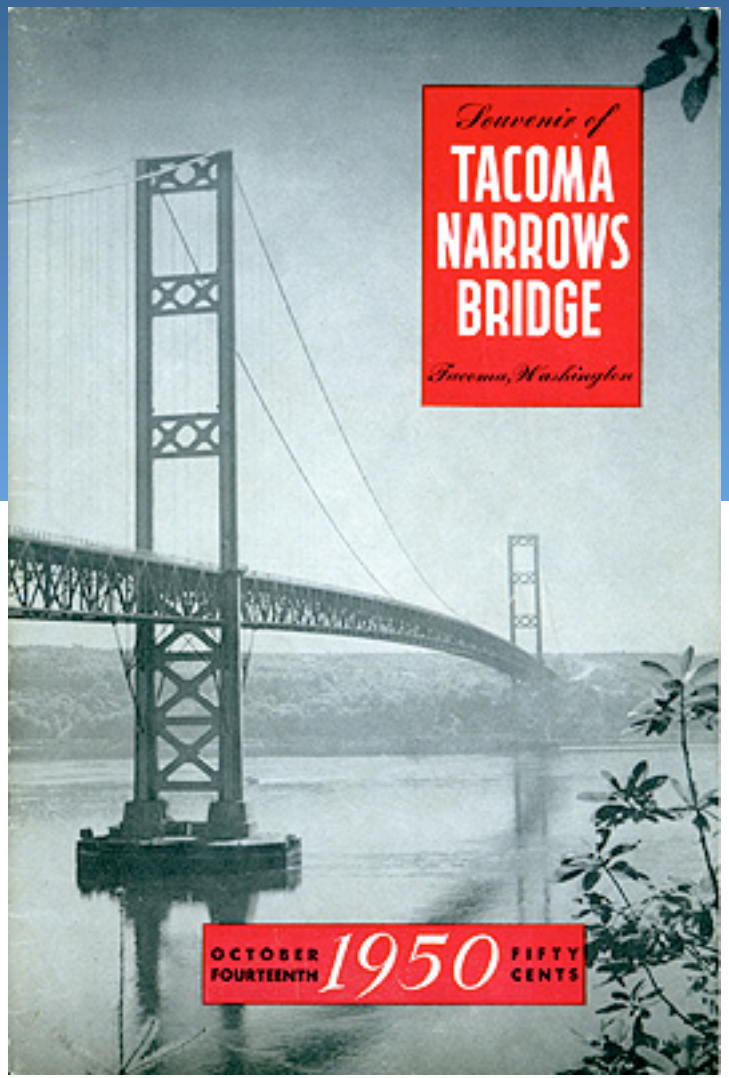
Bridging the Socio-Cultural Gap:
An International Physicist's Experience



J. Pedro Ochoa
Berkeley Lab

APS March Meeting:
Experiences and Issues of Young Physicist's on the International Arena

Dallas, TX – March 2011

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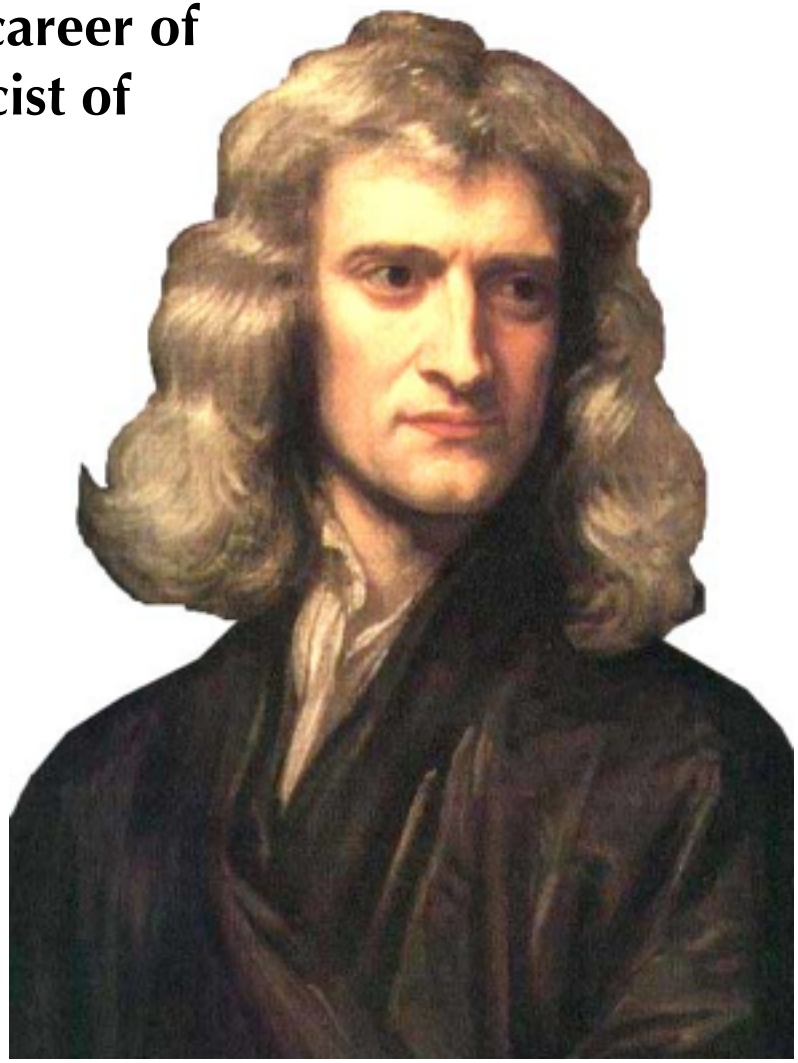

