



## Importance of International Collaboration

Jefferson Lab  
Users' Meeting

Jonathan Bagger  
June 24, 2019



# APS Task Force

# APS Task Force on Expanding International Engagement

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- **Johanna Stachel** University of Heidelberg, [Germany](#)
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# APS Task Force on Expanding International Engagement

## Why now? Physics is increasingly international!

- **RESEARCH:** International research collaborations are on the **rise**; more countries are partnering to build large-scale collaborations and facilities
- **INDUSTRY:** Companies are increasingly multinational; more U.S. corporations are **expanding offshore** research and development facilities
- **JOURNALS:** **Two-thirds** of corresponding authors publishing in APS journals are now from outside of the United States
- **EDUCATION:** The United States competes to attract and retain first-rate students and scientists, yet international applications to U.S. physics Ph.D. programs are **declining**

# APS Task Force on Expanding International Engagement

## Why now? Physics is increasingly international!

- **OUTREACH:** APS engages physicists at all levels **worldwide**, offering K-12 students hands-on physics activities and bringing the excitement of physics to the United States and, increasingly, to international audiences
- **POLICY:** Open exchange is the lifeblood of scientific progress; recent government policy shifts regarding **scientific mobility** are affecting U.S. participation in international collaborations, as well as international participation in U.S.-based collaborations
- **MEMBERSHIP:** Nearly **one-quarter** of the APS membership lives outside of the United States; APS surveys indicate that many members would welcome a more international outlook from the Society

# APS Task Force on Expanding International Engagement

## Guiding Principles

- International partnerships strengthen the American Physical Society
- International collaboration strengthens physics in the United States

30% of American Nobel Prize winners in physics were born outside the United States

# APS Task Force on Expanding International Engagement

## American Physical Society: Strategic Goals

1. Offer new/expanded ways to participate in the APS community
2. Integrate international affairs across all APS activities
3. Expand international opportunities for young physicists; better prepare young physicists for international careers
4. Advance government policies that promote international scientific collaboration

Our report, released last fall, offers recommendations and provides an implementation plan. It has been incorporated into the APS Strategic Plan

# Nuclear and Particle Physics

# Nuclear and Particle Physics

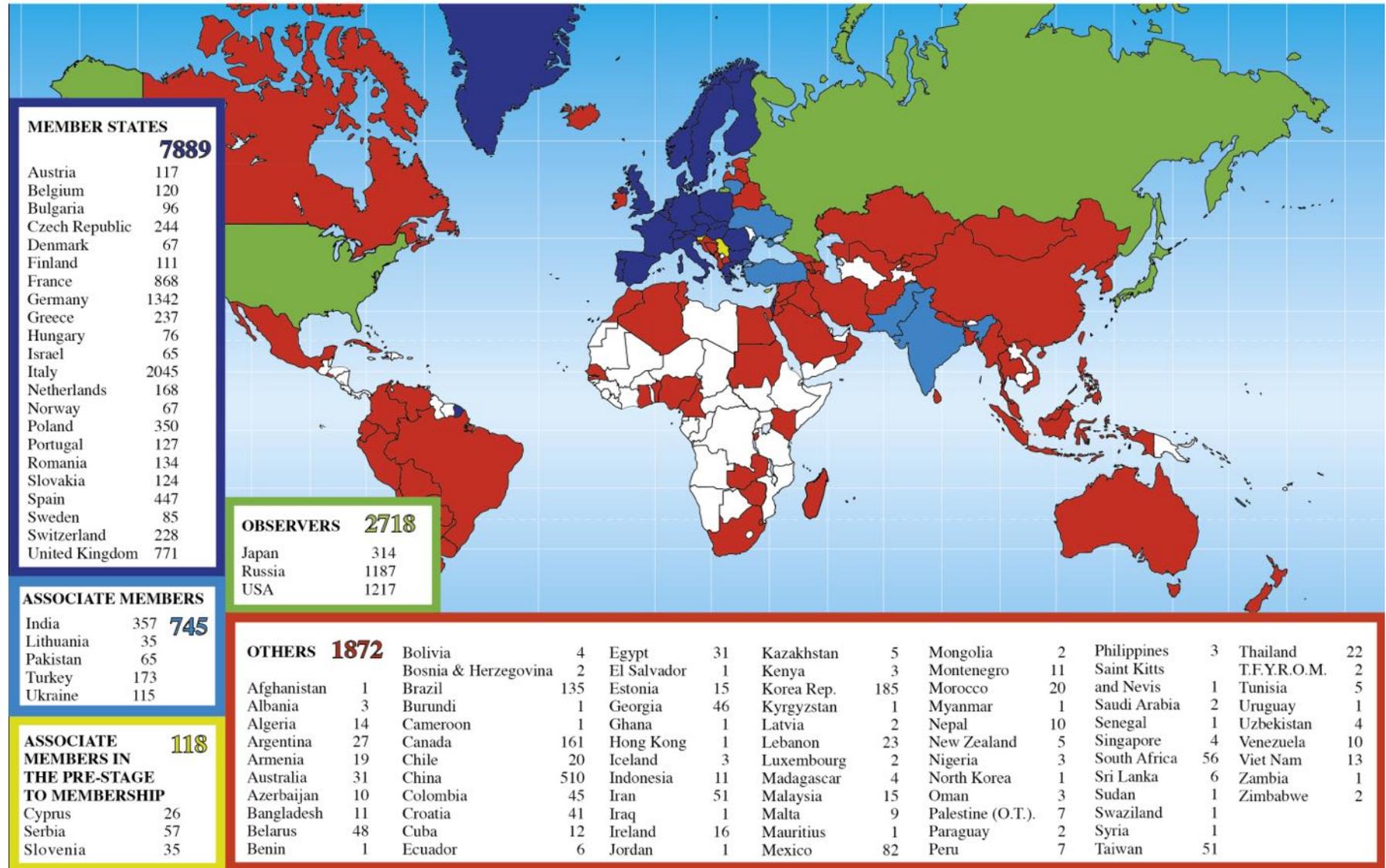
**Our field is fully international. I will focus on**

