

変革を駆動する

先端物理・数学プログラム

FoPM

Forefront Physics and Mathematics  
Program to Drive Transformation

Hitoshi Murayama, Coordinator

(Berkeley, Kavli Institute for the Physics and Mathematics of the Universe)



東京大学  
THE UNIVERSITY OF TOKYO

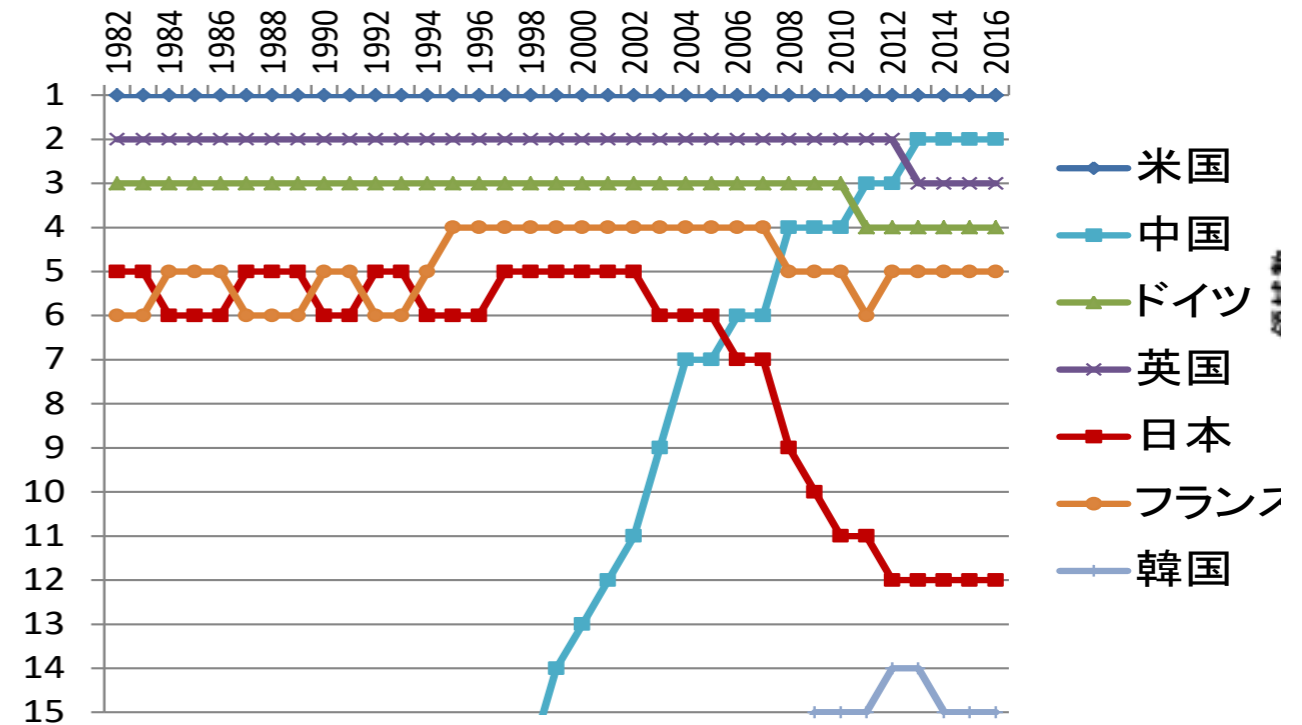
KAVLI  
IPMU

INSTITUTE FOR THE PHYSICS AND  
MATHEMATICS OF THE UNIVERSE

# facts

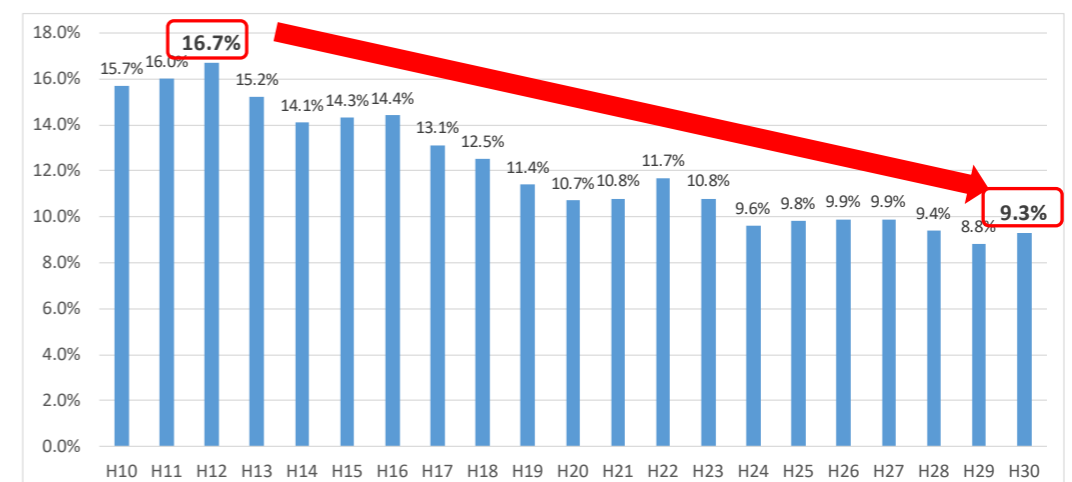
- scientific leadership of Japan is slipping
- graduate school is attracting less students
- graduate students are normally not supported in Japan
- Yet technical knowledge is evermore important for future of human society
- how can Japanese universities change for the better future?