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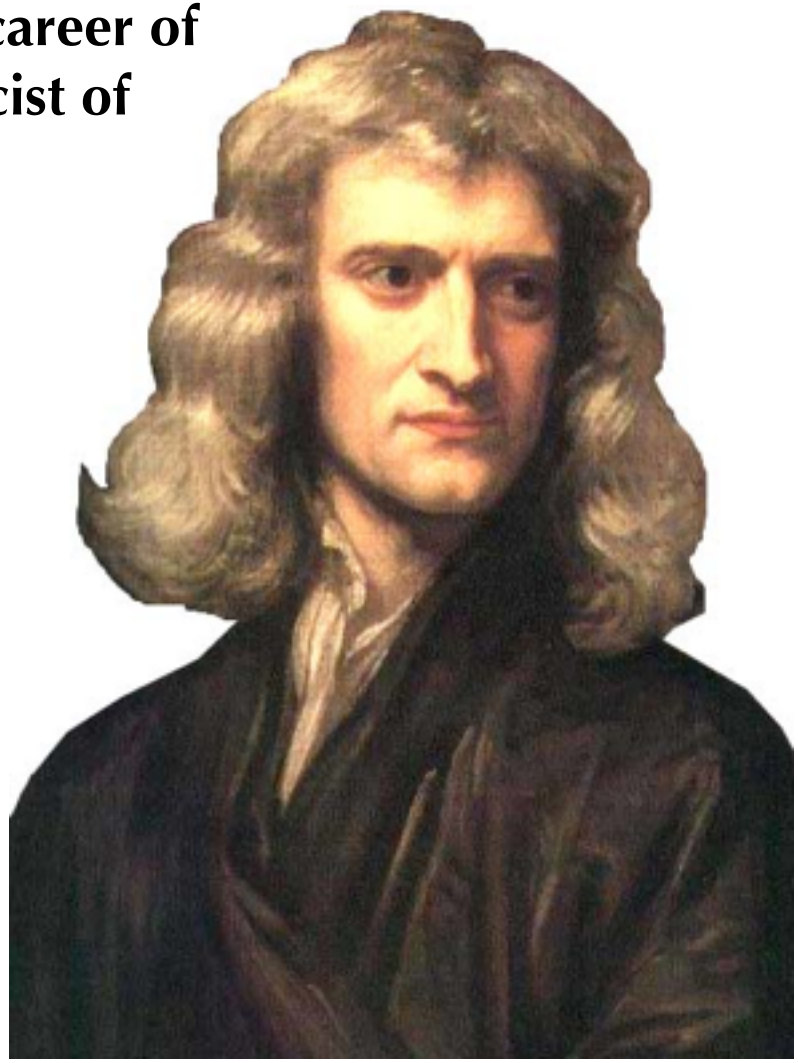

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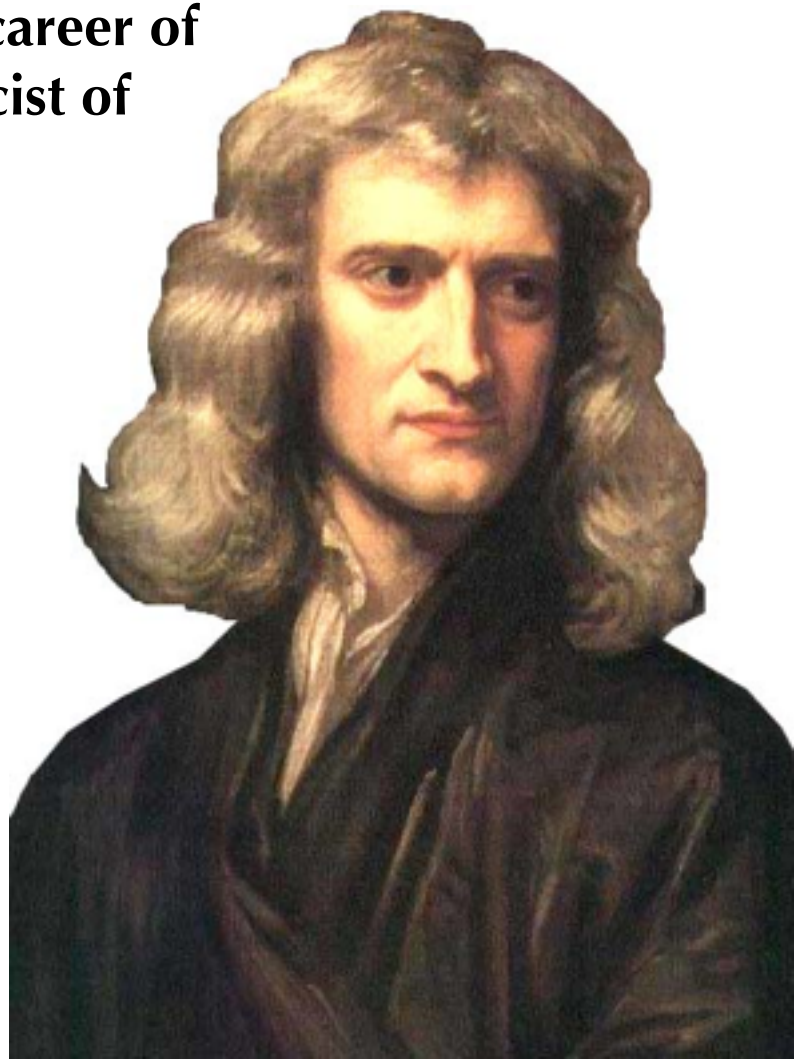

