

# **HEP in Vietnam, present and perspective**

**Inputs fr. various Vietnamese physicists:  
Nguyen A. Ky, Nguyen T. H. Van (IOP, VAST);  
Le D. Ninh, Dao T. Nhung (Phenikaa Univ.);  
Dong V. Thanh (Duy Tan Univ.); Nguyen T. Dung (VNU-HUS)  
Jean T. T. Van (Rencontres du VÑ), P.Q Hung (Virginia Univ., US)  
Son Cao, IFIRSE-ICISE**

**20th Rencontres du Vietnam — PASCOS 2024, July 11**

# We would like to thank ICTP for training generations of Vietnamese physicists

15 out of 68 diploma students

theorists/ phenomenologist  
in Vietnam now

US/ Neutrino/was T2K-MINERvA collaborator

IOP-VAST, VN/Neutrino/T2K collaborator

South Africa/LHC experiment

found 15 students matching:

- field: **HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS**
- Country: **Viet Nam**

Last Name	First Name	Country	Academic Year▼	Field
TRAN	Tuan Anh	Viet Nam	1994–1995	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
HOANG	Nguyen Ky	Viet Nam	1996–1997	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
TRANG	Nguyen Thi	Viet Nam	2000–2001	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
NGUYEN	Hoa Thuan Thi	Viet Nam	2001–2002	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
LE	Trung Phuoc	Viet Nam	2001–2002	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
KIET	Hoang Anh Tuan	Viet Nam	2002–2003	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
DO	Huong Thi	Viet Nam	2003–2004	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
DINH	Binh Thanh	Viet Nam	2005–2006	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
NGUYEN	Thi Hong Van	Viet Nam	2006–2007	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
DAO	Thi Nhung	Viet Nam	2007–2008	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
DINH	Dinh Nguyen	Viet Nam	2008–2009	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
TRUONG	Loan Thi Ngoc	Viet Nam	2010–2011	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
PHAM	Nhan Thi Kieu	Viet Nam	2012–2013	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
HO	Quoc Trung	Viet Nam	2021–2022	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS
LE TRUONG MY	Hau	Viet Nam	2022–2023	HIGH ENERGY, COSMOLOGY AND ASTROPARTICLE PHYSICS

*(Not all fellows is tracked recently)*

# Some pioneering efforts to foster the rise of HEP in VN

- 2000s: **ATLAS-Vietnam program** supported by CNRS-VAST was initiated and organized by **Patrick Aurenche, Denis Perret-Gallix, Francois Le Diberder** fr. France and **Nguyen Anh Ky** fr. Viet Nam
  - ~2006: VAST,VN -CNRS, FR Agreement; 2 Vietnamese students/ year supported by France for summer program at CERN.
- 2006-2016: “**Advanced program major in Physics**” in Hue Univ. in collaboration with Univ. of Virginia, US (**P. Q. Hung**)
  - ~200 students graduated; 1/3 went abroad for grad. program
- 2008-2011 **LHC schools** organized by IOP-VAST and VNU-HUS w/ support fr. **Ha Huy Bang**, VAST, Rencontres du VN, APCTP
- 2009~2023 **LHCb**, **Nguyen M. Chung**, VNU-HUS
- 2009~ **Belle-II**, **Nguyen A. Ky** (IOP, VAST)
  - officially joined since 2011
  - Supported activities: “4th Particle Physics School in South-East Asia” in 2015; “Belle-II and Vietnam: school and workshop” in 2017



**There is no “official”  
particle physics /  
HEP division in  
Vietnam Physics  
Society.**

Form to register member of Vietnam Physics Society  
(In Vietnamese)

