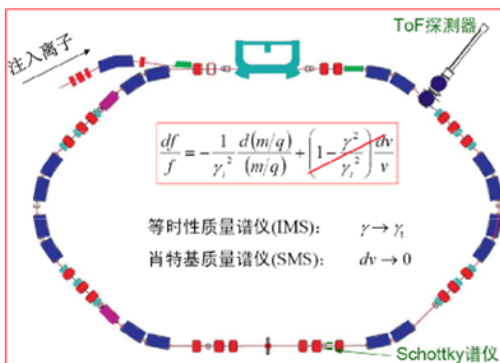
Institute of Modern Physics (IMP), Chinese Academy of Science (CAS)  
National Laboratory of Heavy Ion Accelerator in Lanzhou

## Introduction to HIRFL

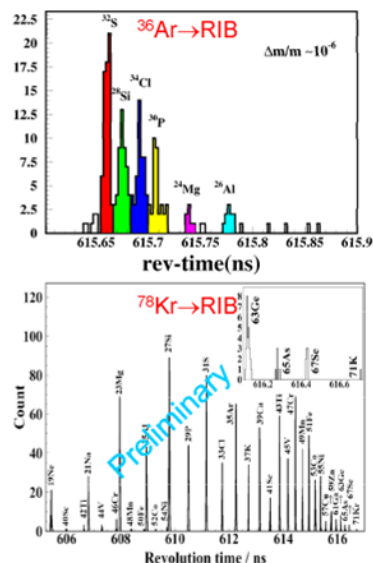
HIRFL: Heavy Ion Research Facilities in Lanzhou



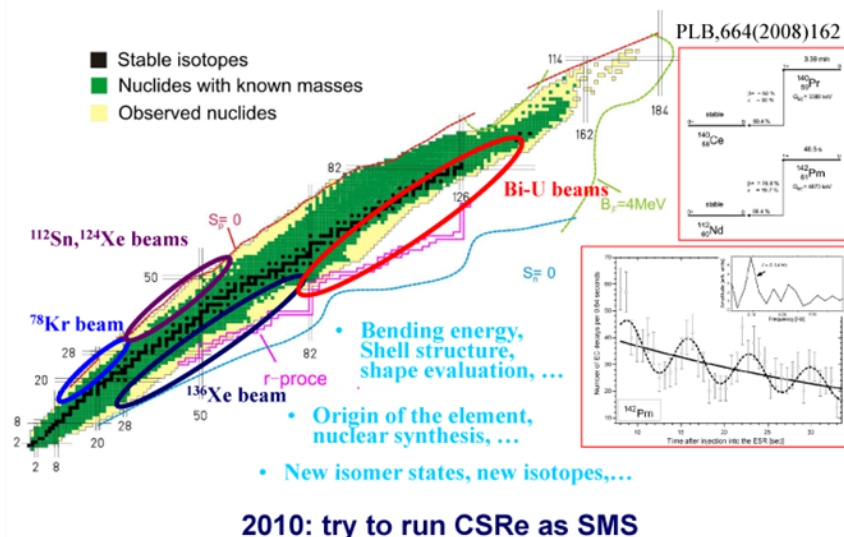
RIBLL2+CSRe  
Isochronous mass spectrometer



- Dec. 2007:  $^{36}\text{Ar}$  test run
- Jan. 2009:  $^{78}\text{Kr}$  test run