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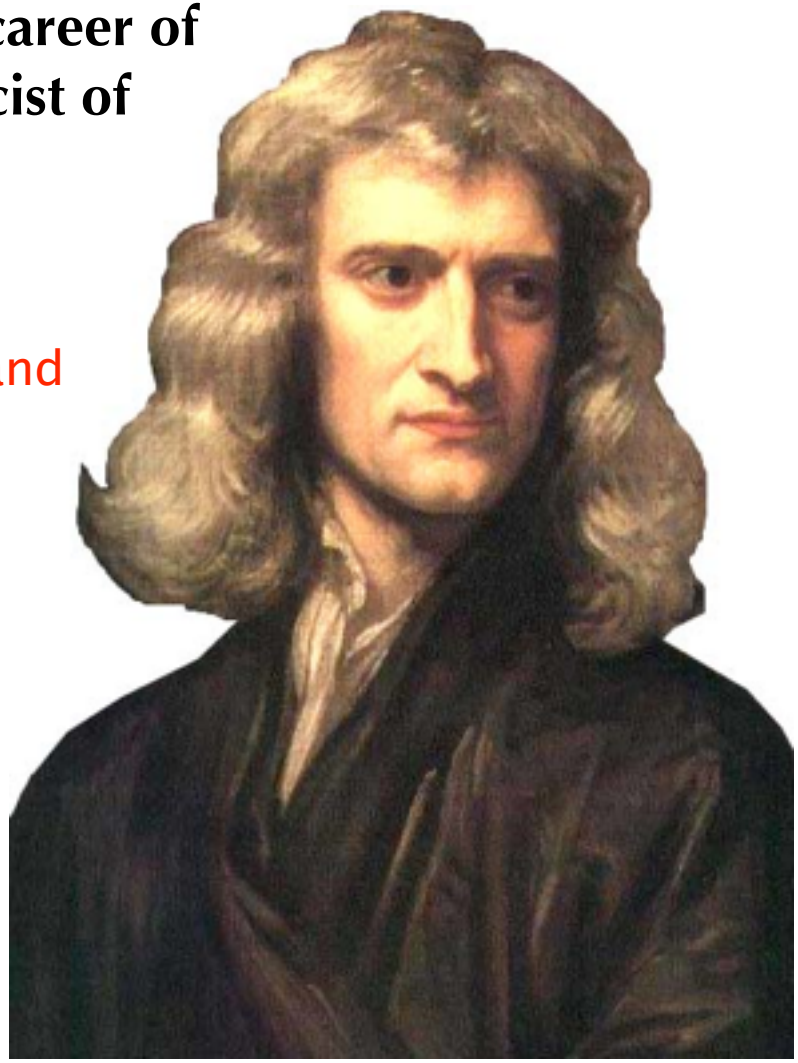

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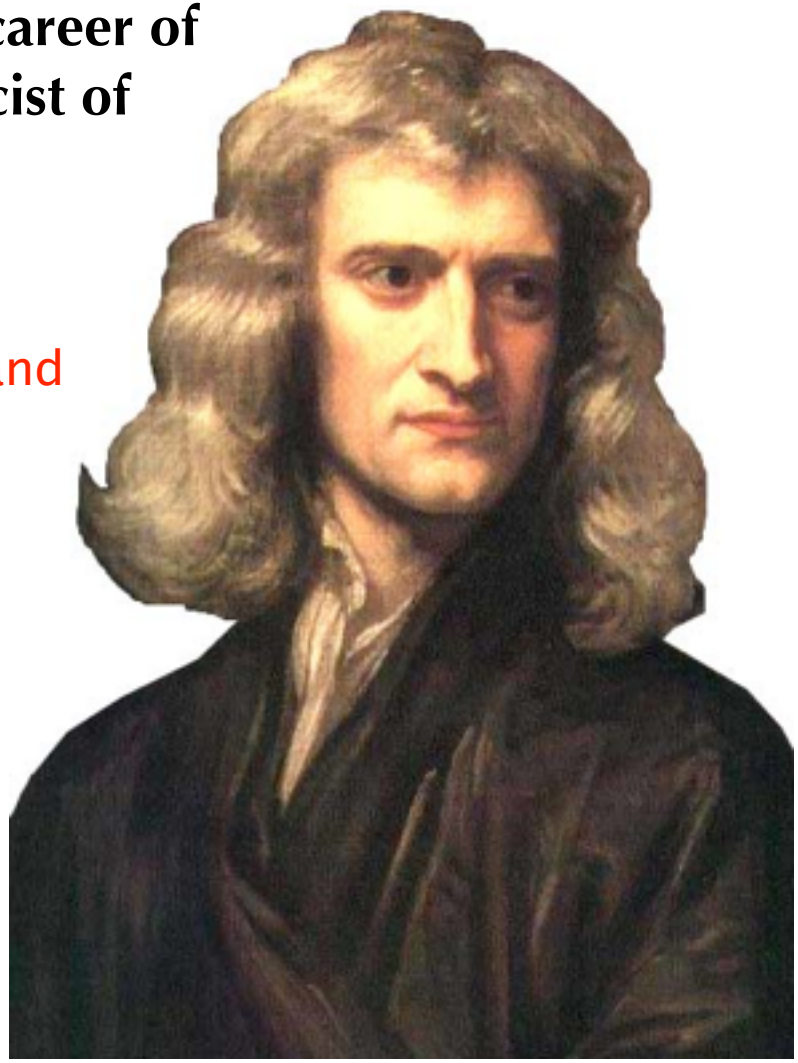