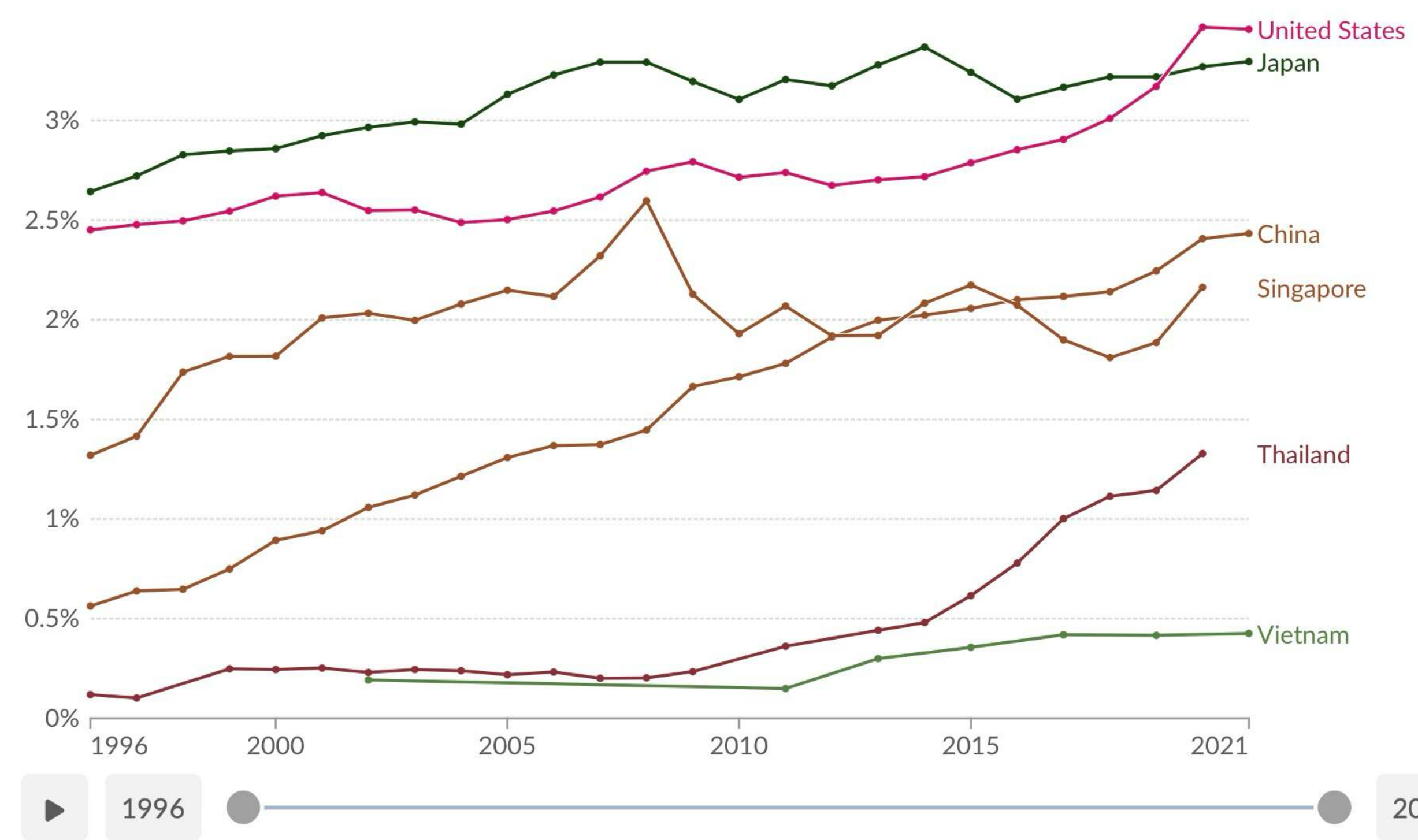
Lĩnh vực chuyên môn \*

(Chọn Hội chuyên ngành trong cơ cấu tổ chức của Hội VLVN phù hợp nhất với chuyên môn của mình)