1. CERN
2. TRIUMF
3. Jefferson Lab

# CERN

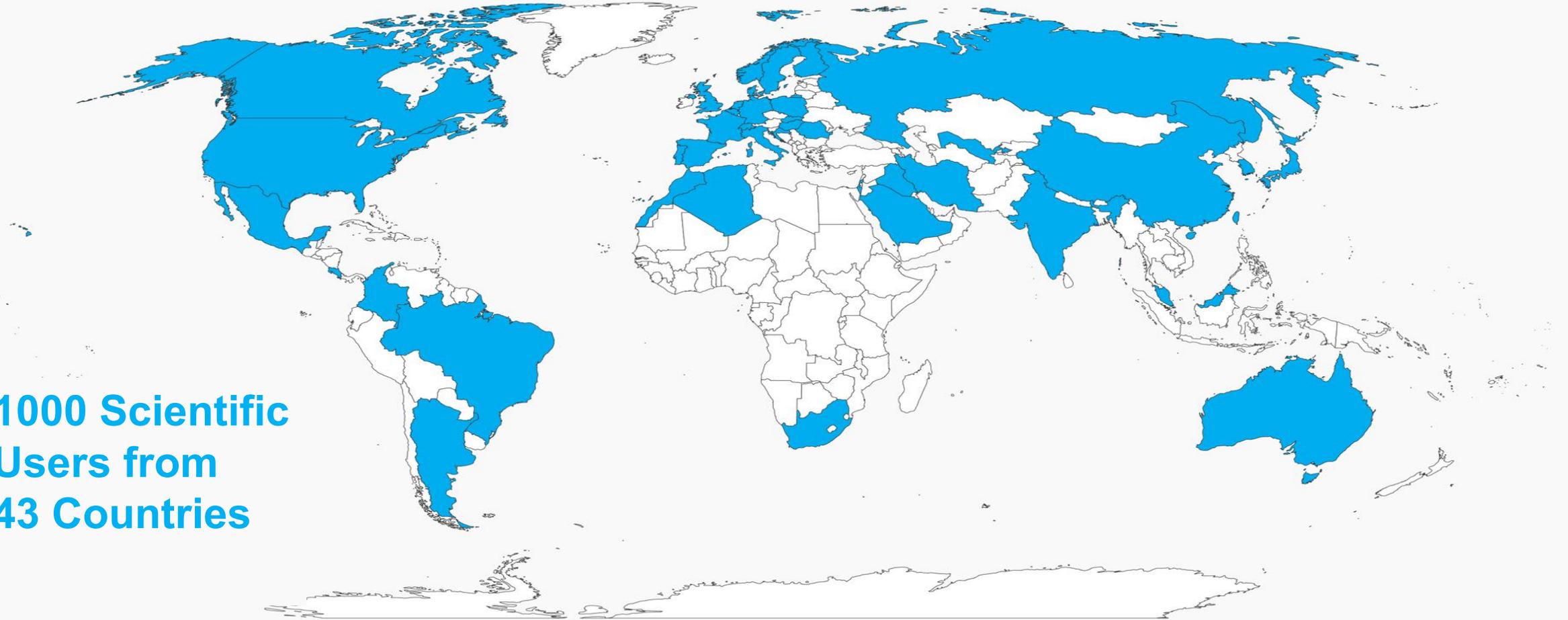
## Distribution of All CERN Users by Nationality on 24 January 2018