Top1%補正論文数(整数)の世界ランク



修士課程から博士後期課程への進学率が減少

H12: 16.7% ⇒ H30: 9.3%  
出典: 学校基本統計



# government initiative



Font Size [A](#) [A](#) [A](#) [SiteMap](#) [Japanese](#)

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## WISE Program (Doctoral Program for World-leading Innovative & Smart Education)

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The WISE Program is a program to encourage universities to systematically collaborate with other domestic and foreign universities, research institutes and private companies, etc. while taking advantage of its own strengths and achievements of graduate school reforms so far, and develop a five-year integrated doctoral degree program aggregating the world's top level educational and research capabilities, thereby fostering excellent doctoral talents who can lead each sector and creating outstanding bases where human resources development and exchange and new joint research are advanced sustainably.

[Policy](#)

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# Forefront Physics and Mathematics Program to Drive Transformation



- University of Tokyo asked me to put together a proposal
- my guiding principle
- get back to basics: education is about maximizing the potential of each student
  - students are worried about their career opportunities
  - don't limit to Japanese academia: overseas, industry
- education in Japan is excellent
  - yet two areas for improvement for students
    - communication skills
    - skill to find new game-changing problems

**FoPM approved 11 out of 44  
launched in fall 2019**

# Forefront Physics and Mathematics Program to Drive Transformation

final aim: maximize potential of graduate students

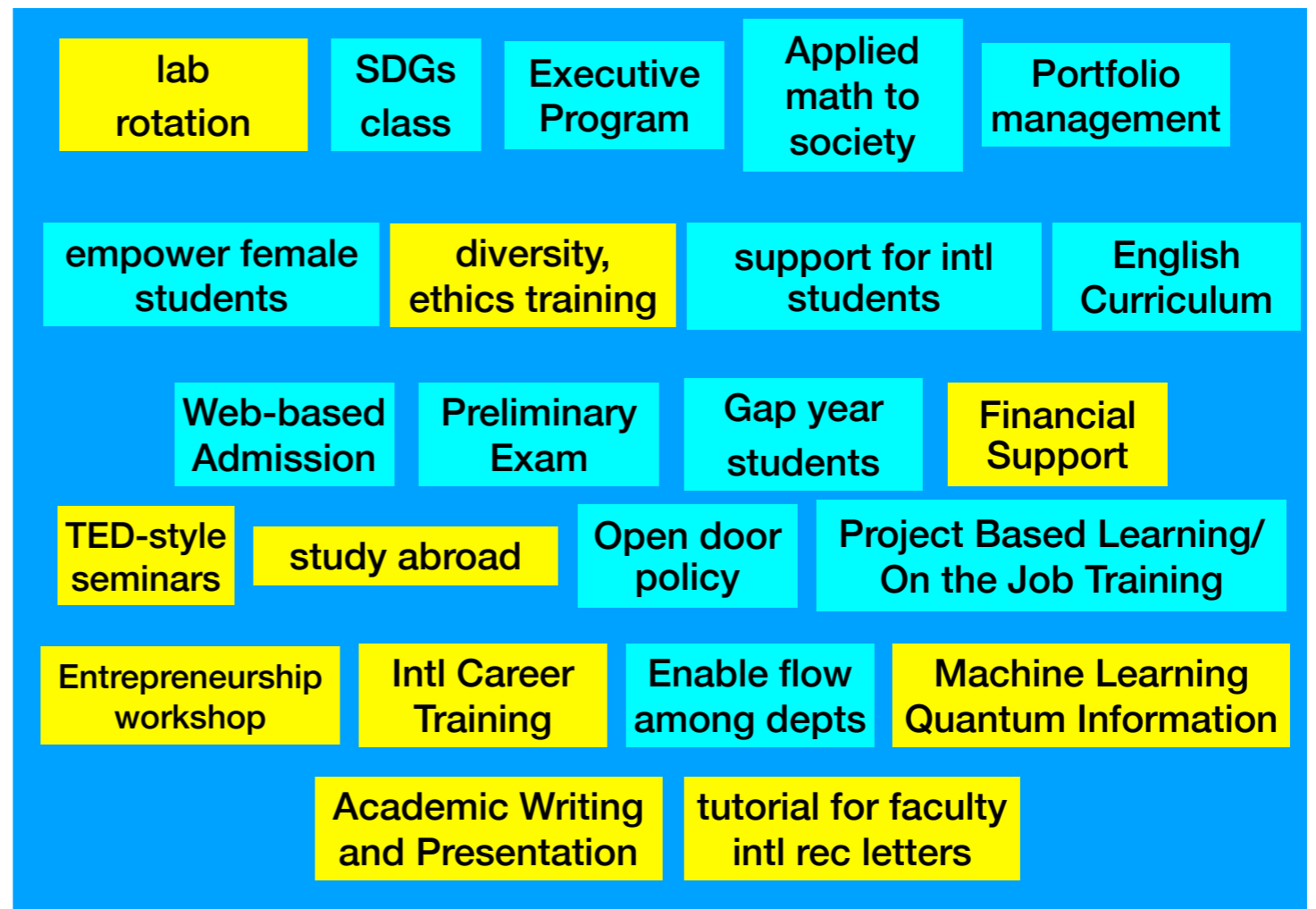
## Diversity & Interaction

Diversity of disciplines

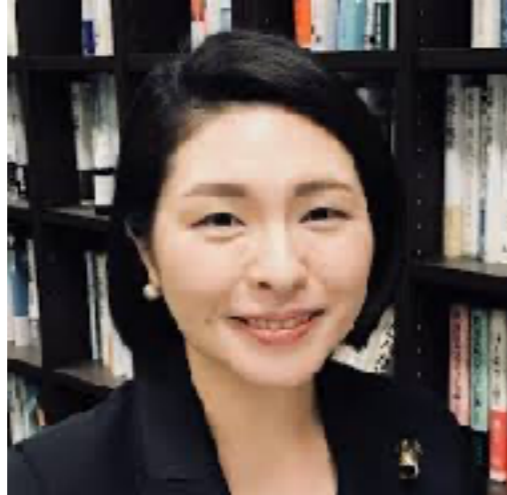
Diversity of Entrance

Interaction

Diversity of Exits







- Required: Diversity Ethics Training
- Required: Academic Writing and Presentation



Mark Vagins IPMU Prof



Kate Harris 理学系 URA  
senior physical sciences editor

授業科目名等	単位数	履修方法	備 考
Academic Writing and Presentation	2	必修	
機械学習(AI)演習	2	選択必修	2科目のうち2単位以上
量子コンピューティング演習	2		
SDGs 特論	2	選択必修	5科目のうち2単位以上
エグゼクティブ・プログラム	2		
社会数理先端科学	2		
社会課題実践演習	2		
数物スタートアップ演習	2		
Introductory Course: Quantum Information Science I	1	選択必修	18科目のうち2単位以上
Introductory Course: Quantum Information Science II	2		
Introductory Course: Neurointelligence I	1		
Introductory Course: Neurointelligence II	2		
Contemporary Mathematics for Physicists I	1		
Contemporary Mathematics for Physicists II	2		
Contemporary Physics for Mathematicians I	1		
Contemporary Physics for Mathematicians II	2		
Contemporary Biology for Mathematicians and Physicists I	1		
Contemporary Biology for Mathematicians and Physicists II	2		
Contemporary Photon Science I	1		
Contemporary Photon Science II	2		
Astroinformatics I	1		
Astroinformatics II	2		
Applied Quantum Beams I	1		
Applied Quantum Beams II	2		
Math for Industry I	1		
Math for Industry II	2		