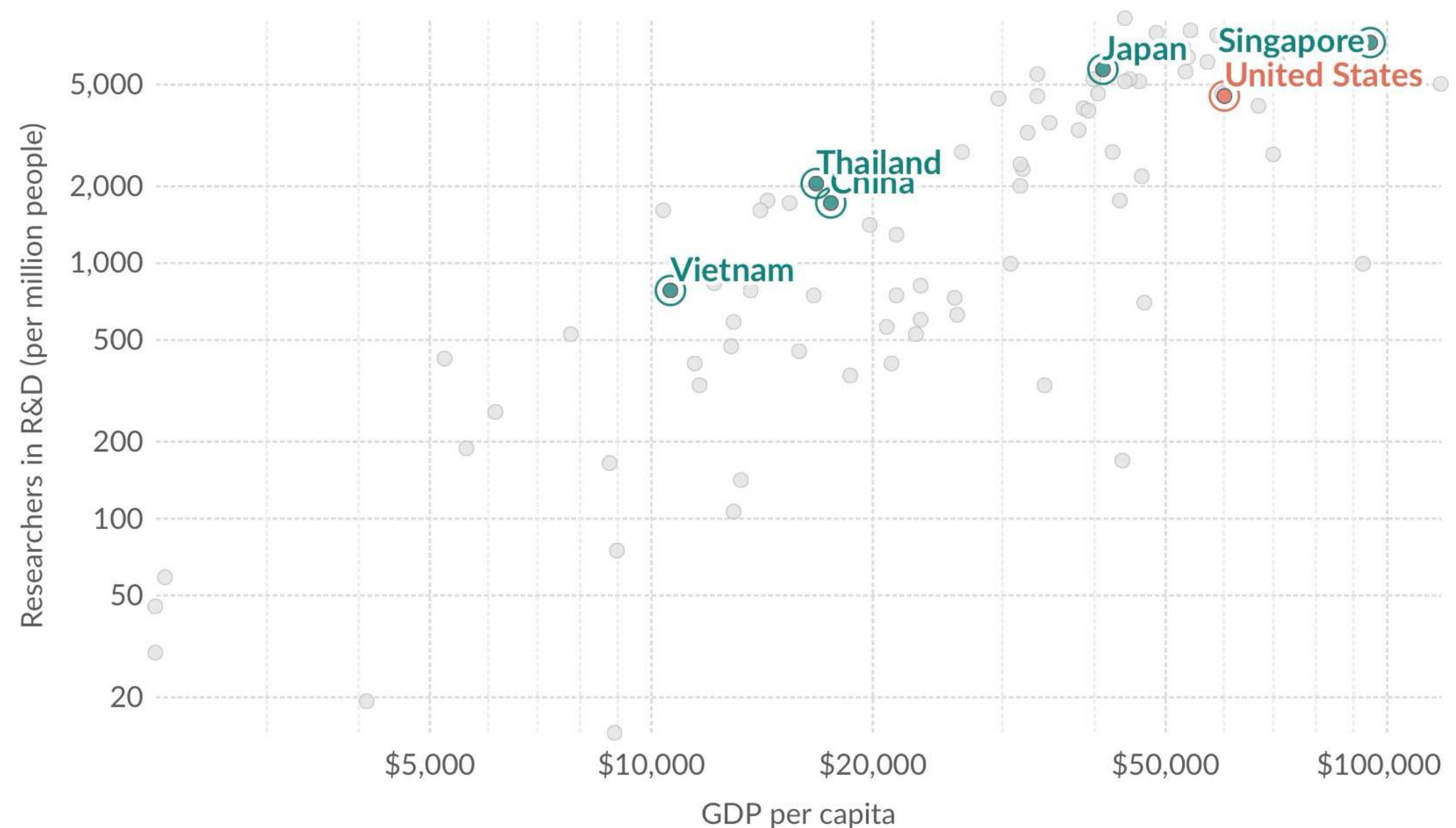
- Hội Giảng dạy vật lý      Society of Teaching Physics
- Hội Hạt nhân      Society of Nuclear Physics
- Hội Khoa học vật liệu      Society of Material Science
- Hội Quang học - Quang phổ      Society of Optics & Spectroscopy
- Hội Thiên văn - Vũ trụ      Society of Astrophysics & Cosmology
- Hội Vật lý lý thuyết      Society of Theoretical Physics
- Hội Vật lý UD&KT      Society of Applied & Engineering Physics
- Hội Vật lý Y tế      Society of Medical Physics