## Example 1: Mass & Decay Measurement at CSRe



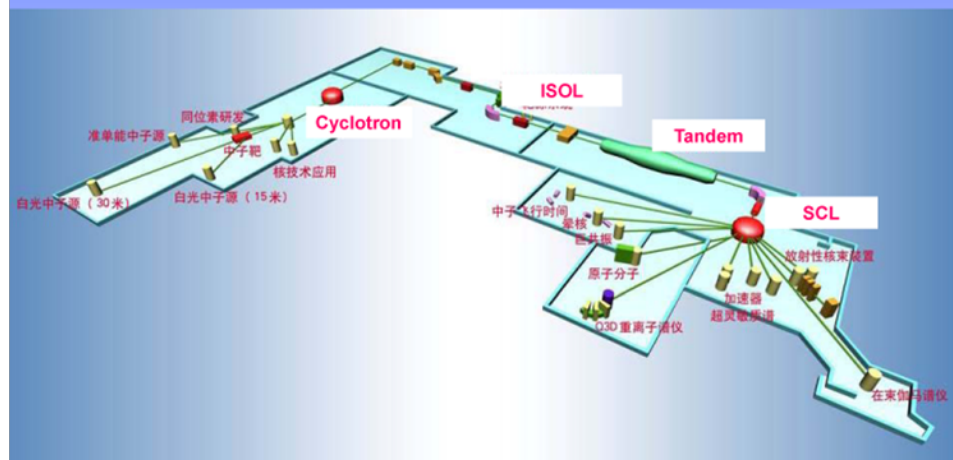
# Perspective of BRIF project in CIAE

Weiping Liu

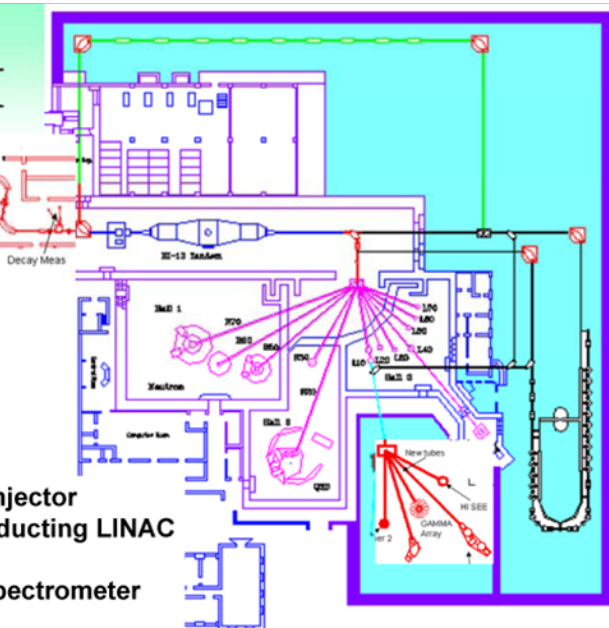
CIAE, China institute of atomic energy  
The first ANPhA Symposium,  
Tokai, Jan. 18-29, 2010

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100 MeV 200  $\mu$ A compact proton cyclotron  
20000 mass resolution ISOL, 2 MeV/q super-conducting LINAC  
Supported in 2004, commissioned in 2012-2013



## BRIFII



- New low beta RFQ injector
- 17 MeV/q super-conducting LINAC
- RMS
- Large acceptance spectrometer
- Gamma array
- Radiation facilities