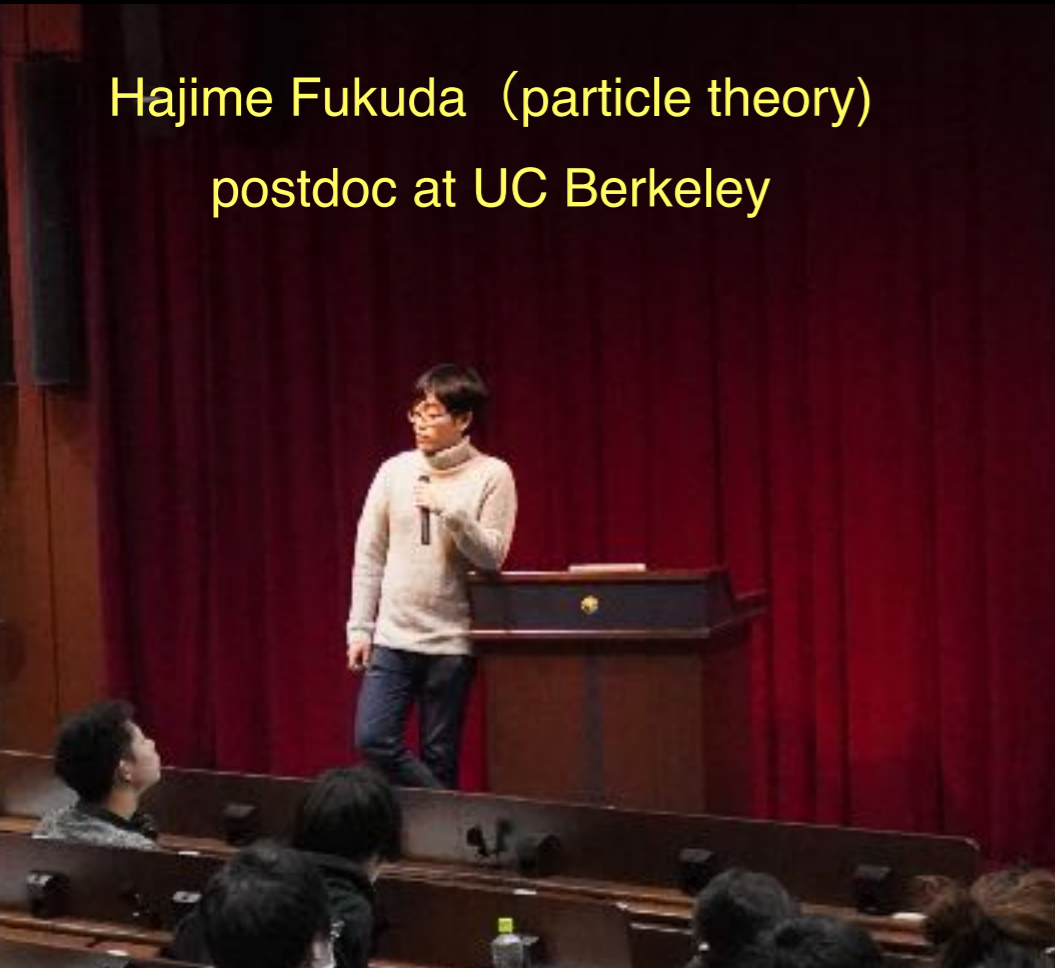
上記授業科目の履修のほか、国際キャリア研修、国外連携機関長期研修、ダイバーシティ・倫理教育への参加を修了要件とする。

- Required: Travel Abroad
- Required: (2 units)
  - data mining
  - quantum computing
- Required: (4 units)
  - entrepreneurship workshop
  - SDGs: proactive environmental science
  - Executive Program (omnibus)