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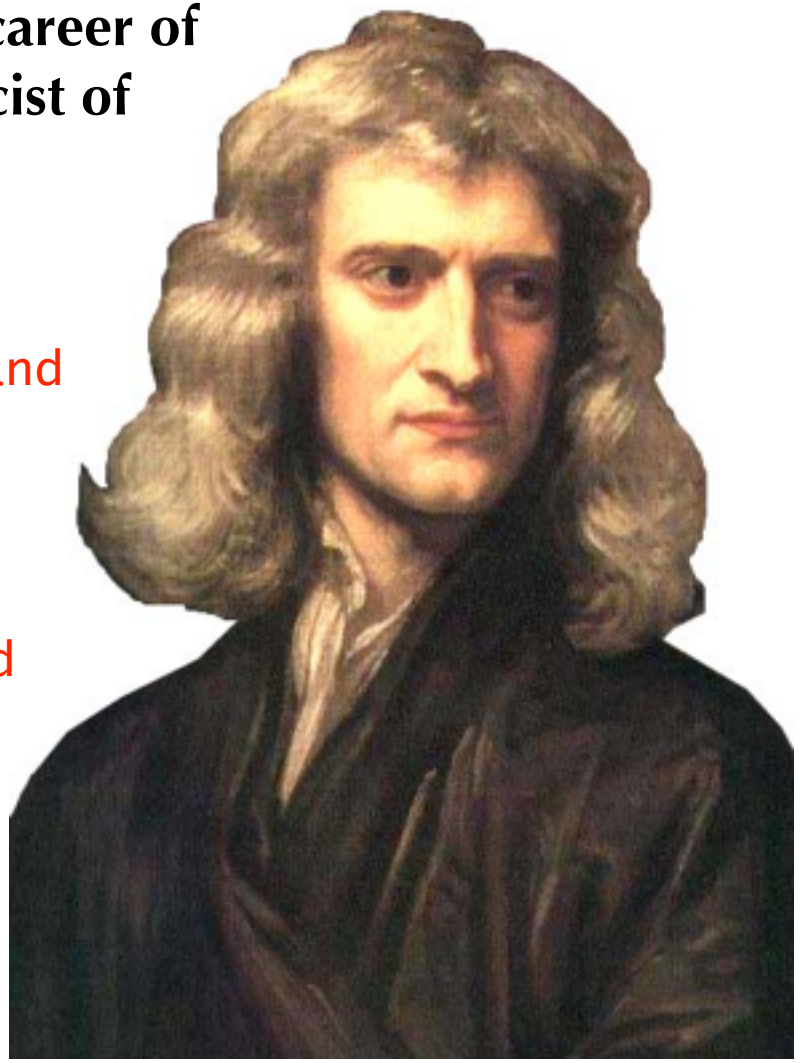

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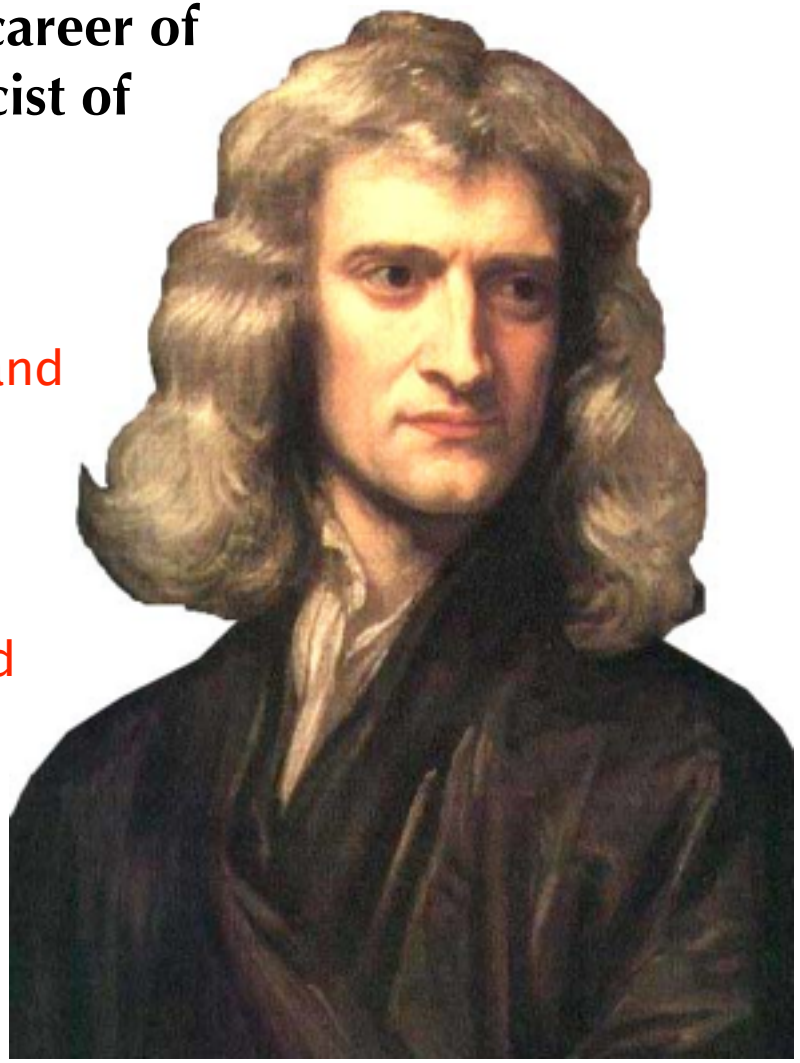