**If summarized in one sentence:  
Like neutrino (*but not dark matter*), HEP  
is almost invisible in Vietnam**

**R&D expenditure:  
0.43% of GDP in  
2021**



**Researchers in R&D:  
779/million in 2021**

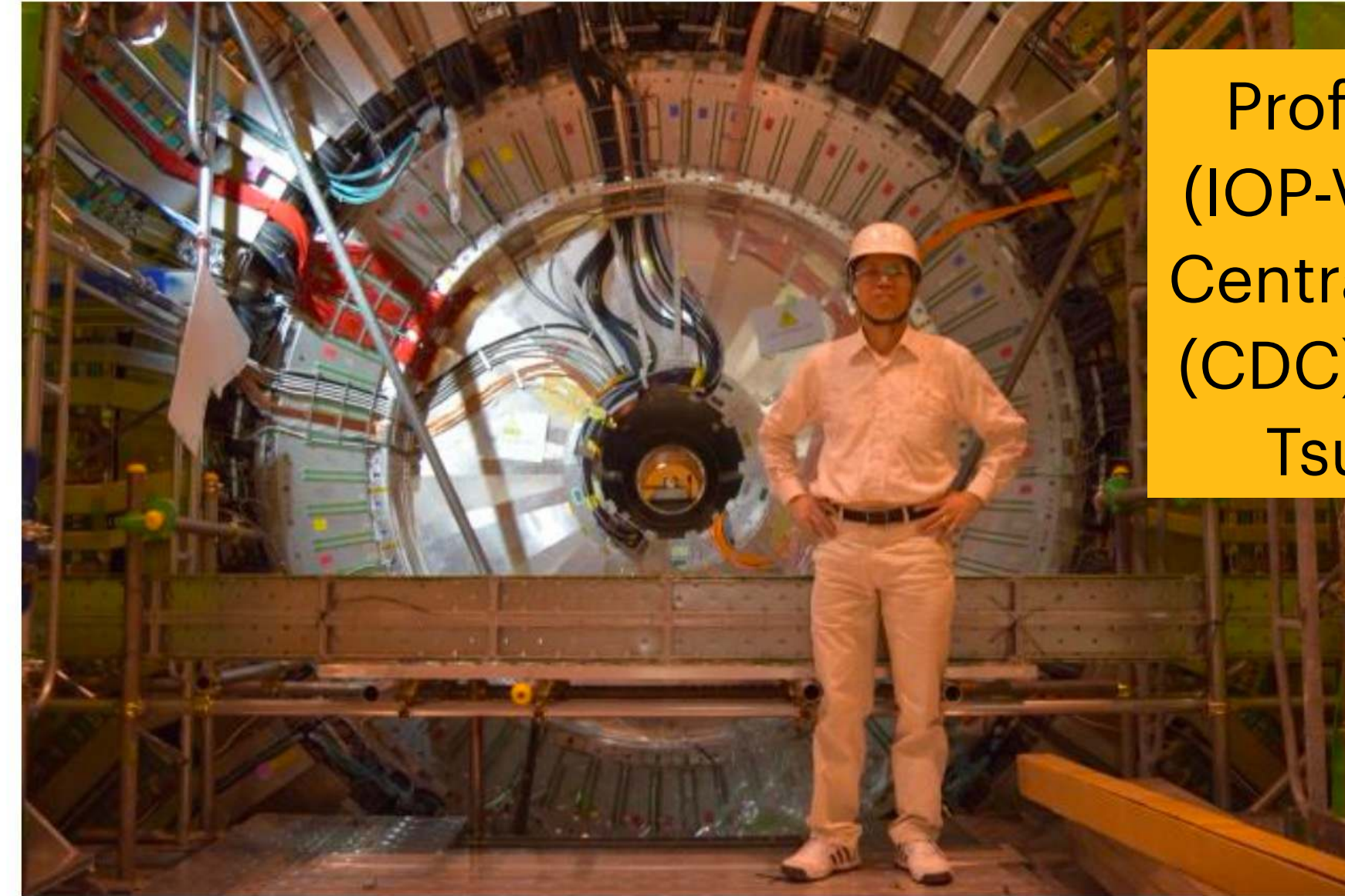


**The situation is slightly  
shifting**

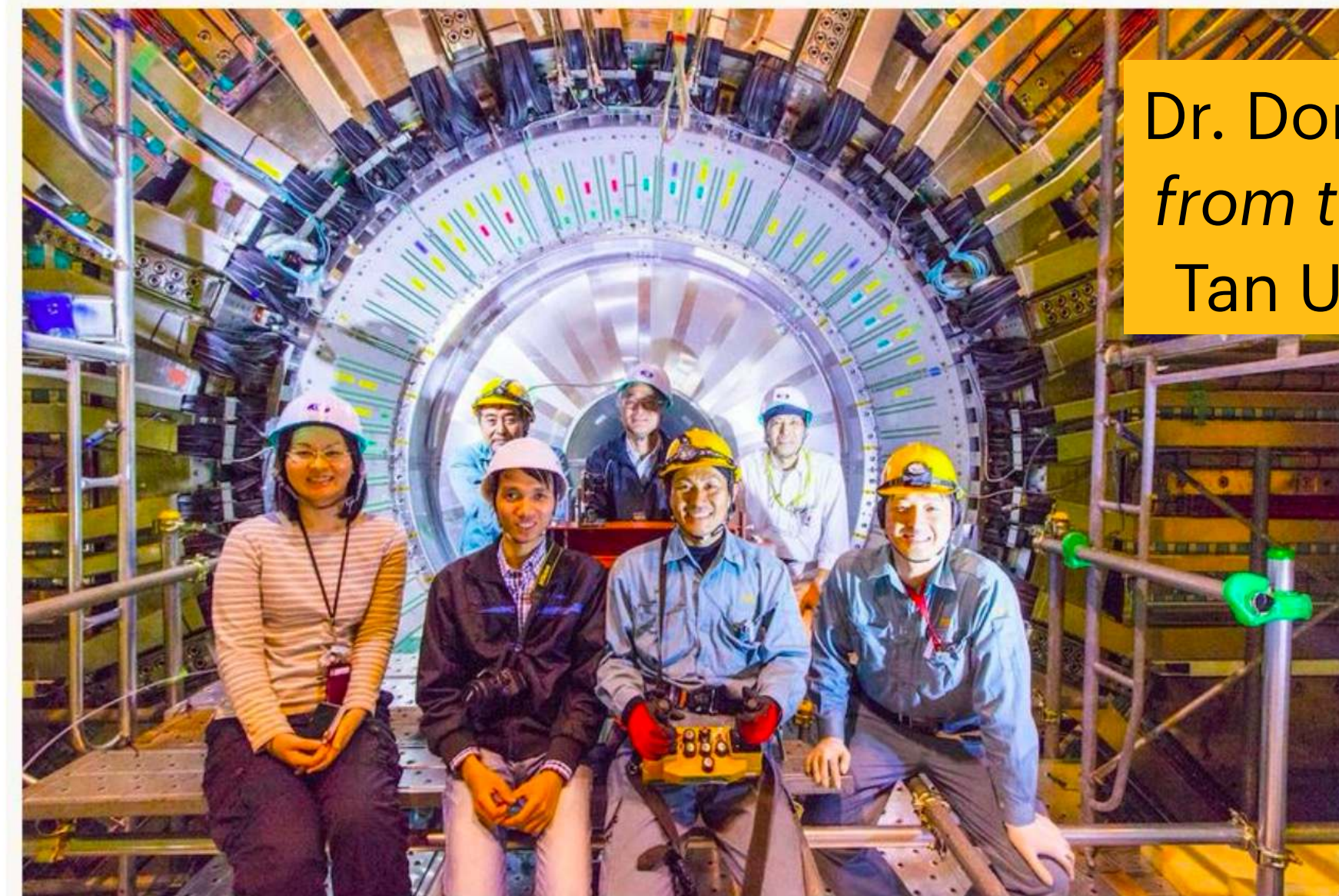
*(Personal observation )*

# The present: Belle-II

- Belle-II: asymmetric  $e^+e^-$  collider for flavor physics and CPV measurement
- Belle-II collaboration: More than 1100 physicists and engineers from 122 institutions in 27 countries.
- Collaborators from Vietnam (firstly join 2011):
  - **Nguyen A. Ky** (IOP, VAST)
  - **Dong V. Thanh** (ITAR, Duy Tan University.)
  - Vietnamese Ph.D. students
- Sub-detector in charge: Central Drift Chamber (*Construction, Calibration and Simulation...*)
- Physics interests: Physics beyond SM (*sterile neutrino, CPV, LFV...*)



Prof. Nguyen A. Ky (IOP-VAST) at front of Central Drift Chamber (CDC), placed at KEK, Tsukuba in 2017



Dr. Dong V. Thanh (2nd from the left) from Duy Tan University., Hanoi

# The present: T2K

- T2K: Accelerator-based long-baseline experiment for neutrino physics
- T2K collaboration: More than 500 physicists and engineers from 74 institutions in 15 countries (incl. CERN).
- Collaborators from Vietnam (firstly join 2017):
  - **Cao V. Son, P. T. Quyen** (IFIRSE, ICISE)
  - **Nguyen. T. H. Van** (IOP, VAST)
  - **Nguyen T. Dung** (VNU-HUS)
  - Also **Ngoc Tran** (*JSPS fr. Kyoto Univ., JP*)
  - And **Viet Nguyen** (*postdoc fr. IN2P3, FR.*)
- Sub-detector in charge or involved: Beam monitors, beam operation, T2K near detector
- Physics interests: Neutrino oscillation, neutrino interaction, accelerator physics





# The present: Super-K

- Super-K: Water-based Cherenkov observatory for various neutrino sources (*Solar, atmospheric, reactor, supernova*) and proton decay search.
- Super-K collaboration: ~230 collaborators from 50 institutions in 11 countries