30/35

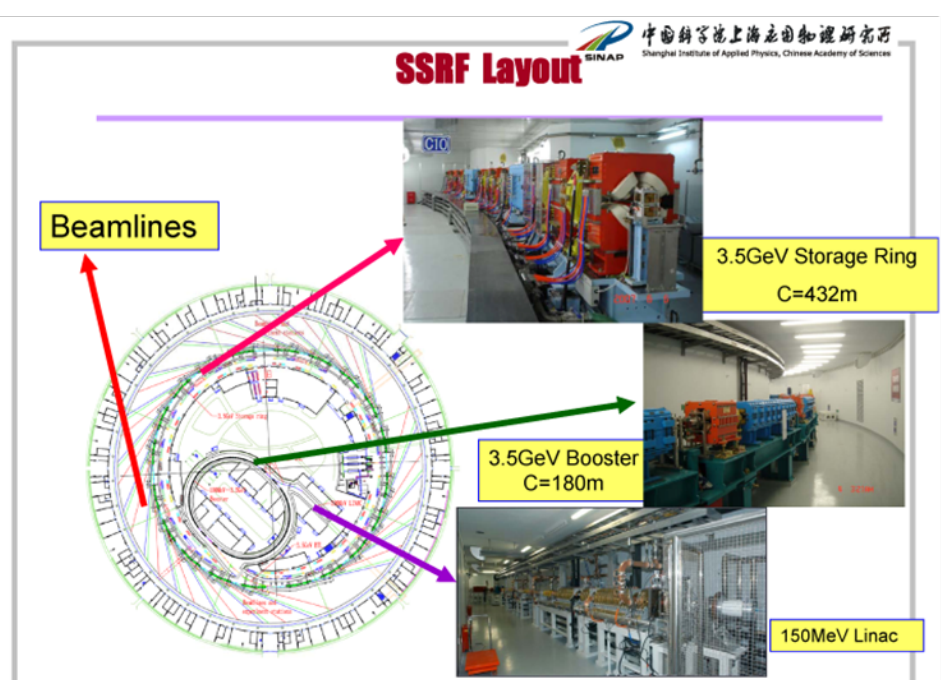
## World existing ISOL facilities

Facility location	Driving beam intensity	ISOL Mass res.	Post Acc. RIB Intensity	Upgrade Year
BRIF, Beijing	Cyc. p 100 MeV 200 $\mu$ A	20000	Tandem+SCB 17 MeV/q, 2013 $10^{8-11}$ pps	BRIFII 34 MeV/q, 2017
ISAC, Vancouver	Cyc. p 500 MeV 100 $\mu$ A	10000	Linac 6.5 MeV/u $10^8$ pps	New e-linac driving 2015
Louvain	Cyc. K30 p 30 MeV 200 $\mu$ A	LISOL	Cyc. K110 0.6-1 MeV/u	
SPIRAL, Caen	Cyc 95 MeV/u HI	ISOL	Cyc K265	SPIRAL II, 2013 SC Linac 40 MeV d
ORNL, Oak Ridge	Cyc. K105 p or $\alpha$	1000, 20000	Tandem 25 MV, 4-12 MeV/u, $10^{5-6}$ pps	
ISOLDE, Geneva	Syn. p 1.4 GeV 2 $\mu$ A	1000, 10000	Linac 0.3-3 MeV/u, $10^{11}$ pps	10 MeV/u
TRIAC, Tokai	Tandem 20MV p 3 $\mu$ A HI, 15 MeV/q	1200	Linac, 0.17-5 MeV/u	Will be moved somewhere
EXCYT, Catania	Cyc K800 HI	ISOL	15-MV tandem	
RIKEN	Photo induce fission by 150MeV, 1kW e	ISOL	Collide with e by SCRIT	Install in 2010
JYFL, Jyvaskyla	Cyc. K130, p 1 $\mu$ A, HI	IGISOL Many terminals		

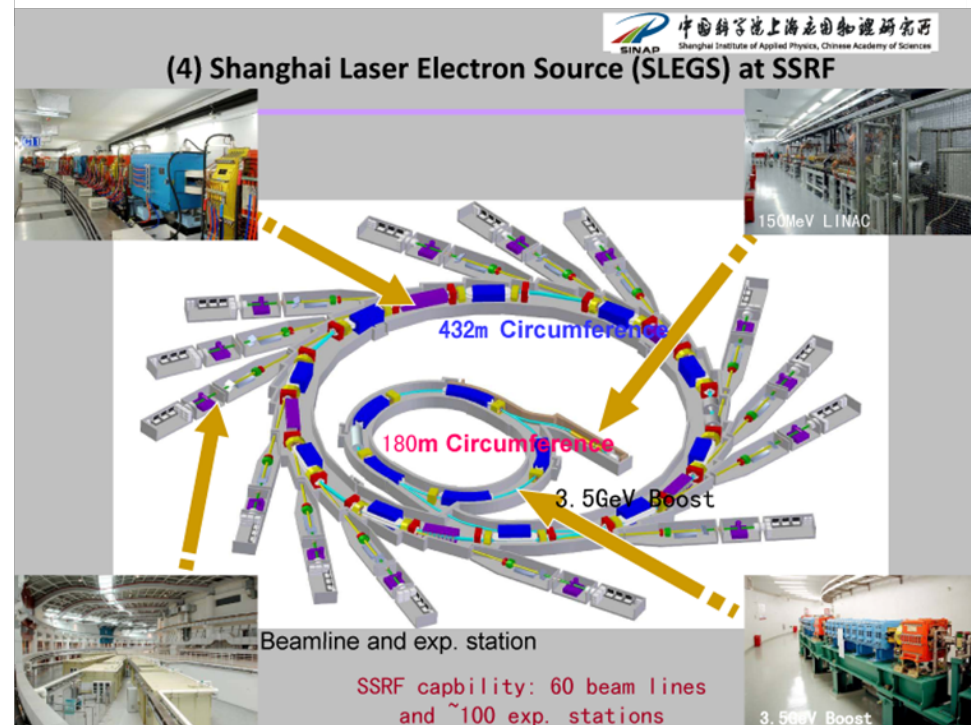
# Shanghai Synchrotron Radiation Facility (SSRF) and SLEGS-prototype