13,350 Scientific Users from 112 Countries



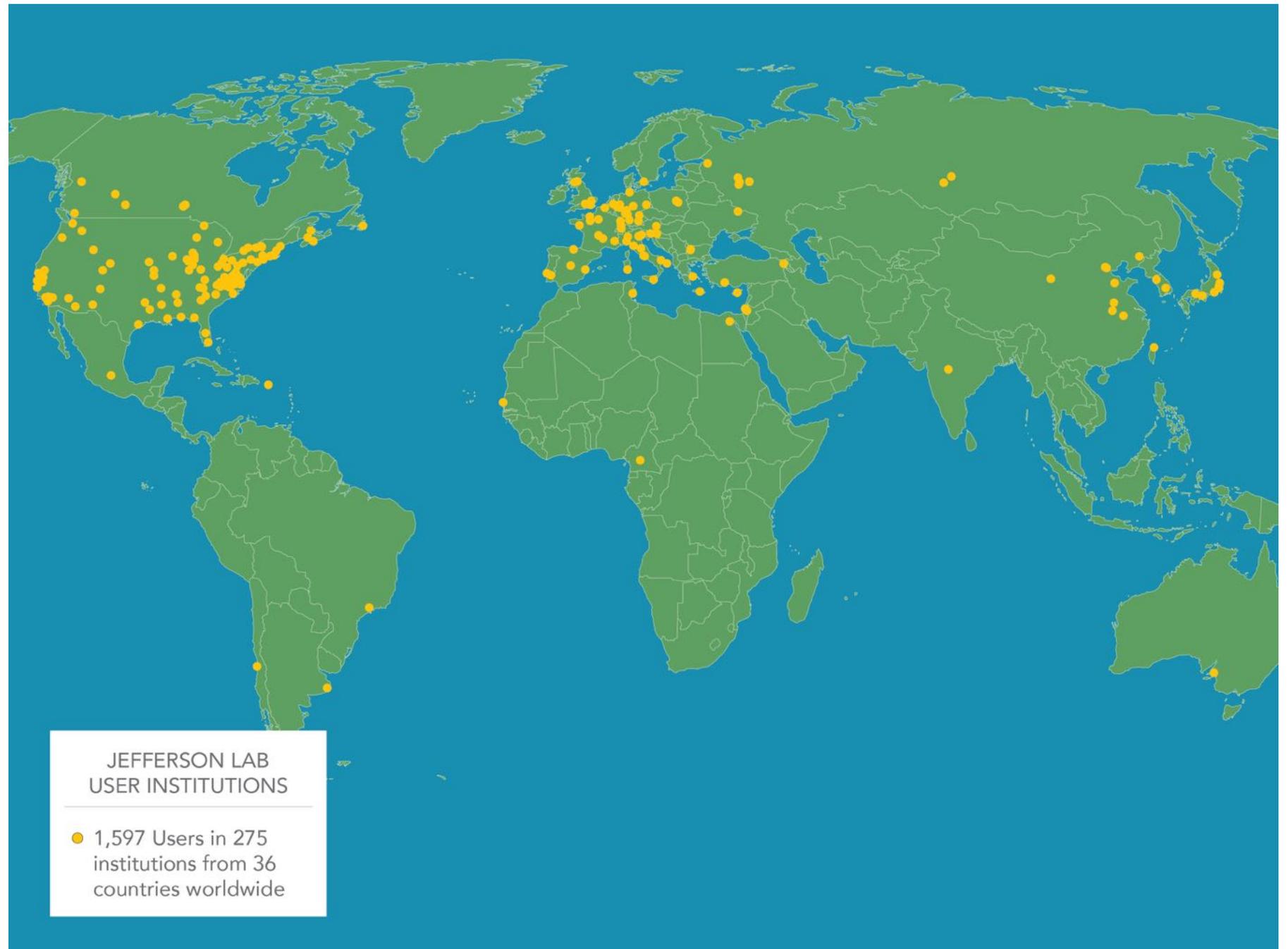
# TRIUMF

**1000 Scientific  
Users from  
43 Countries**



# JLAB

**1600 Scientific  
Users from  
36 Countries**

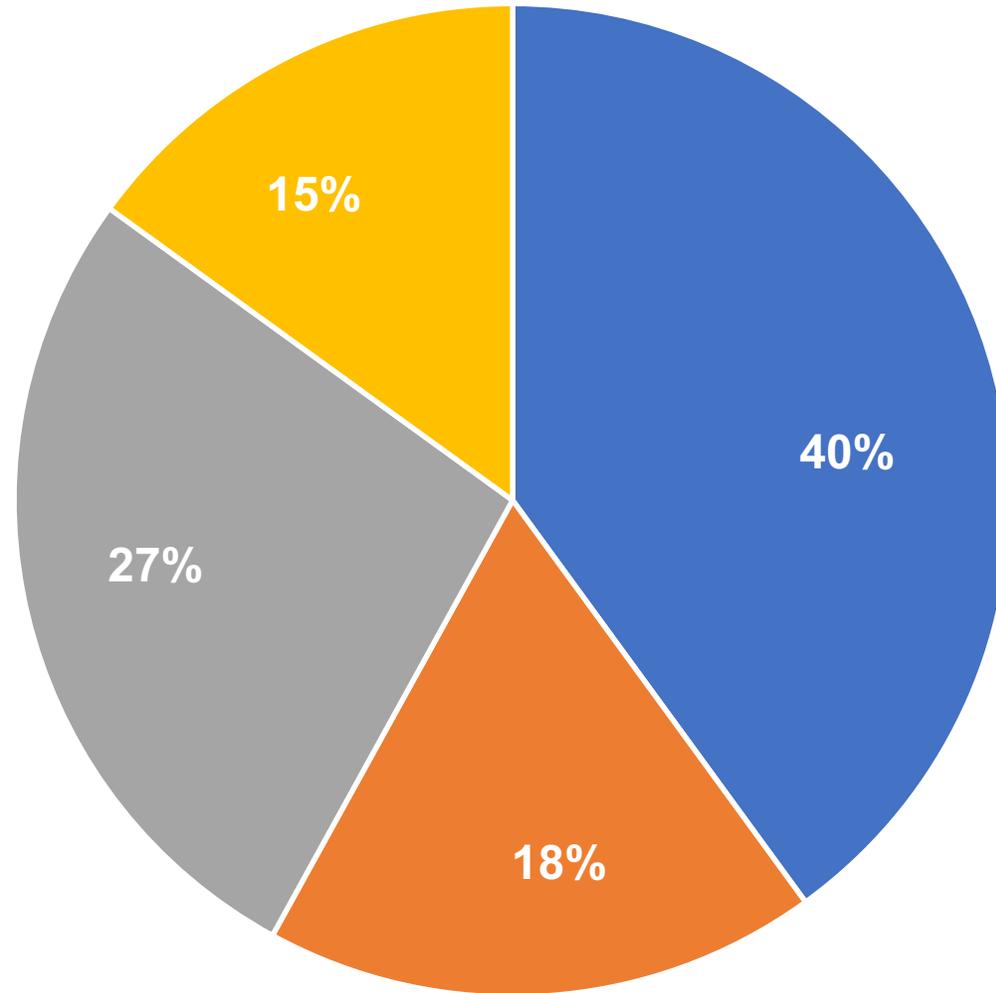


# Nuclear and Particle Physics

## Internationalization is prevalent across each lab

- The present Directors of Fermilab and Los Alamos were born outside the United States, as was the previous Director of Jefferson Lab
- The present Director of TRIUMF was born outside Canada, as were three of the four previous Directors
  - At TRIUMF, 1 out of 2 Deputy Laboratory Directors was born outside Canada, as were 2 out of 4 Associate Laboratory Directors
  - TRIUMF students and staff hold passports from 30 countries
  - 60% of TRIUMF's users come from outside Canada...

## Scientific Users and Visitors by Region (2018)



Mobility ensures  
the best science  
is done

■ Canada ■ Africa & Europe ■ Americas ■ Asia & Pacific

# Nuclear and Particle Physics

**Our field has a special role to play in an increasingly complex and globalized world**

- Diplomacy
- Collaboration, Cooperation, and Communication
- Global Challenges

**Diplomacy**

# Nuclear and Particle Physics: Diplomacy

## Atoms for Peace: 1953

“I know that the American people share my deep belief that if a danger exists in the world, it is a danger shared by all; and equally, that if hope exists in the mind of one nation, that hope should be shared by all....

[The] United States pledges before you ... to devote its entire heart and mind to finding the way by which the miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life.”

*President Dwight D. Eisenhower, Speech to United Nations, December 8, 1953*

# Nuclear and Particle Physics: Diplomacy

## International Atomic Energy Agency: 1957

The International Atomic Energy Agency

- encourages the development of the peaceful applications of nuclear energy, science and technology