- Collaborators from Vietnam (joined in 2020):
  - **Cao V. Son** (IFIRSE, ICISE)
- Physics interests: Diffuse supernova neutrino, proton decays



SC in Super-K for refurbished work in 2018 before doping Gd for new observation period

# HEP Theory and phenomenology groups

- IOP, VAST <https://iop.vast.vn/theor/page.php?p=group-naky>
- Phenikaa Univ., <https://pias.edu.vn/en/high-energy-physics-and-cosmology-group/>
- IFAS, Duy Tan Univ. <https://ifas.duytan.edu.vn/vat-ly-ji9>
- Van Lang Univ. <https://www.vlu.edu.vn/research/area/vat-ly-hat-ha-nguyen-tu>
- Department of theoretical physics, HCM university of science.
- Faculty of Engineering Physics, Hanoi Univ. of Science and Technology
- Faculty of Applied Science, HCM City Univ. of Technology and Education
- Department of Physics, Tay Nguyen Univ.
- ....

# Particle physics schools in Vietnam

Many efforts to foster the particle physics generation in Vietnam with thematic schools

- **“Vietnam School of Physics” (VSOP) series**

founded in 1994 by Nguyen Van Hieu and Jean Tran Thanh Van. The 30th school will happen here in ICISE, July 15-26 2024 focusing on “Particles and Dark matter”

- **“Vietnam School on Neutrinos” (VSON) series**

founded in 2017 with MoU btw. IFIRSE/ICISE and four Japanese professors (Tsuyoshi Nakaya, Kyoto Univ.; Yuichi Oyama, KEK; Makoto Miura, ICRR, The Univ. of Tokyo; Atsumu Suzuki, Kobe Univ. ). This 8th school will happen here in ICISE, July 15-26 2024

- **“Hardware Camp for Fast and Low-light Detection” series:**

founded in 2021 by IFIRSE/ICISE; 3rd camp happened here in ICISE, March 3-9, 2024



# Particle physics conferences in Vietnam

Thanks to Rencontres du Vietnam and ICISE centers. Many international conference on particle physics (as well as other field) has been held in Vietnam since 2000

Check out <https://www.icisequynhon.com/conference-calendar/>



Windows on Universe-2023



PASCOS-2016, 2024



Thank you ALL for coming. It means a lot for HEP development in Vietnam.