## SSRF Layout



## SLEGS-prototype and the future plan





# Heavy Ion Accelerator for RIB KoRIA in International Science & Business Belt

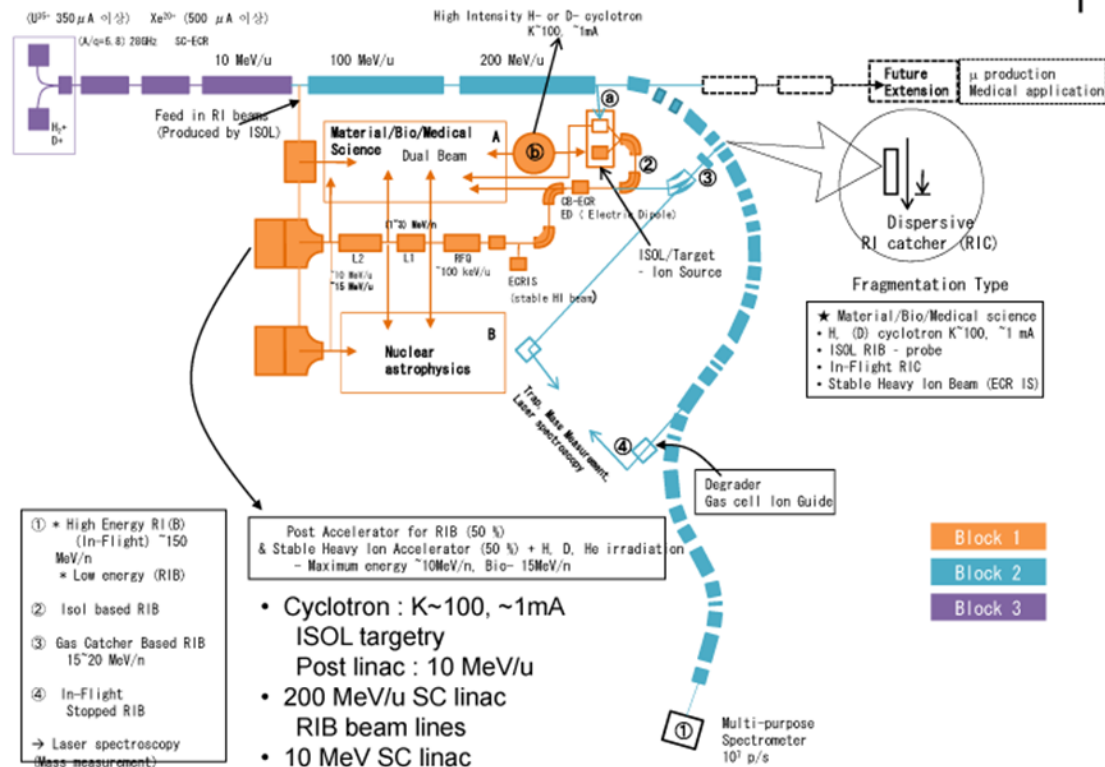
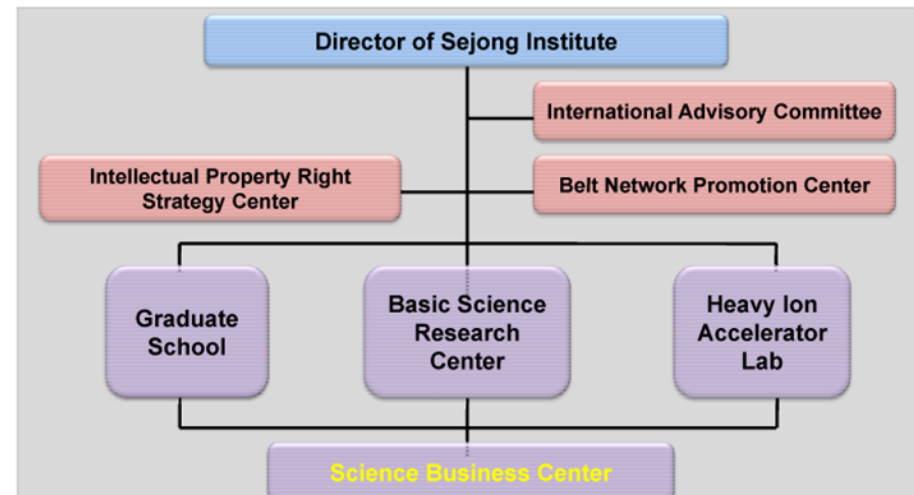
S. W. Hong  
Sungkyunkwan University (SKKU)

The First ANPhA Symposium at J-PARC

## General features of the facility

- Block 1 : Cyclotron : K~100, ~1mA  
ISOL targetry  
Post SC linac : 10 MeV/u
- Block 2 : 200 MeV/u driver SC linac for all ions and RIB
- Block 3 : 10 MeV SC linac for injection of stable beams
- A broad range of experimental tools (fast, stopped, reacceleration)
- Two ISOL target stations and an in-flight fragmentation target

Sejong Institute as announced Jan. 11, 2010

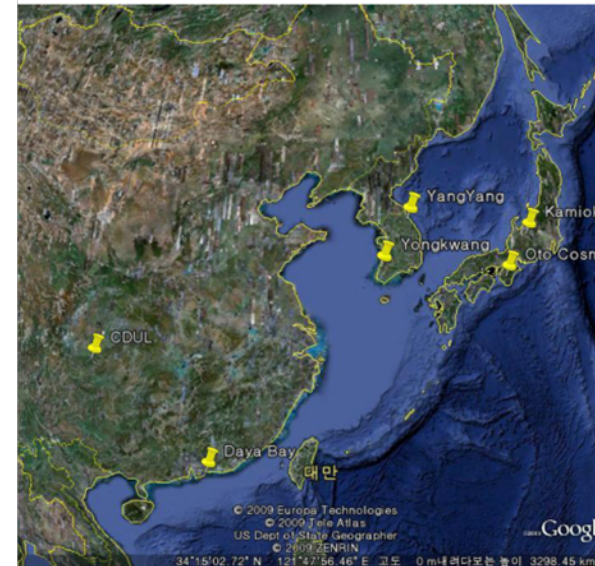


# RENO and Related Physics

Yeongduk Kim  
Sejong University

First ANPHA Symposium  
Jan. 19, 2010

## Neutrino Laboratories in Asia



SK  
 $\Theta_{13}$  exp  
RENO  
DAYA BAY  
Double Beta  
CANDLES( $^{48}\text{Ca}$ )  
CaMoO $_4$  ( $^{100}\text{Mo}$ )  
CDUL : New Lab.