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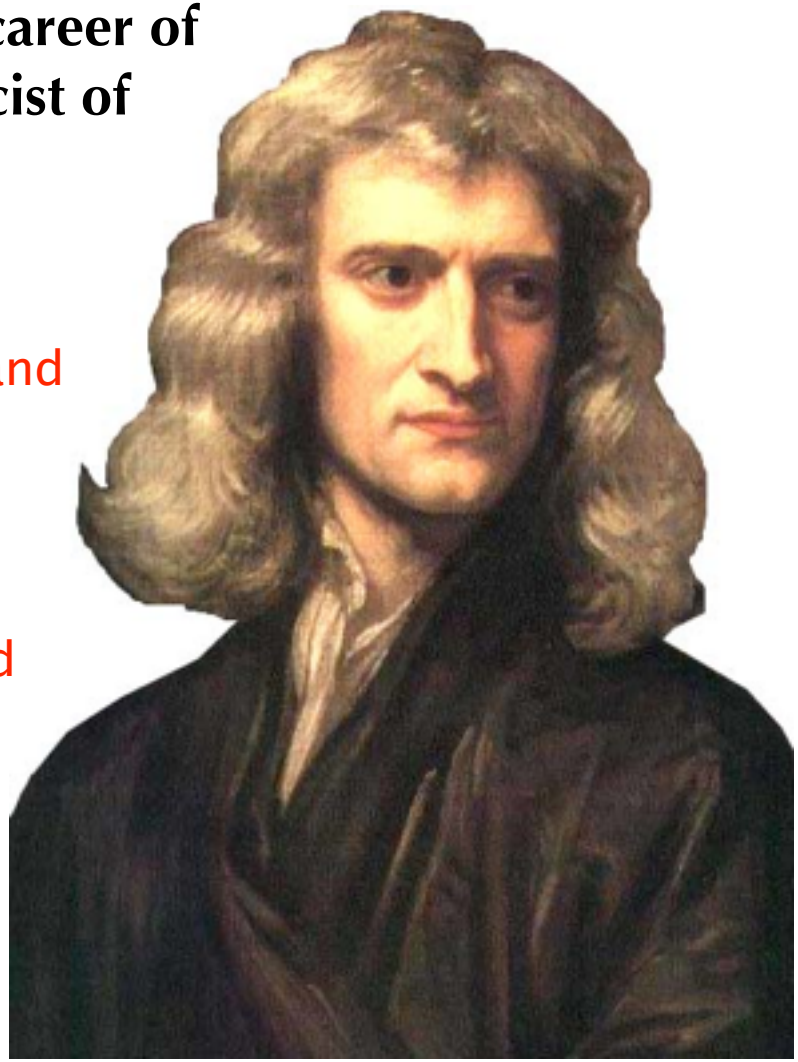

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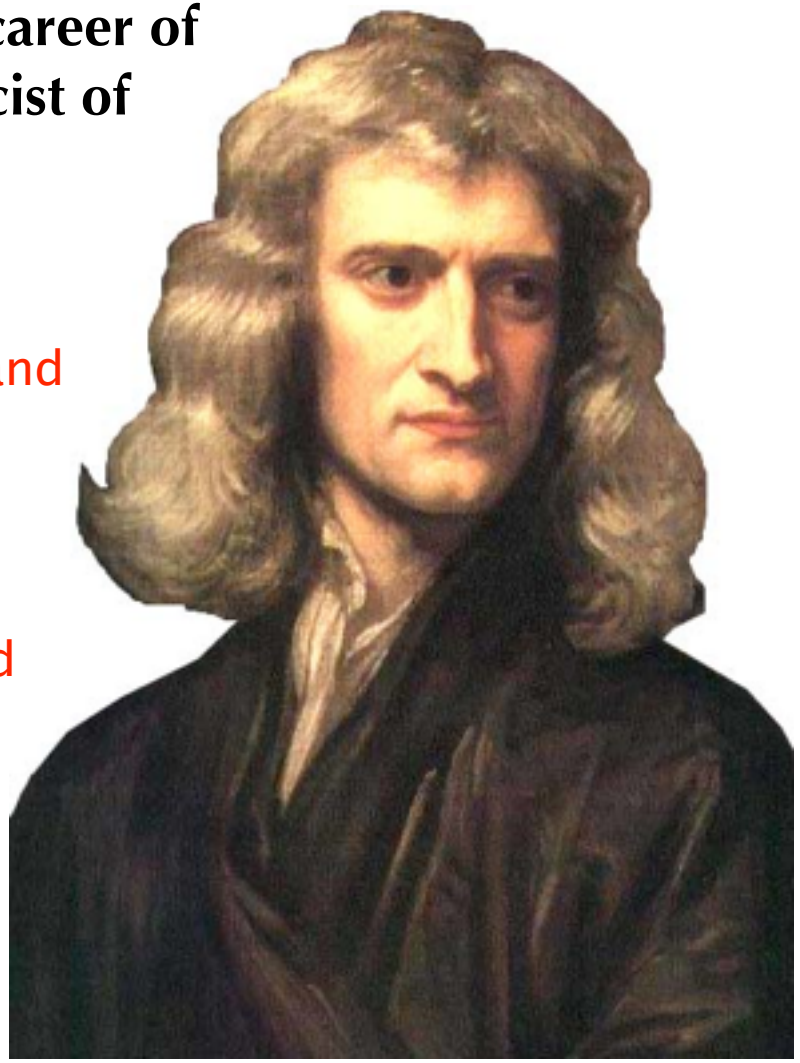
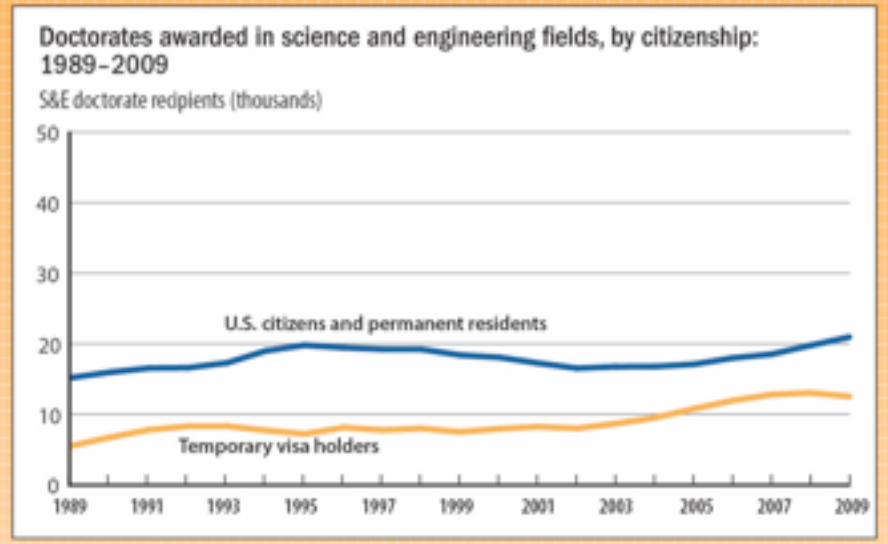