  - Introduction Course Neurointelligence (IRCN)
  - Contemporary Math for Physicists
  - Contemporary biology
  - Practical Research in Applying Mathematics to Society



# Career workshop Dec 19, 2019

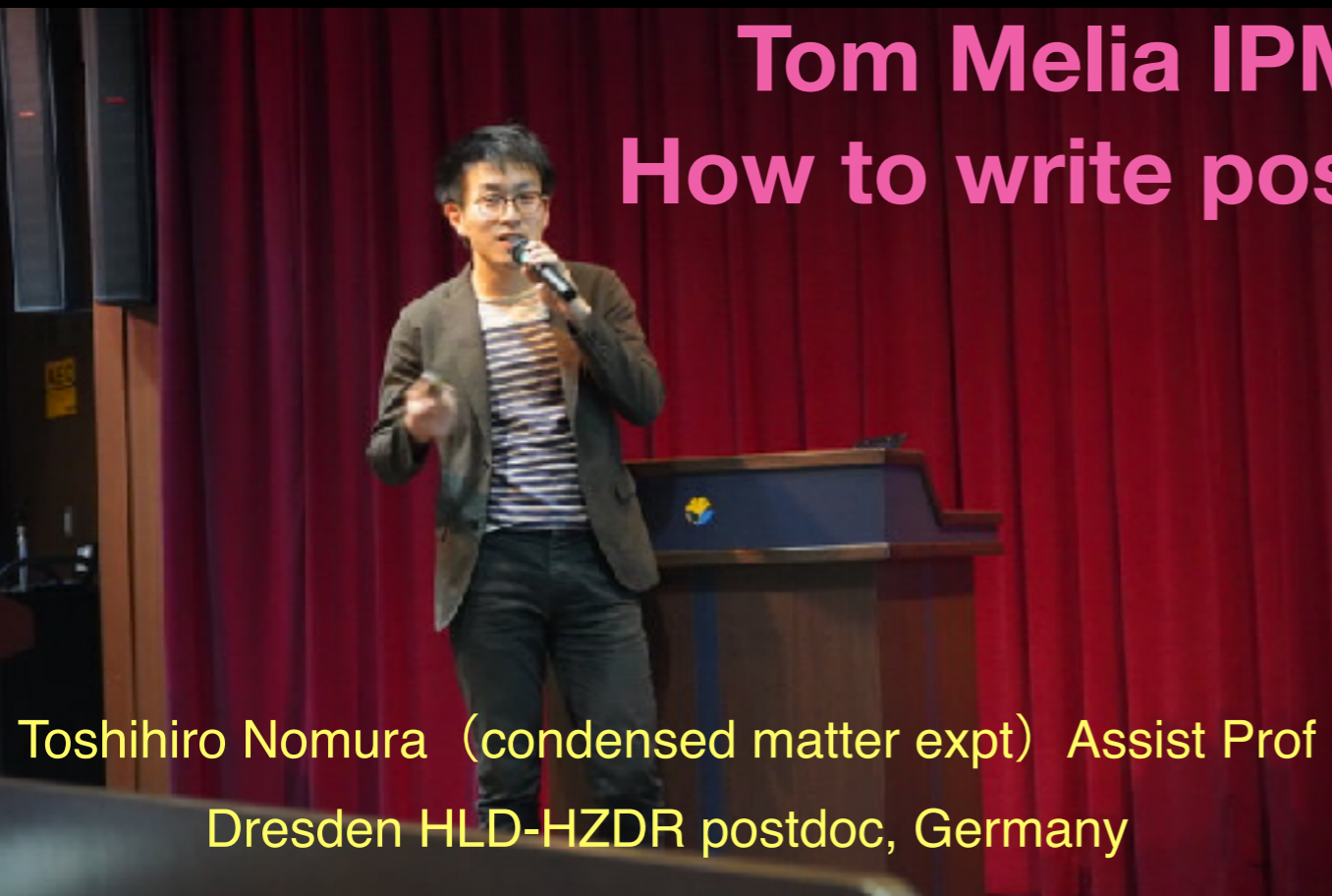
Hajime Fukuda (particle theory)  
postdoc at UC Berkeley