- provides international safeguards against misuse of nuclear technology and nuclear materials
- promotes nuclear safety and nuclear security standards and their implementation

The IAEA and its former Director General, Mohamed El-Baradei, were jointly awarded the Nobel Peace Prize on October 7, 2005

# Nuclear and Particle Physics: Diplomacy

## CERN: 1954

CERN was founded in 1954, in the ashes of WWII, to restore European science to its prior eminence – and to bring together former enemies in a noble and common pursuit

CERN predates the European Union by three years, and looks to survive Brexit as well!



# Nuclear and Particle Physics: Diplomacy

## SESAME: 2004

Today, in the mid-East, SESAME has created an unlikely coalition to build and operate a third-generation light source



Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestine, and Turkey

# Nuclear and Particle Physics: Diplomacy

## SESAME

- Constructed with much advice and assistance from CERN
- Started operations in 2017
- First and only solar powered accelerator!



Can the CERN spirit be replicated?

# Nuclear and Particle Physics: Diplomacy

## TRIUMF: 1968

Canada is a confederation of 10 provinces and 3 territories, each with its own history, traditions, cultures, and opinions!



# Nuclear and Particle Physics: Diplomacy

TRIUMF has 20 owners - member universities stretching 5000 km from coast to coast!



# Nuclear and Particle Physics: Diplomacy

Six provinces invest directly into TRIUMF!



# **Collaboration, Cooperation, and Communication**

# Nuclear and Particle Physics: Collaboration

## **Our passion for physics underlies all that we do**

- Because of that passion, we can overcome obstacles and do great things together
- Physics is hard. Our science requires that we cooperate, communicate, and collaborate. Over the years, we have learned how to do it
- History shows that these are valuable skills, in science and beyond