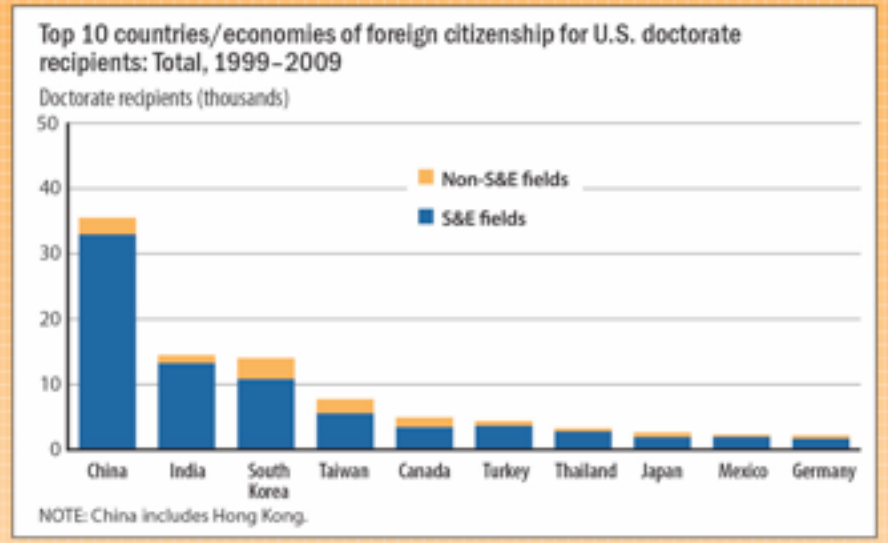
- It's not like he was isolated from the rest of the world either, but it does show us how different things are nowadays.

The Globalization of Science

- Nowadays, the work of a scientist necessarily involves moving across cultural gaps
  - For one, the complexity and cost of the projects require increased collaboration:
    - Examples abound in particle physics, astronomy, fusion research…
  - Moreover, students want to go where the action is:
    - Example of the United States:



NSF Doctorate Recipients from U.S. Universities 2009; www.nsf.gov/statistics/nsf11306/



NSF Doctorate Recipients from U.S. Universities 2009; www.nsf.gov/statistics/nsf11306/

- The percentage of visa holders earning a PhD in S&E increased from 27% to 37%

Crossing the gaps

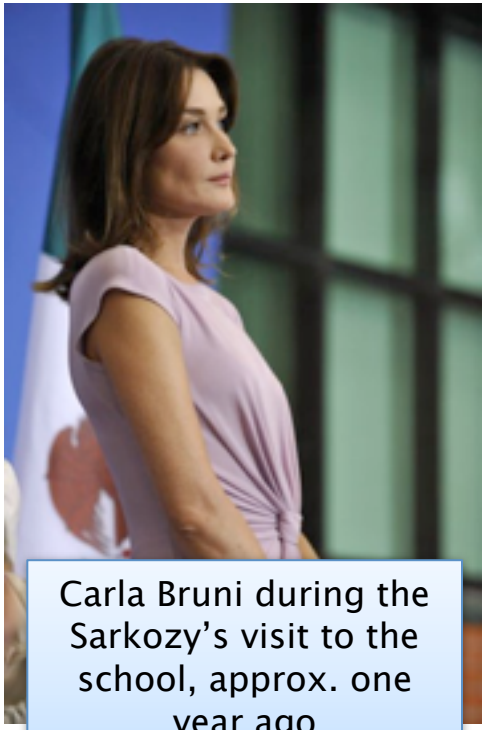
- The issue is, of course, that crossing these gaps isn't always easy:
  - There's **social** gaps, such as differences in education and/or differences in opportunities.
  - There's **cultural** gaps, such as differences in language, in life-style, and in working culture.
- I will address these issues in the context of my own experience as someone who:
  - Was born in Mexico
  - Was educated under the French System
  - Was trained as a physicist in Mexico and the United States
  - Is currently working in an experiment in China
- I will end with some suggestions and personal thoughts.

My personal experience: until highschool

- **Note**: I was <u>not</u> an underprivileged kid who rose through insurmountable difficulties in order to become a physicist. I was very fortunate.
- I was born in Mexico city, one of the largest cities in the world.
  - I am actually ½ French, and because of that I attended French school (in Mexico city)

(http://en.wikipedia.org/wiki/Lycée_Franco-Mexicain)

- The French program is followed 100% (even take Baccalaureate at the end)
- Approximately ½ of the students are French, and the other ½ Mexicans.
- High-school is free for French students but costs ~$1,100 USD / month to Mexican students.



Carla Bruni during the Sarkozy's visit to the school, approx. one year ago

  - I got an education 100% equivalent to what I would have gotten in France.

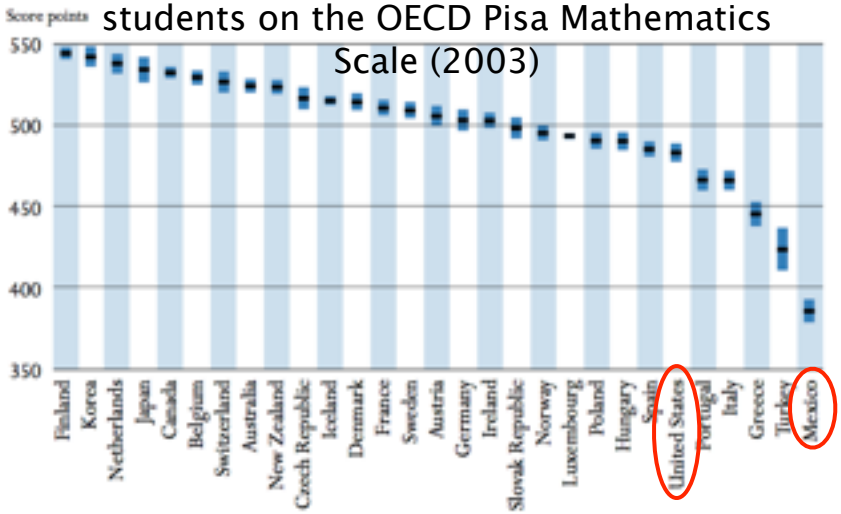
My personal experience: until highschool