Yuji Chinone (CMB expt) Project Assist Prof  
LBL Associate Specialist till 2018



Tom Melia IPMU Assist Prof  
How to write postdoc application



Toshihiro Nomura (condensed matter expt) Assist Prof  
Dresden HLD-HZDR postdoc, Germany

# Reference letters

Your supervisor will likely be your first choice of reference writer — good!

It *really* helps to have another senior scientist as a reference writer.

It *really* helps to have one or more reference writers outside your institution, and

It *really* helps if one of these is from outside Japan



# Reference letters

This means that you need to interact with senior scientists beyond your direct supervisor.

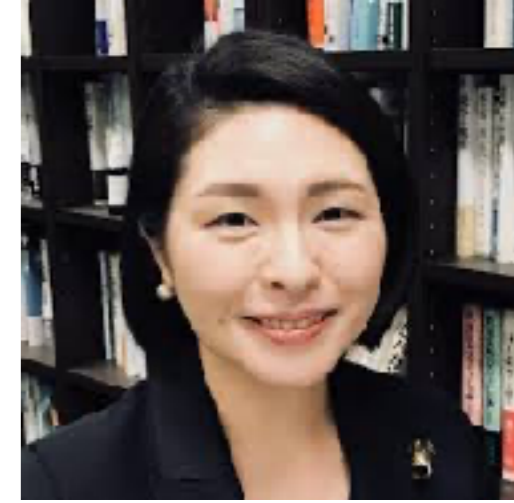
But this is important beyond simply obtaining reference letters. You will learn new science from them, and they can learn from you! The latter is important in disseminating your scientific work and insights to the broad community

# Reaching out

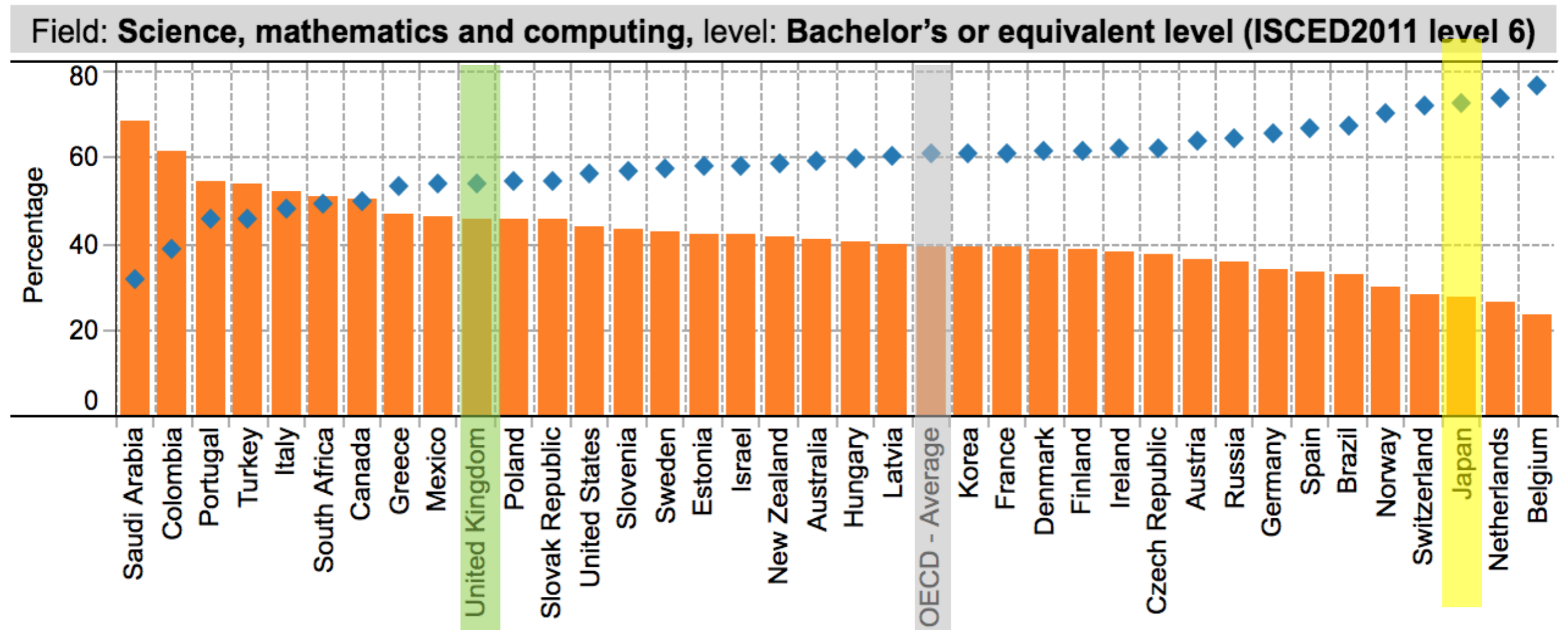
Golden opportunities will arise when you go to (international) **conferences** and **workshops**