# Nuclear and Particle Physics: Collaboration

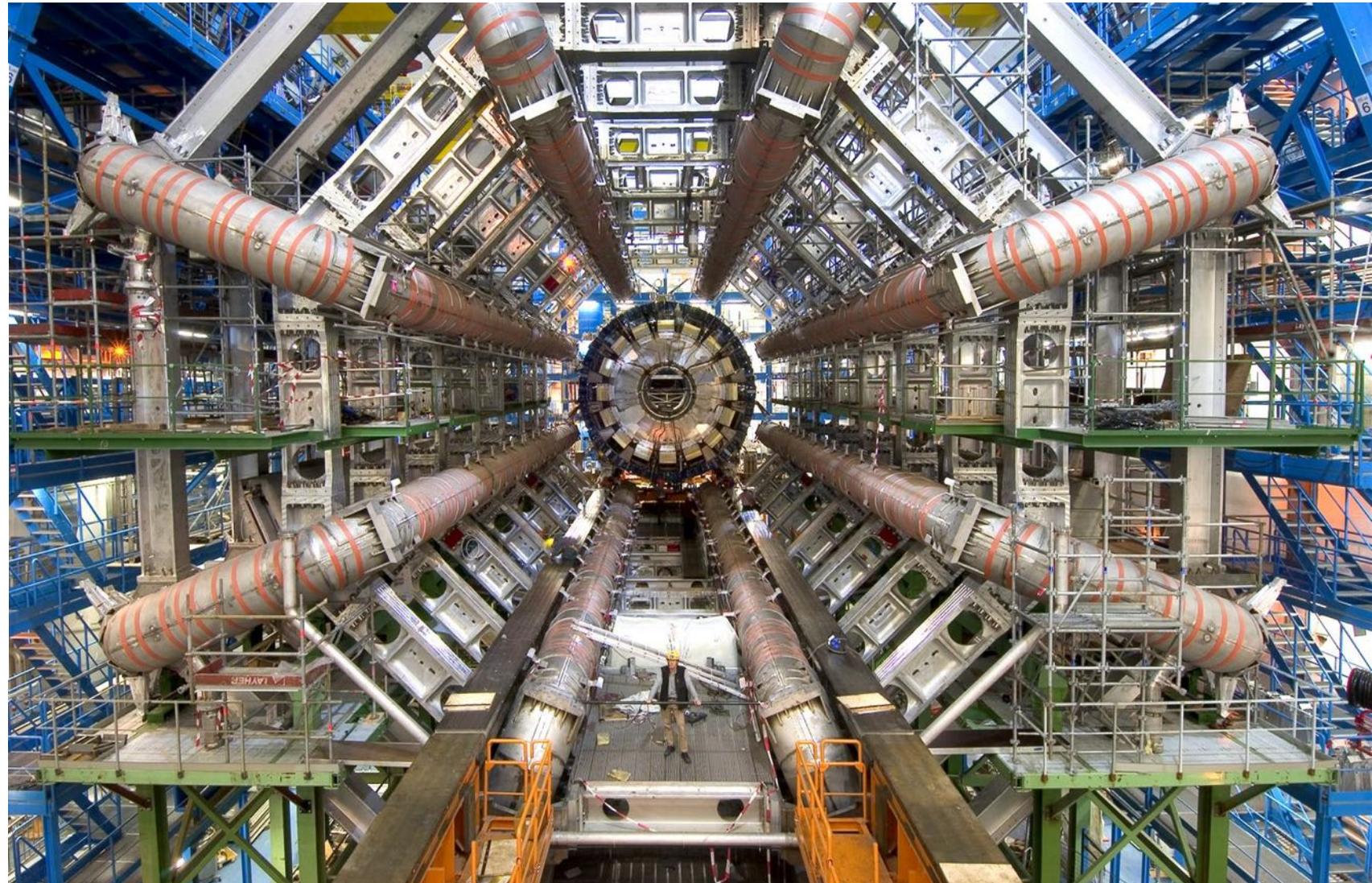
## ATLAS

The quintessential example, with 3000 scientists from 183 institutions in 38 countries

And despite all odds, it works!

1200 Ph.D. students!

(Likewise CMS)



# Nuclear and Particle Physics: Collaboration

## TRIUMF

On a smaller scale, at TRIUMF, hundreds of students and postdocs work with scientists, engineers, technicians, and tradespeople – from dozens of countries

At places like TRIUMF, JLAB, and CERN, our field offers training not available at any university