- Why am I telling you this?
  - My affinity for physics and science started in high-school.
  - Program is much stricter than other Mexican schools but, most importantly, the philosophy of teaching is radically different:

focus is on making you think, rather than making you memorize

- I was truly lucky to get such an education:
  - Investment in education per student is not as high as in other countries.
  - Problem lies in large growth of population, smaller GDP, and in corruption.
  - What can we do improve the quality of public education?

Student Performance of 15 yr old students on the OECD Pisa Mathematics Scale (2003)

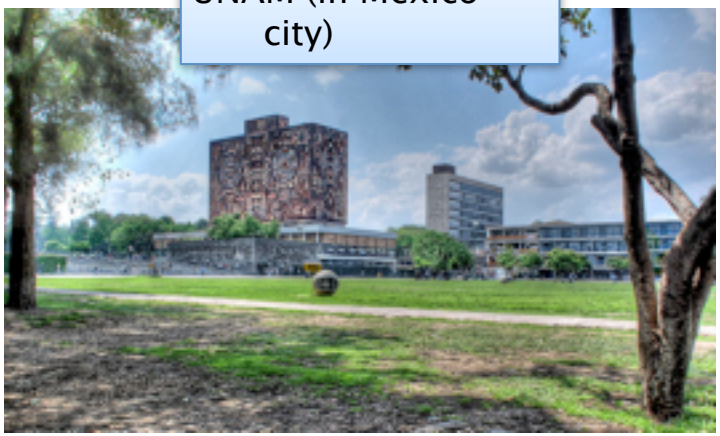


My personal experience: college

- **I then went on to college at the "Monterrey Institute of Technology"**
  - Private, with cost of ~70,000 pesos per semester (approx. $5,300 USD)
  - Very good quality in terms of the classes; used the same books and curriculum as in the US.


Monterrey Institute of Technology

- Again, my experience in this regard is not the one of the average Mexican student:
  - Few public universities compare in terms of quality.
  - The most distinguished one, the National Autonomous University of Mexico (UNAM), is the oldest in Mexico, and has a good physics department (that does good research).
  - But the UNAM is in very high demand. It hosts ~300,000 students, and rejects ~90% of those who apply to it.

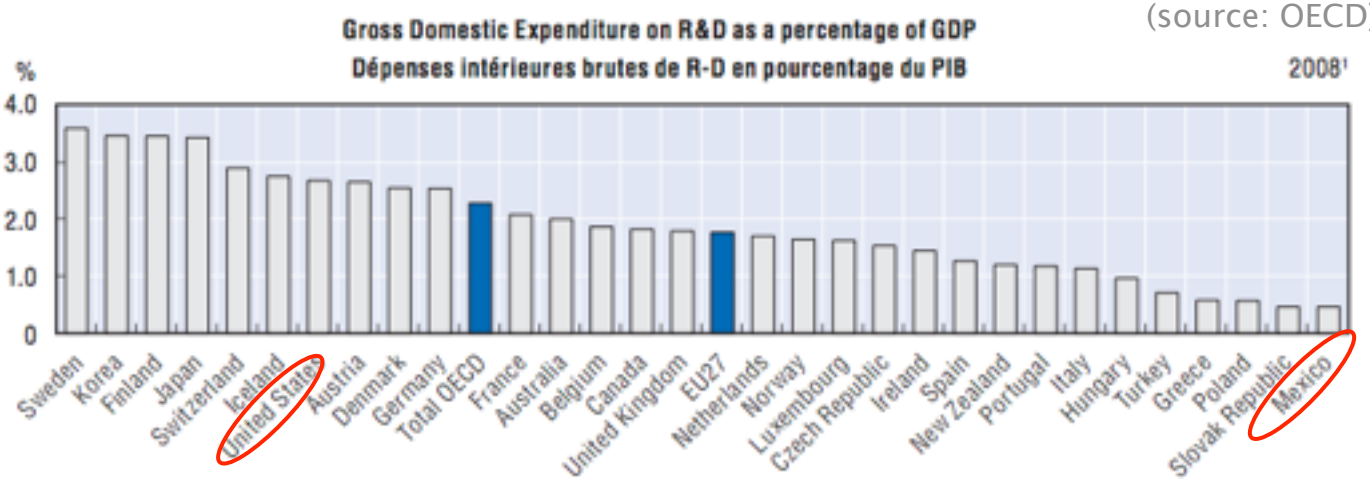

UNAM (in Mexico city)

sources: http://www.jornada.unam.mx/2007/01/03/index.php?section=sociedad&article=034n1soc
http://www.jornada.unam.mx/2008/07/21/index.php?section=sociedad&article=045n1soc

My personal experience: college

- **One problem at most Mexican institutions**: almost no research in physics

(source: OECD)



Mexico has ~8-9 times less researchers per capita than the US.
(see backup slide)

  - Fraction of GDP is small (around 0.4% of the GDP), and GDP is smaller than for most of these countries (although larger than for ~120 other countries of the planet!)