# We all thank to endless efforts from Jean Tran Thanh Van



The rise of the ICISE center, which now hosts many international conferences and thematic schools, has had a significant impact on the growth of HEP (*as well as other fields*) in Vietnam.

# Other key players for current HEP development in Vietnam

## ○ The National Foundation for Science and Technology Development (NAFOSTED)

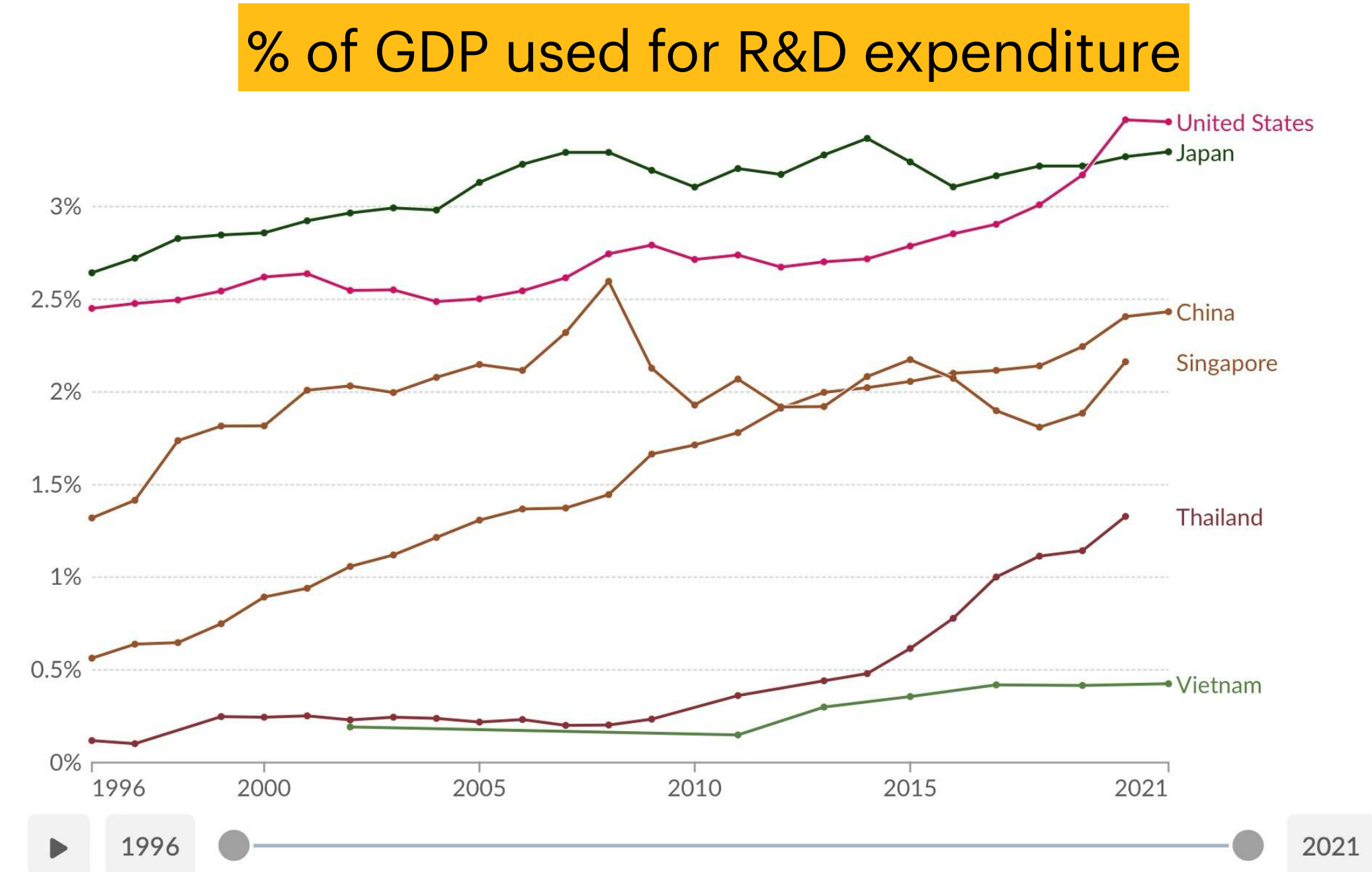
*Towards creating a favorable research environment that meet international standards in order to enhance national S&T capacity, including improving the research quality and developing high-quality human resources in S&T.*