# Nuclear and Particle Physics: Communication

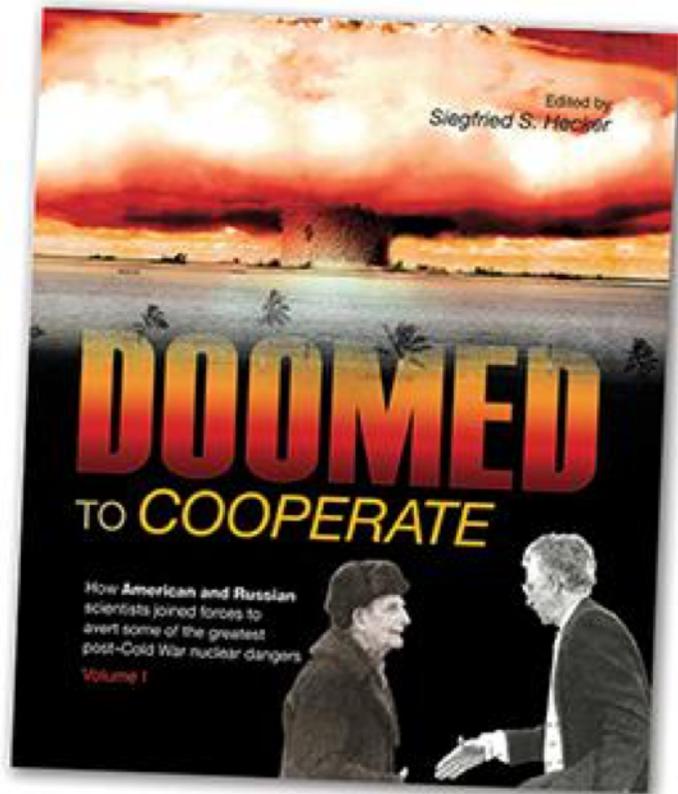
## **This training is important**

It allows us to transcend barriers. During the cold war, American and Soviet scientists were able to communicate and cooperate across political divides



# Nuclear and Particle Physics: Cooperation

## *Doomed to Cooperate*



This book, by Sig Hecker, former LANL Director, and its accompanying web site,

- [lab2lab.stanford.edu](http://lab2lab.stanford.edu)

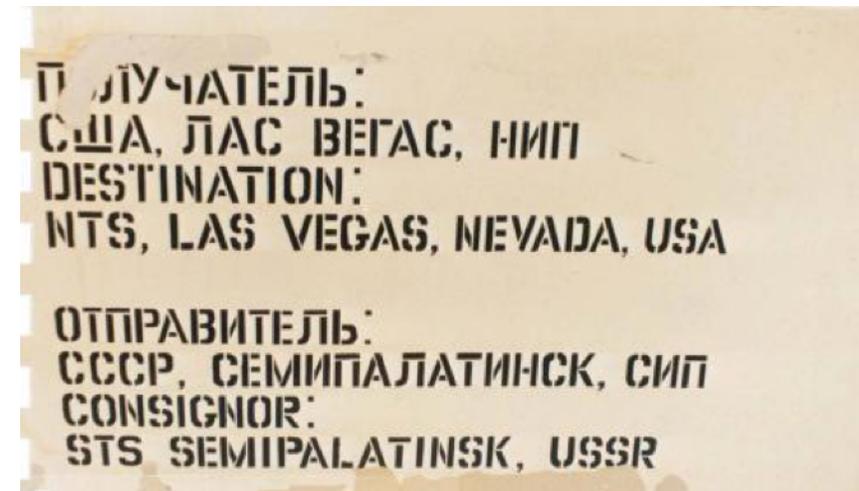
tell the story U.S.-Russian lab-to-lab cooperation, from both points of view, starting with the 1988 Joint Verification Experiment, and continuing through many subsequent years of collaboration, in particular countering the threat of proliferation

# Nuclear and Particle Physics: Cooperation

## Joint Verification Experiment

In 1988, the U.S. and the Soviet Union opened their nuclear test sites in Nevada and Semipalatinsk to each other to conduct the Joint Verification Experiment. Dozens of scientists and technicians on both sides worked side-by-side to compare ways to assess the yield of a nuclear explosion. This allowed the U.S. and Soviet delegations to reach an agreement on the Threshold Test Ban Treaty

- The experience left a deep impression on the U.S. and Russian nuclear weapons communities
- In 2013, DOE and Rosatom sent delegations to the Nevada Test Site to celebrate the 25 anniversary of this remarkable experiment



# Nuclear and Particle Physics: Cooperation

## Joint Verification Experiment

By 2018, the political winds had shifted, and there were no commemorations. Nevertheless, the Russian participants reached out to their American counterparts:

“JVE launched widest possible interaction between scientists of the two Nuclear Powers in the defense and, even more importantly, civil spheres. The interaction involved thousands of scientists on both sides. It facilitated setting-up personal contacts and friendly relations between many of them.

We ask you, dear Sig, to pass our warmest regards, best wishes and congratulations on the 30<sup>th</sup> anniversary to the American JVE participants.... [We] do our best to share our experience of useful bilateral cooperation with the young generation of scientists as well as our hope for its renewal.”

# Nuclear and Particle Physics: Communication

## And today, with Iran?

Ernie Moniz and Ali Akbar Salehi were both nuclear scientists at MIT in the 1970's

Their shared experience was instrumental to framing the 2015 agreement with Iran

Let's hope such a time will come again, before it becomes too late...

## *No. 2 Negotiators in Iran Talks Argue Physics Behind Politics*



Energy Secretary Ernest J. Moniz during a break from negotiations in Lausanne, Switzerland. Fabrice Coffrini/Agence France-Presse — Getty Images

# Global Challenges

# Nuclear and Particle Physics: Global Challenges

## Facing challenges

- The world is facing enormous challenges: climate change, food security, clean water, human health, sustainable development, income inequality ...
- Many of the problems are of a global nature and will require international communication, cooperation, and collaboration
- Some, but not all, of the solutions will rely on technology
- As scientists, we cannot ignore these challenges. It is our responsibility to give back, to act with our heads as well as our hearts