- 1) **Look up** who is there (participant list on the website)
- 2) You are allowed to **'prepare'**! Read up on the latest papers of scientists whom you are interested in talking to. And have ready a 2 minute explanation of your recent work. And have ready a 10 minute blackboard version.
- 3) You have to **Go For It!**

# OECD data



Sex: ■ Women ■ Men



# Why DEI?

## Ethics Guidelines of American Physical Society

The American Physical Society values a diverse membership, and supports **the right of all people to pursue the study of physics and to participate in the physics community** free from discrimination. As stated in the 2019 Strategic Plan of the American Physical Society “In order for physics and the physics community to benefit from the greatest talent, and to strengthen APS as an organization, we will provide a welcoming and inclusive environment for all those engaged in physics.” The American Physical Society specifically rejects discrimination based upon race, color, national origin, sex, religion, disability, age, gender identity, sexual orientation, and political ideology. For example, research has shown it is not unusual for members of groups defined by sex, race, and color to feel unwelcome in physics and other scientific fields, because of low expectations and poor treatment by some mentors, colleagues, and peers. **More members of groups that have historically been excluded or discouraged from physics would bring valuable contributions to the field** if barriers to their participation were removed.



# “blind” audition



“This research analyzed whether gender biases could help account for the significant underrepresentation of women in the United States orchestras, where women’s ratio was around 5-10% in the 1970’s and 1980’s despite the fact that women comprised of about 45% of the top United States music school graduates. Some orchestras began experimenting with a “blind” audition. Musicians were hidden behind a screen and Judges could not see the gender of the musician. The rate at which female musicians Passed the initial audition increased almost immediately.

Most major United States orchestras had changed their hiring policies by 2000. Openings became widely advertised in the union papers, and many positions attracted More than 100 applicants where fewer than 20 would have been considered before. At Present, ratio of women players reached 25%-46% in the top United States orchestras.

*C. Goldin and C. Rouse. (2000) American Economic Review 90, 715-741”*

# Implicit Bias is...



**Attitudes, Stereotypes, & Beliefs**  
that can affect how we treat others.

Implicit bias is not intentional, but it can still impact how we judge others based on factors, such as:



**Race**



**Ability**



**Gender**



**Culture**

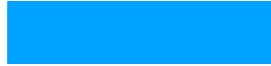


**Language**

In early childhood settings, implicit biases can affect how providers perceive and respond to children, which can lead to unfair differences in the use of exclusionary discipline practices, such as suspension and expulsion.

# necessary for US faculty applications

## Statement on Advancing Diversity, Equity, and Inclusion



### Introduction

I firmly believe that *diversity* plays a key role in advancing science. The variety of world views and ways of thinking, arising from our personal experiences and the culture we grew up in, is a tremendous resource of new ideas, viewpoints, critical questioning of existing paradigms, and stimulating discussions. In comparison with the world at large, the average conference room in high energy particle physics is sadly quite uniform, both in the audience and the selection of speakers. I am dedicated to changing this as best I can. This is, of course, a challenging task with no simple magical solutions. We need to proactively ensure *equity*, the fair treatment and access to support for those who have had structural issues and barriers placed in their career paths. The current worldwide COVID-19 crisis is tremendously increasing those barriers for some, with many children cut off from the education and programs provided by their schools. It will be an additional challenge in the upcoming years to reach out to and support these young people. Finally, I strive to achieve a high level of *inclusion* in scientific environments by providing a welcoming and respectful atmosphere. Research thrives on asking critical questions and recognizing mistakes, so I believe it is crucial to value all contributions to a discussion, encourage questions, and openly admit errors. I also believe it is important (and often neglected) to provide feedback, both critical and positive, to students and colleagues.