## ○ Rise of private college/university with relatively higher salaries payed to researchers

*There is a visible shift of researchers from public to private sector.*

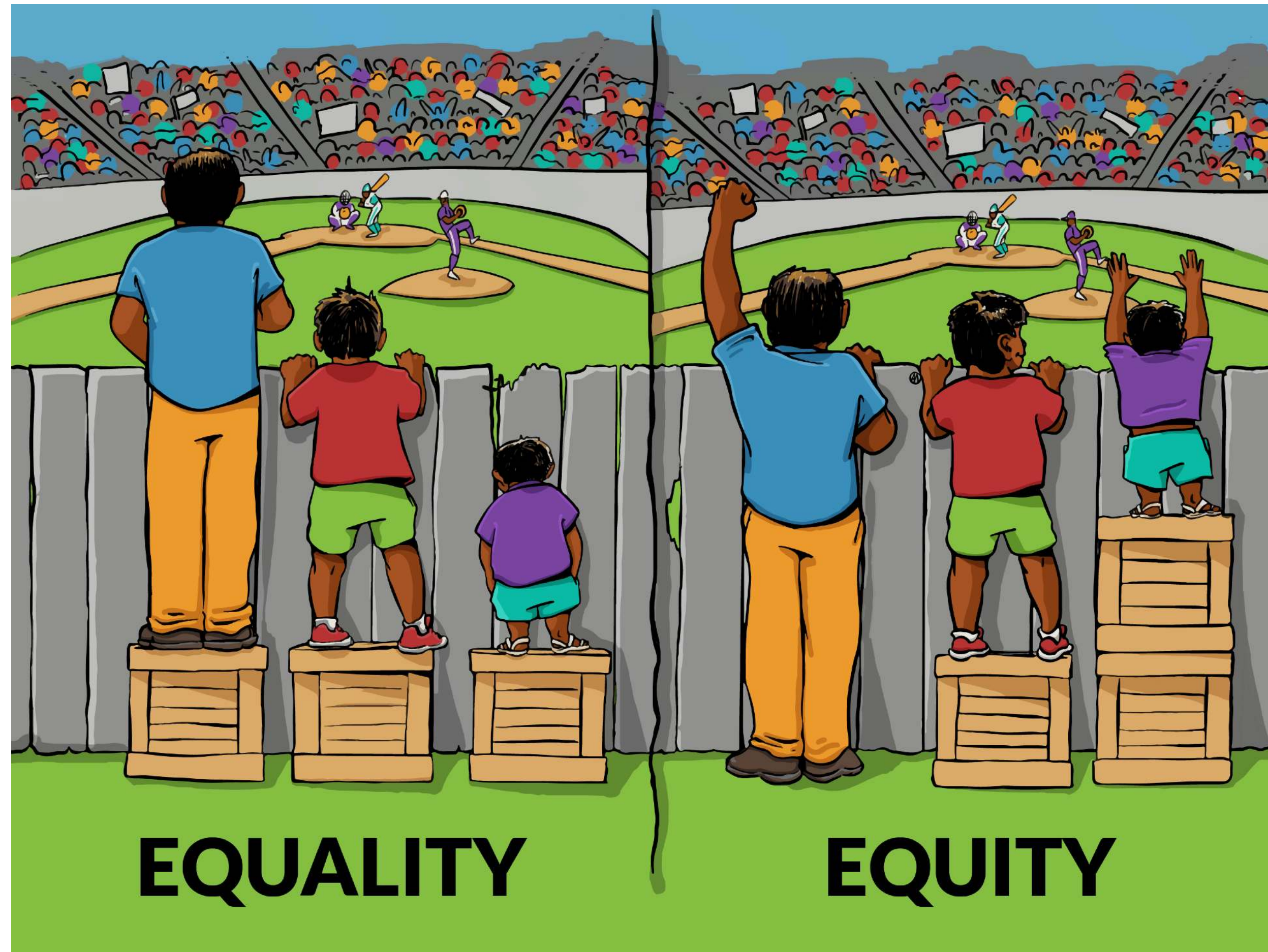
# HEP-VN Perspectives?

- *Personal view*: It's a difficult subject because it depends significantly on how GDP is utilized for R&D expenditure in general, and HEP in particular.
- If the share remains below 0.5%, *I suspect* major growth is nearly difficult.
- We continue to persuade the authorities to promote research and development, particularly HEP.
- It is crucial to demonstrate the benefits of the field **directly and continually**



Increase GDP share for R&D is of central importance

In any case, we love what we are doing and would like to enjoy the HEP games with you all. **We hope for equity in international partnership.**