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## RENO



### Yonggwang Nuclear Power Plant

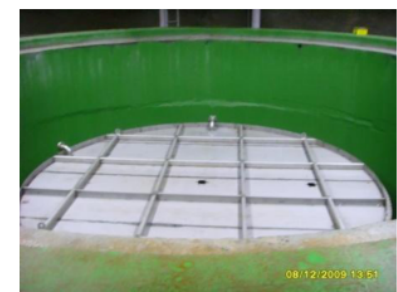
- Six ~ 1 GW<sub>e</sub> class PWRs
- Total average thermal power of 16.4 GW (max 17.3 GW)
- Started operation in 1986~2002.
- Operational factor > 90%



## Near & far tunnels are completed

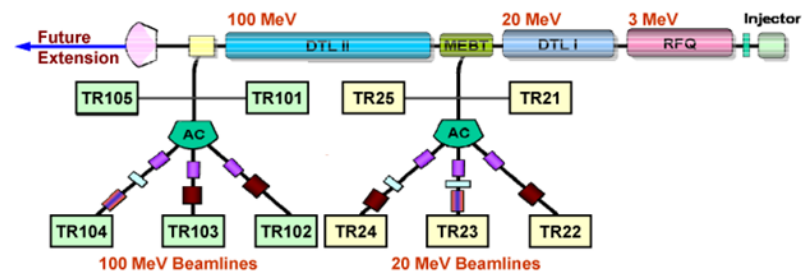
(2008.6~2009.3)

by Daewoo Eng. Co. Korea





## PEFP Accelerator & Beamline



### Features of the PEFP linac

- 50 keV Injector (Ion Source + LEBT)
- 3 MeV RFQ (4-vane type)
- 20 & 100 MeV DTL
- RF Frequency : 350 MHz
- Beam Extractions at 20 or 100 MeV
- 5 Beamlines for 20 MeV & 100 MeV
- Beam to be distributed to 3 BL via AC

Output Energy (MeV)	20	100
Peak Beam Current (mA)	20	20
Max. Beam Duty (%)	24	8
Avg. Beam Current (mA)	4.8	1.6
Pulse Length (ms)	2	1.33
Max. Repetition Rate (Hz)	120	60
Max. Avg. Beam Power (kW)	96	160

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# Proton Engineering Frontier Project\*

Kui Young Kim  
on behalf of the Proton Engineering Frontier Project  
Korea Atomic Energy Research Institute

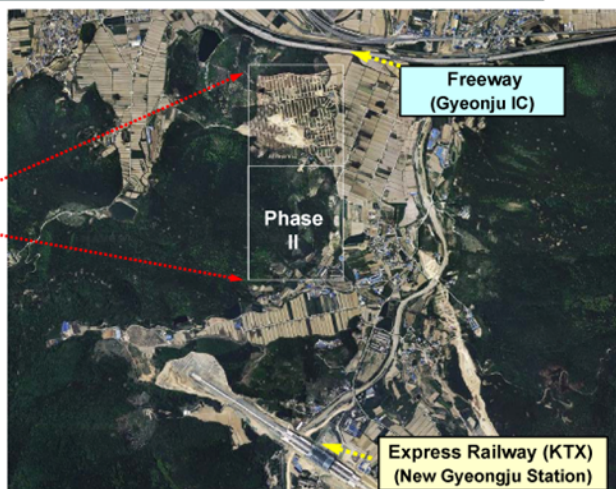


\* Supported by the Ministry of Education, Science & Technology, Korea

## III. Construction Work

### The Project Site

- ❖ The Project Site (Area: 440,000 m<sup>2</sup>) is located at Gyeongju.  
(The capital of Shilla dynasty for 992 years, from BC 57 to AD 935.)