Advancing diversity, equity and inclusion is a complex and multi-dimensional task. In this statement I will focus mainly on aspects of geographic, socioeconomic and gender diversity, but other aspects such as race, ethnicity, religion, language, abilities/disabilities, sexual orientation are by no means less important. Some aspects which I discuss here can be extended into these other directions, but the complexity necessitates a multitude of carefully tailored steps to address them all.

### Track record

As an undergraduate, I spent a semester in Singapore and travelling the neighbouring countries of Southeast Asia, curious to explore the world beyond the boundaries of Europe. I learned some science there, too, but mostly I was impressed by cultural differences, some of them rather entertaining but others leading me to seriously question my views of the world. I was deeply impressed by the hospitality and the open-mindedness of people who in my 'western' eyes were bitterly poor and had very little education. After finding myself stranded in the countryside of Laos during a motorcycle tour, a schoolteacher in a remote village brought me into his home. The next day when I met his students, I was struck by their tremendous enthusiasm for science; at the same time it was sadly clear that these kids had little chance of any higher education. I felt there was little I could do, beyond setting up their only computer, answering some questions, and helping them to practice English. Later on in my career, I have tried to create opportunities for students and young researchers from countries which are not traditionally strong in natural sciences. I have given talks and visited research institutes in Vietnam and India, and recently, during the COVID-19 crisis, I gave a public lecture to undergraduate students in Bangladesh. Last year, I was a co-organizer of a [workshop on gravitational waves](#) at ICTP, Trieste, with a special budget and strategy to attract participants from developing countries.

I also strive to improve the gender balance in natural sciences. As a postdoc in Paris, I was

## Statement on Contributions to Advancing Diversity, Equity, and Inclusion



The lack of diversity in physics as a whole and in theoretical particle physics in particular is a serious problem. I believe that there is a lot that I can do as a professor to try to increase the number of women and members of underrepresented minorities in the field. Below I outline some of the strategies that I have implemented towards this end since starting at the University of Michigan and transitioning to LBNL. I have been actively approaching this problem from two different perspectives. First, I work to encourage women and members of underrepresented minorities to consider careers in theoretical physics. Second, I work to promote researchers from underrepresented groups already in the field.

In my first semester at Michigan it became clear to me that while there are many white women and members of underrepresented minorities in the department, these undergraduate and graduate students were not approaching me about research opportunities. After talking with colleagues, I started to suspect that many of these students were simply more intimidated about approaching the faculty, especially in the particle theory group. To counter this issue I decided to approach Zhiquan Sun, an extremely strong undergraduate student in my advanced physics class, to see if she would be interested in working in my research group. She was enthusiastic and told me that she was hoping to work with someone in the theory group on a research project but felt too intimidated to approach anyone directly. My work with Zhiquan has been extremely successful, and we have authored three papers together. I encouraged her to present some of her work at the APS conference in Denver in 2019, where she made valuable connections with successful female faculty members in the field (who I asked in advance to chat with Zhiquan). I also encouraged her to apply for the FUTURE of Physics workshop at Caltech for aspiring young women in physics in the fall of 2019. I nominated her for the program and her application was successful. She said that the program made her excited about graduate school and helped her ease her sense of impostor syndrome. I helped Zhiquan prepare her graduate school applications, and she was accepted to an impressive number of top programs in theoretical physics, including MIT, Princeton, Stanford, and Caltech; she is now pursuing a PhD in theoretical physics at MIT.

Last year I tried applying the same hiring approach to graduate students. I was frustrated that our incoming class of graduate students interested in high-energy phenomenology was almost exclusively male, so I searched through the applications of the incoming class and found that one of the graduate students (Yujin Park) who was accepted for cosmology theory indicated on her application that one of her main interests is dark matter. I contacted her over the summer of 2019 to see if she would be interested in discussing research prospects with me, and I started having conversations with her. I quickly discovered that she was in fact most interested in working on exactly the type of physics done in my group but that she felt intimidated by the high-energy theory group and so was planning to approach faculty members in cosmology instead. Yujin and I have been working together now for around a year, and I have found her to be a very strong physicist. We are currently finishing our first paper together. One point that I have taken away from these experiences is that there may be barriers that make it less likely for students from underrepresented groups to contact faculty directly about research opportunities. One way to help work around this is to contact promising students from these groups directly, which is an approach that I plan to continue in the future.

In 2019/2020 I served on the Michigan graduate admissions committee, and I was specifically in charge of phenomenology and cosmology theory applications. I am proud to have helped recruit one of the most diverse groups of incoming students, starting in fall 2020, in these subfields in recent years at Michigan. I believe that part of this success was due to an aggressive recruiting strategy that I adopted, where I spent extra time encouraging women and members of underrepresented minorities to attend Michigan. In the future I would like to continue exploring ways to increase the diversity of incoming graduate students in high-energy theory, phenomenology, and cosmology.