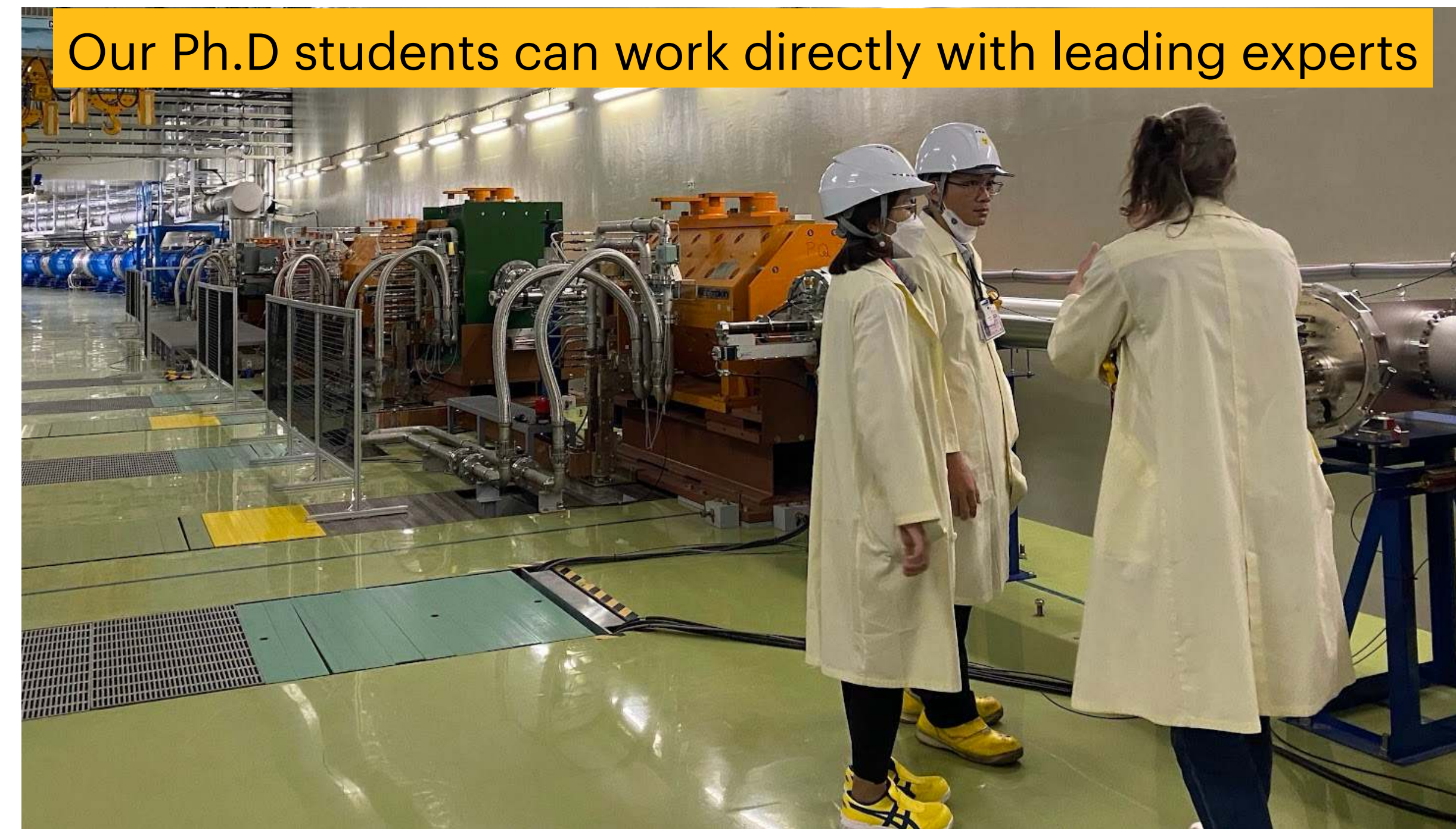
# HEP-VN: Short-term and long-term

- **Short-term (<5 years):**
  - plan to keep contributing to Belle-II (run end in ~2031) , T2K/ Super-K (run end in ~2027)
  - build up the human sources: students through well-established thematic schools and overseas researchers (including Vietnamese physicists currently abroad).
  - Build HEP labs in Vietnam: it's critical to enrich our experimental HEP techniques and carry out minimal-budget R&D (eg. *proton beam monitor, siPM and its optimal readout electronics, water-based liquid scintillator,...*)
- **Longer-term (> 5 years)**
  - Hyper-Kamiokande (2027~ ): we hope to join this under-construction experiment. Our experience and skill sets with T2K/Super-K are well-suited for this move. But funding sources is uncertain.
  - Others: *neutrinoless double beta decay, dark matter search...*

# Something changed marginally, but it gives me hope.

Previously, selected Vietnamese students were sent abroad to study at international universities with some hopes for a return to advance their professions in Vietnam.

Our students enjoy moment of witnessing record high beam powers with experts right in the J-PARC accelerator center



We now can have students enrolling in doctoral programs in Vietnam and send them abroad to study from the leading specialists, contribute directly to the experiments, and advance their professions.

# Something changed marginally, but it gives me hope.



We have a small “opening” lab for training particle and nuclear technique (w/ plastic scintillator, SiPM/PMT, electronics ...)

Senior physicists and Ph.D students visited and worked with our groups

HEP are almost invisible in the Vietnam Physics Society still, *much like neutrinos*, but we believe it is worthwhile to investigate further.

Thank you so much for coming to Vietnam. It is extremely important for the growth of HEP in Vietnam. We wish to collaborate with you.