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# ACCELERATOR ACTIVITIES AT MUMBAI & DELHI

## NUCLEAR PHYSICS RESEARCH

*S.KAILAS (Bhabha Atomic Research Centre,Mumbai)*

*A.ROY(Inter University Accelerator Centre,Delhi)*

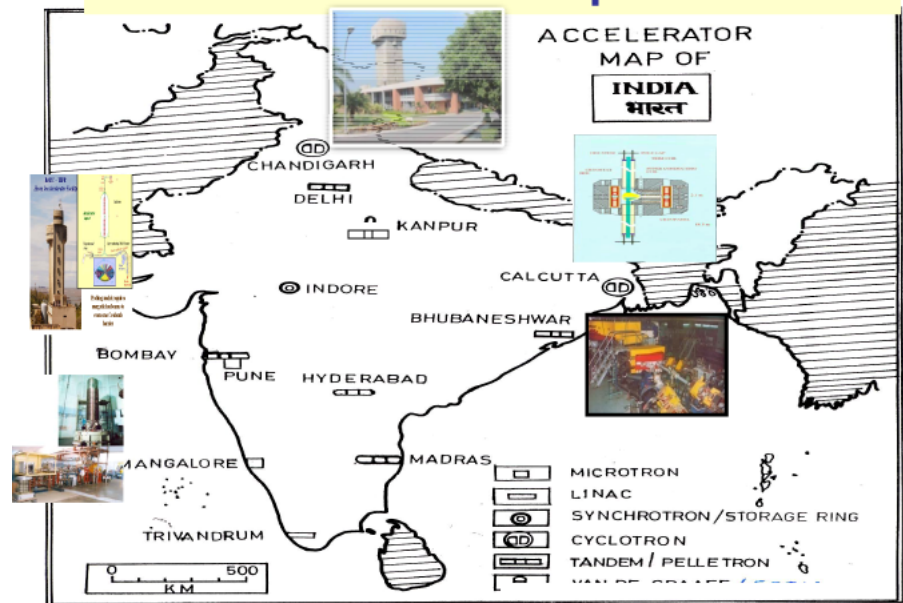


**MUMBAI**



**DELHI**

## ION Accelerator Map of India



## Light & Heavy Ions For Nuclear Physics Research

LIGHT & HEAVY IONS	VERY LOW E 1 to - 5.5 MeV	1 MV (CG) TIFR 5.5 MV(VDG) BARC PU cyclotron IIT(Kanpur)	Isobaric Analogue Resonances Nuclear Spectroscopy of Low Lying States Coulomb ex Nuclear Optical Model at Sub-Coulomb energies CP,n-fission
	LOW E 30 MeV p 80 MeV $\alpha$	K = 130 (VEC) VECC	Quasi Molecular Resonances High Energy Gammas Nuclear Fission
	MEDIUM E 1 - 7 MeV/A	14 MV(Pellet) (TIFR) 15MV(Pellet) (IUAC) HI (VEC) VECC IOP,FOTIA	Sub-Barrier Fusion &Pre-Equilibrium Fission High Spin Spectroscopy GDR IMF Breakup Orbiting Pheno.
	HIGH E 10 -50 MeV/A	SC Linac (TIFR,IUAC) SCC (VECC) ECR + SC Linac	DIC & QF Weakly Bound Proj. Multifragmentation LGP PEQ Spectroscopy of HN & LN RI Nuclei at Extreme Ex, J , T & A