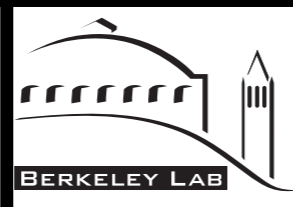
In addition to encouraging white women and members of underrepresented minorities to consider careers in theoretical physics, I believe that serious effort needs to be done to make sure that these aspiring researchers stay in the field. In my own group I try to foster an inclusive atmosphere, where everyone feels comfortable and respects professional boundaries. At the same time I try to make sure that my group feels like a community, for example we all have lunch together almost every day (since going virtual due to COVID-19 we all have a daily virtual coffee time), as I believe that having a sense of belonging is especially helpful for members of underrepresented groups in maintaining confidence with their career choices.

At the professional level I make an effort when organizing seminars, conferences, and workshops to include a diverse array of participants and speakers. I have organized multiple conferences and workshops, and this is always one of my



# How to give an effective talk

Hitoshi Murayama (Berkeley, Kavli IPMU)  
4pm Seminar, Oct 30, 2024





# Basic Idea

1. Know your audience
  - Find a common denominator between you and them
2. Give a clear message
  - You can't give a good talk if you don't know what you are saying
3. Keep it simple
  - Slides should be simple, clean, visual
4. Entertain the audience
  - Make sure the audience is engaged
5. Practice, practice, practice!
  - Nobody likes it when you go over time

# 枕 = Makura ('pillow')

- Traditional Japanese comedians (落語家 = Rakugoka) always start with their show with a “makura”
- Start with what is in everybody’s mind
- If you can’t grab the attention on the first slide, you lost them
- And every slide should keep their attention



# Don't be afraid of asking questions in class (and in life)



**“I’m the only one who doesn’t know this.”**

Everyone else probably thinks the same...you’re doing them a favor.

(slide inspired by: Jae Woo Lee)

# Put it to a practice!

- Approach invited speakers
  - “Exposure”: become known by senior scientists
  - Go to lunch with them
- Give accessible talks
  - Your chance to shine!
  - If you give good talks, you receive questions
- Ask questions
  - it will make you look good, also help other students
  - This is what coffee breaks are for



Overview

Timetable

Contribution List

Speaker List

Layout of Ito International Research Center

Layout of Yayoi Hall (Japanese)

Poster

Group Photo

Contact

wings.s@gs.mail.u-toky...

# Timetable

< Mon 17/02 Tue 18/02 Wed 19/02 All days >

Print PDF Full screen Detailed view Filter  
Session legend

● Career Seminar 1 ● Coffee Break ● Coffee Break ● Lunch Break X  
see more...

09:00

Welcome Prof. Shin-ichi Ohkoshi  
Auditorium, Ito International Research Center 09:30 - 09:35

Logistics Dr Kate Hens  
Auditorium, Ito International Research Center 09:35 - 09:40

FoPM Prof. Hitoshi Murayama  
Auditorium, Ito International Research Center 09:40 - 10:00

10:00

Machine Learning the Universe: Testing cosmological theories with galaxy surveys Prof. Binurvesh Jain  
Auditorium, Ito International Research Center 10:00 - 10:30

Coffee Break  
Auditorium, Ito International Research Center 10:30 - 11:00

11:00

Optical response of edge ... Hirokazu KO... Hofstadter butterfly of to... Hiroyuki SUDO Waveform inversion for th... Keisuke OT... How hot cools faster than... Naruo OHGA

Transport theory of an ele... Keigo TAKA... Quasiperiodicity and supe... Mao YOSHII Extension of optimal trans... Ryuna NAG... TBA Shinichi ARITA

Probing nonlinear spin-wa... Kensuke OG... GLTCAM: Ultra-wideband ... Shuhei INOUE TBA Kosuke FUJIWARA Reducing qubit usage in e... Kosuke MAT...

Seeds of Massive Stars R... Kaho MORII Fermionic CFTs from error... Shinichiro Y... Dynamic nuclear polarizat... Yuki NAKAM... Fock State Generation wit... Takefumi N...

12:00

Toward label-free observa... Masato SAWA Observation of chiral dom... Moebe TSUK... Building a bridge between... Leo YOSHIO... Structural Fluctuation in ... Masaya SA...

TBA Yingdong LUO Games with backtracking ... Eitetsu KEN Neutrino mass ordering d... Shintaro MIKI Spin Nernst and thermal ... Nense ESAKI

Lunch Break

# Public slides

- We would like to post your slides on the web page
  - Let the world see your work! Your pride.
- But in some fields, people worry about making the research public before publications
  - Somebody may steal your work: “scooping”
- Please check with your advisor. If OK, send me the slides. I’ll post them on the web.
- You can list your talk at this symposium on your resumé

***Have fun!***

**FOPM**