# Nuclear and Particle Physics: Global Challenges

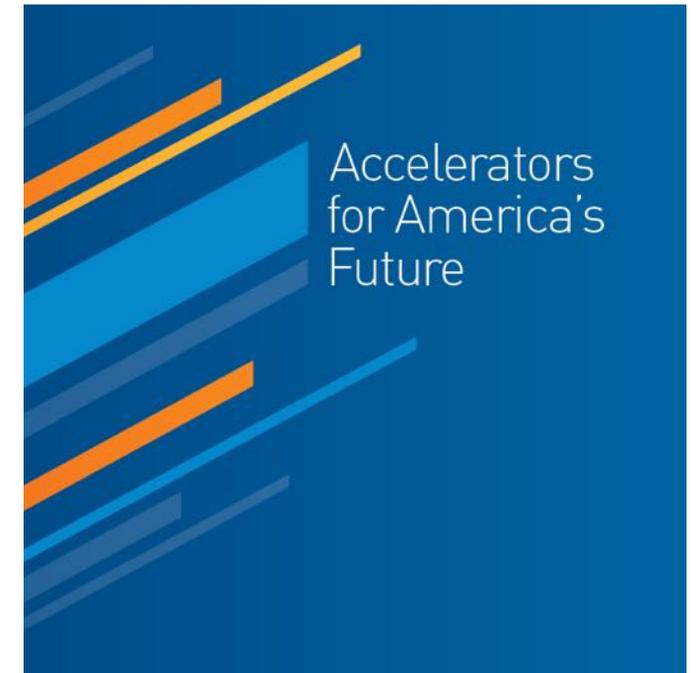
## To start, educate yourself

- Study the excellent monograph and web site

### **Accelerators for America's Future**

which details the impact of the world's 30,000 particle accelerators across

- Energy and Environment
- Medicine
- Industry
- National Security
- Discovery Science



# Nuclear and Particle Physics: Global Challenges

## Examples, from *Nautilus* magazine and Bob Kephart, Fermilab

1. Is your milk carton sealed? *An accelerator did it*
2. A lot of natural gas is wasted. *Accelerators can fix that problem*
3. Want your spinach *E. coli* free? *Accelerators may have cleaned it*
4. Can coal be a clean fuel? *Yes, if you attach an accelerator to the smokestack*
5. Antibiotics harm fish? *Accelerators can turn pharmaceuticals into fertilizer*
6. Your new computer has arrived. *Thank an accelerator for building it*
7. Accelerators make us live longer. *They kill cancer*
8. Can nuclear reactors be accident-proof? *Yes, if particle accelerators control them*
9. The world still runs on oil. *Accelerators can find it*
10. Accelerators keep watch for weapons of mass destruction