## India -International Collaborations

**CERN - LHC** India has Observer Status

**FAIR, Germany-** India is a member

**ITER –** India is a member

**IAEA, Vienna-** NDS

**MOU with** Fermi lab, USA,

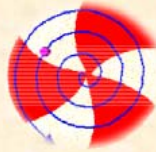
**GANIL, CEA, ILL, France**

**RIKEN, KEK,Japan**

**IBA, Belgium,TRIUMF, Canada**

**BESSY,Germany,RAL,UK,.....**



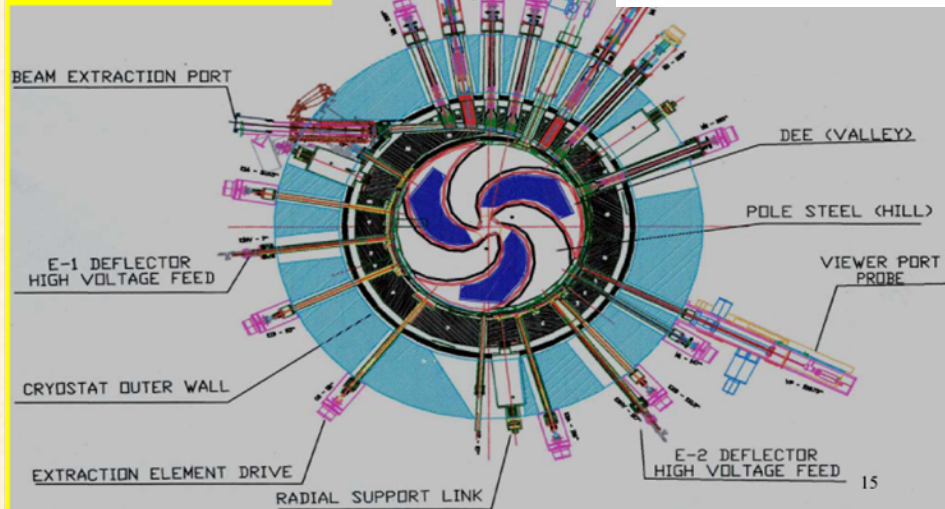


# Variable Energy Cyclotron Centre

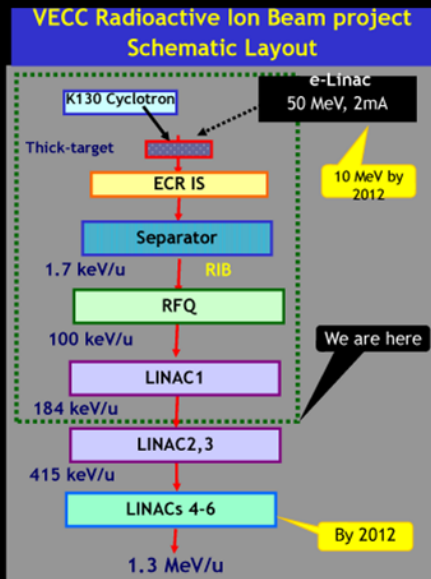
**Bikash Sinha**  
Homi Bhabha Professor

January 2010

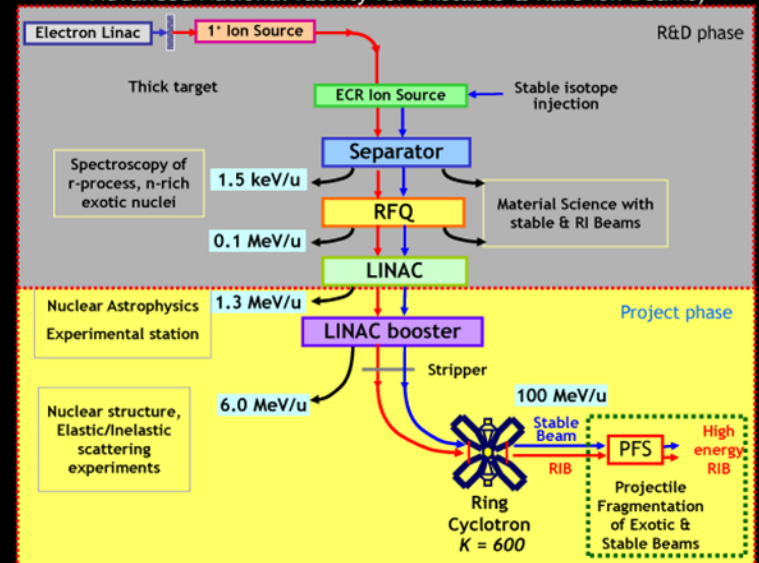
## Sectional view of Median Plane of Cyclotron



SC cyclotron  
K=500 MeV  
(K=130 MeV)



## The Future ? Proposed Mega Science facility ANURIB Advanced National facility for Unstable & Rare Ion Beams)





VAST

VIETNAM ACADEMY OF SCIENCE AND  
TECHNOLOGY

INSTITUTE OF PHYSICS



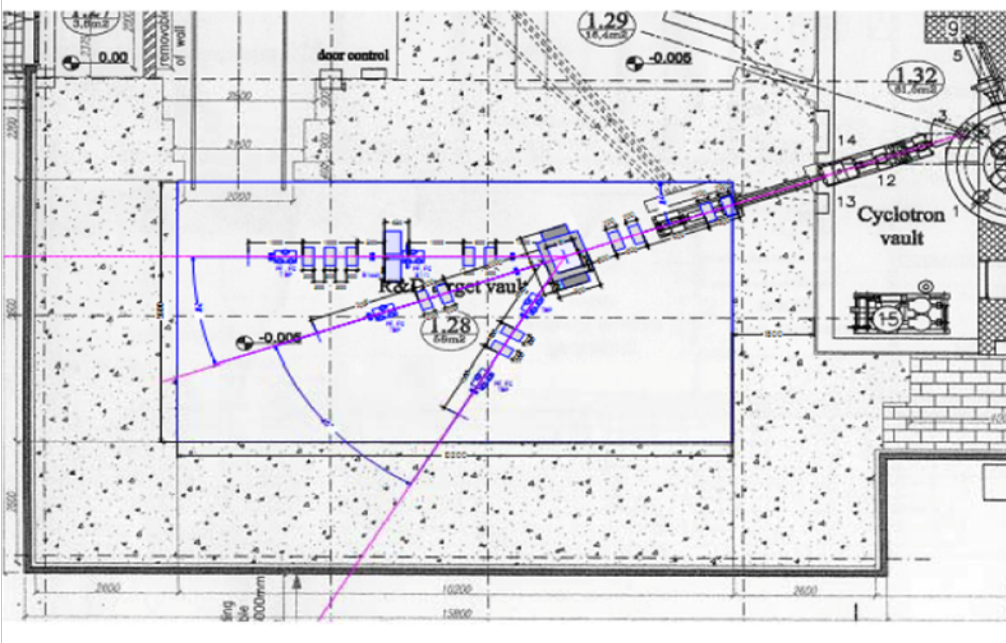
## Introduction of Vietnam Institute of Physics and the present status of nuclear physics and applications in Vietnam

Le Hong Khiem

Cyclotron



### PROPOSED DESIGN FOR R&D BEAM LINE



# Nuclear Physics in Taiwan

Jiunn-Wei Chen  
Physics Dept., NTU

- **LEPS:**
  - Implementation of polarized HD target for the double-polarization experiment.
  - LEPS2 upgrade.
- **E906 in FNAL:**
  - Plan to operate in 2010-2013.
- **High-flux 30/50 GeV proton beam in JPARC:**
  - Di-muon and hadron physics experiment.
  - After 2014.



## Status of the ALICE at LHC

Daicui Zhou  
(for the ALICE collaboration)  
Institute of Particle Physics,  
Huazhong Normal University, China



## Upgrade program born in Asia



- 1) The earlier collaboration between Asia countries on high energy heavy ion physics, originated from the first **Athi** 2006 in Yonsei, 2008 in Tsukuba, 2010 to be in Wuhan
- 2) The first workshop on photon and jet physics with LHC/ALICE in Wuhan in Dec. 3-7, 2008, to discuss the possibility to build Dijet calorimeter
- 3) This idea was submitted to ALICE by Tsukuba on behalf of Japanese team) and by CCNU on behalf of the Chinese team respectively in March 2009
- 4) A joined weekly meeting by EVO for DCAL physics since May 2009
- 5) Formal proposal formed together and submitted to ALICE collaboration in the end of June 2009 together.
- 6) A general DCAL proposal approved by ALICE in the end of Oct, 2009
- 7) Production plan made by DCAL collaboration (**Japan, China, USA, France and Italy**) and approved by ALICE in the end of Oct, which should be finished before end of April 2011.
- 8) The workshop on ALICE upgrade by Asia counties In Nov. 5-7, 2009 was held in Yonsei.
- 9) Workshop on ALICE analysis strategy by Asia countries to be held in Hiroshima from Jan. 21-23 2010.



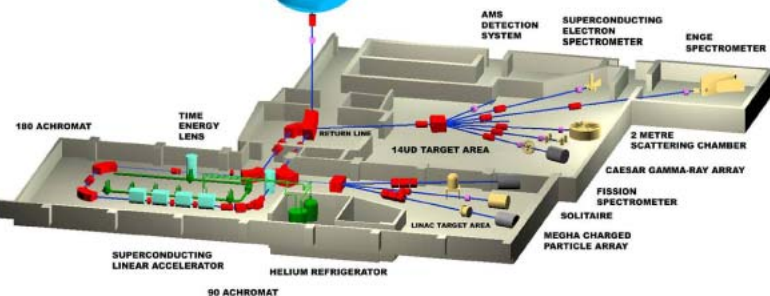
## Experimental Nuclear Physics Research in Australia

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### ANU HEAVY ION ACCELERATOR FACILITY



- NEC 14UD tandem electrostatic accelerator  
Commissioned 1972  
Highest voltage in experiments: 15.85 MV  
Max beam on target  $\sim 1\mu\text{A}$  electrical  
Beam pulsing system 1ns on 106ns to 1s off



## Accelerators in Australia



- ANSTO  
Sydney \$25M  
10MV tandem  
Materials, AMS  
(Research Reactor OPAL)
- Heavy Ion Accel. Facility  
15MV tandem+Linac  
Canberra \$50M  
Nucl. Phys, AMS, Materials
- Australian Synchrotron  
Melbourne \$200M  
Electron synchrotron  
3<sup>rd</sup> gen. light source

## Future Developments (2010-2013)

- Australian Government response to Global Financial Crisis:
- A\$7.6M given (*not taken away!*) over 4 years for upgrades

### Accelerator enhancements

- Beam pulsing update and upgrade – 200 ps pulses RTB
- Linac pilot project to replace Pb plating by Nb – 12 MV/q
- Two to three new beamlines, target stations
- Second dedicated s/c solenoid beamline (RIB, spectroscopy)
- Upgrade of AMS capability – automation
- Migrate accelerator computer control and D/A from VAX
- Modern pumps and magnet power supplies

**Asia nuclear physics community ANPhA is ready to make an effort on bi-regional cooperation with that of Europe NuPECC !**