# Nuclear and Particle Physics: Global Challenges

Examples, from TRIUMF industrial partnerships



**D-Pace**



GE Healthcare



**LOCKHEED MARTIN**



**TOYOTA**

**AIRBUS**

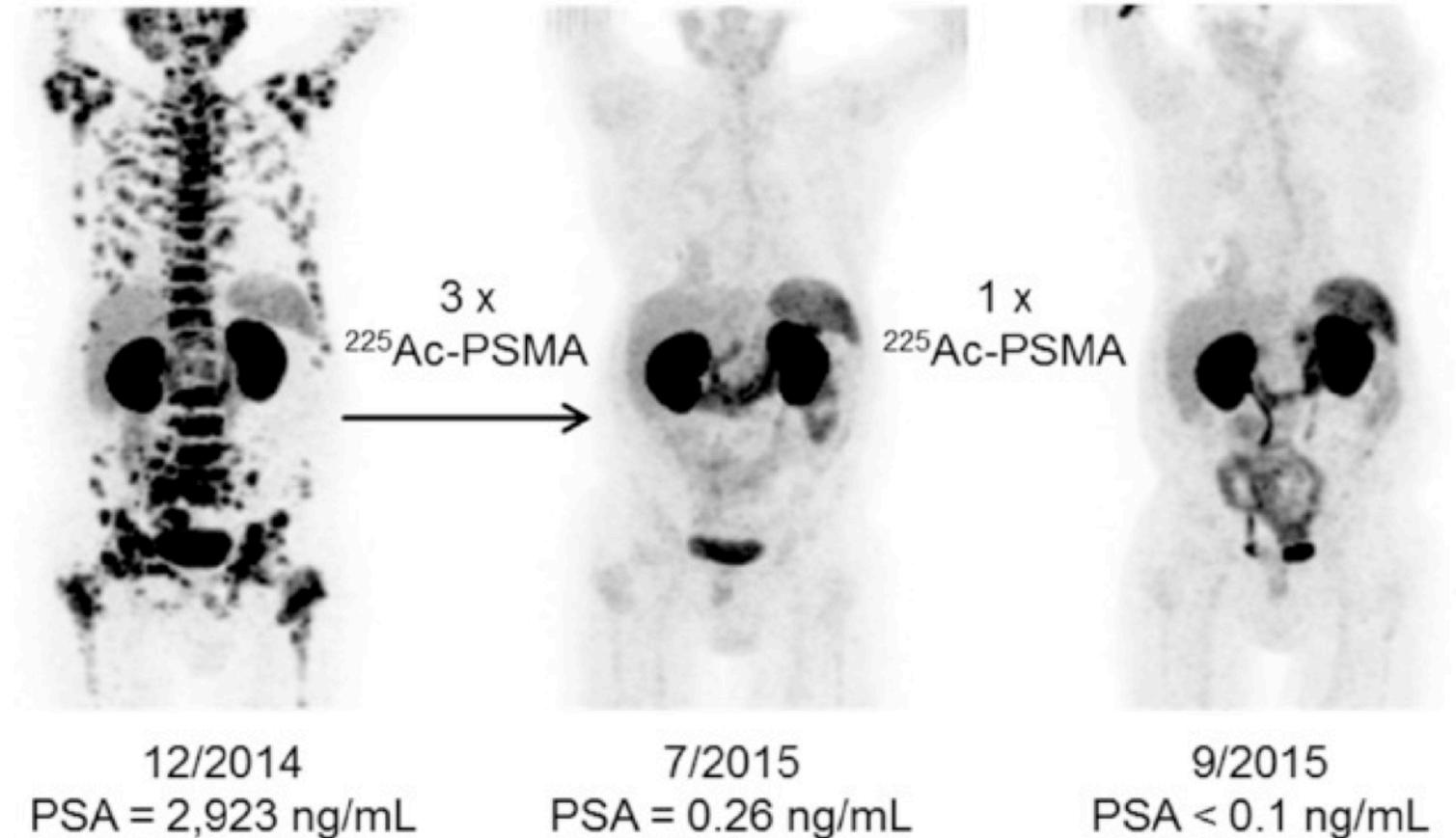


# Nuclear and Particle Physics: Global Challenges

## Example: Targeted $\alpha$ Therapy

Prostate cancer patient before and after treatment with  $^{225}\text{Ac}$ -PSMA

Both TRIUMF and DOE are preparing accelerators to produce  $^{225}\text{Ac}$  for clinical use



# Nuclear and Particle Physics: Global Challenges

## Continue to educate yourself

- Read the encyclopedic review article

### **Particle and nuclear physics instrumentation and its broad connections**

by M. Demarteau, R. Lipton, H. Nicholson, and I. Shipsey, in Rev. Mod. Phys. **88**, 045007 (20 December 2016)

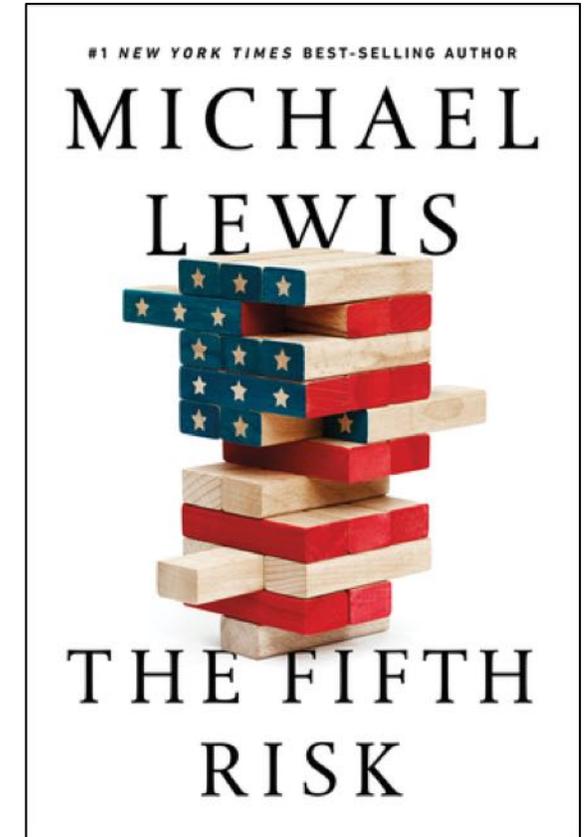
The article describes a wealth of scientific, security and commercial applications – including detector technologies, as well as and scientific data management and computing

# Nuclear and Particle Physics: Global Challenges

Follow with a quick – but scary – read ...

- Don't forget the scientists in fields outside our own...
- For example, in the Departments of Agriculture, Commerce and Energy, as described by Michael Lewis in the *Fifth Risk* (author of *Moneyball*) ...

Science is infused across the U.S. government, but no one knows!



# Nuclear and Particle Physics: Global Challenges

## And then pay it forward

- Encourage the 80% of our students who will leave the field to go forward with pride to make a difference
- Reach out to friends and colleagues from across the globe to learn their perspectives
- Talk to your friends and neighbors (and your Congressman) about the importance of science and international engagement
- Keep an eye out for technologies that have a broader impact
  - Don't just fill out your NSF grant proposal by rote
- Seek solutions – our future depends on it!

# Nuclear and Particle Physics

## Summary

- Our field is completely international, so as a community, we are in a privileged position – and therefore have a special responsibility – to address global challenges. We have done it before, and we can do it again
- Our field is of a size and scope that international collaboration is essential to advance our science. But so are the challenges that we face. So be engaged!

To me, this is the true importance of international collaboration



**Thank You!**  
**Merci!**

[www.triumf.ca](http://www.triumf.ca)

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