- **What I did:**
  - Very strong group in mathematical optics at Monterrey Inst. of Tech, but that's it
  - I wanted to be able to get in a good graduate school in the US, so I got involved with optics a little bit
  - But I knew I needed more…

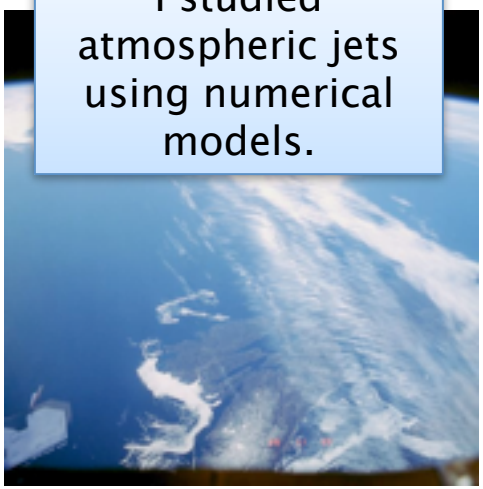
My first article: "Exploring the Behavior of Solitons on a Desktop PC". Published in:

REVISTA MEXICANA DE FISICA

My personal experience: college

- I benefited greatly of an exchange program between the Monterrey Tech and UIUC (University of Illinois at Urbana-Champaign):
  - There I was able to take higher-level courses that were not available at my home university (solid state, graduate level QM, …etc).
  - Also, it provided the graduate admission committees an objective frame of reference as to which to match me.
  - It was a bit frightening arriving there by myself, but the people at the International Office were extremely helpful.

- I was lucky to find a professor who guided me and who took me on to do research:
  - It was hard finding a research group in physics on such short notice, so I went with atmospheric sciences.
  - I believe that when professors take the time to do this it can have a profound influence on the student's career.



My personal experience: summer research

- **I had another experience that really helped me:**
  - The Mexican Academy of Sciences awards one or two places for summer research at CERN every year.
  - After being at CERN, I decided that I would pursue particle physics.
- I believe experiences like these are critical in opening opportunities for young physicists and getting them interested in research
  - It undoubtedly enhanced my graduate applications and helped me make the transition to forefront research.
  - Unfortunately, these opportunities are quite limited to people from countries like Mexico.

For this program, the cost is split between CERN and Mexico

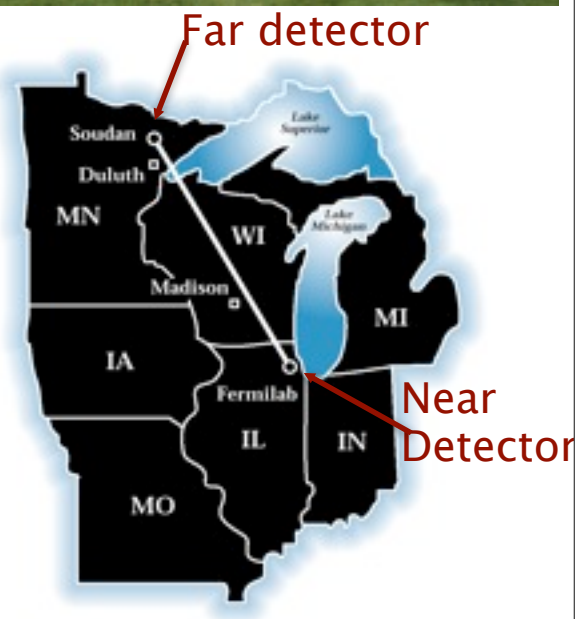

One of the lectures offered to summer students

My personal experience: grad school

- **Thanks to everything I've mentioned I was able to make a successful transition to a top US university:**
  - Cultural shock at that point was not a problem
  - However, I was still not exactly at the same level as my classmates, especially in terms of research abilities (what is object oriented programming? What is a systematic error?... etc)
  - Help and guidance that I got from my advisor and the group were crucial.

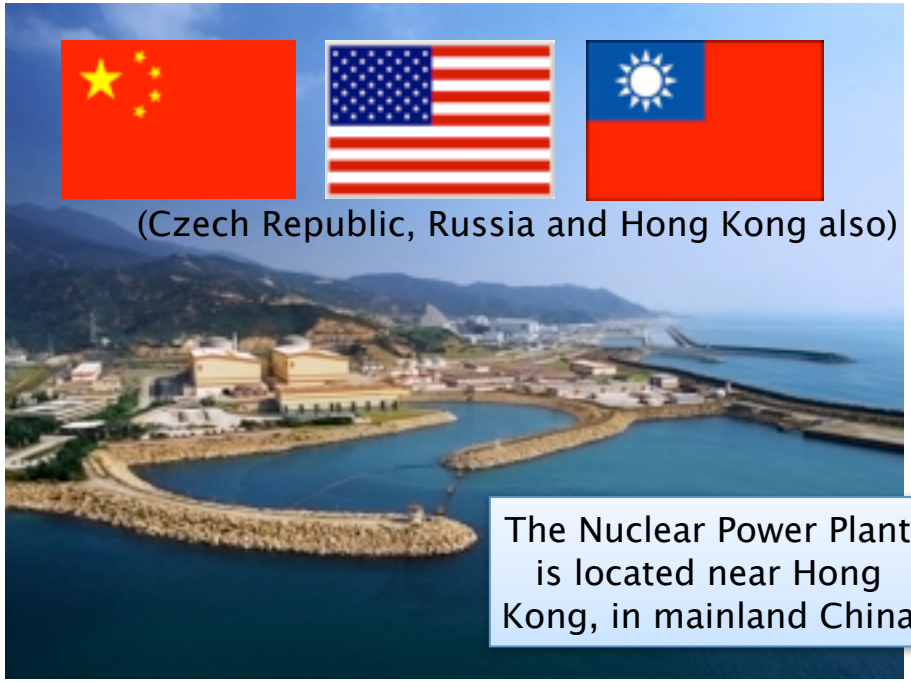
- **While at Caltech I worked in the MINOS neutrino oscillation experiment:**
  - Collaboration is primarily American-British:

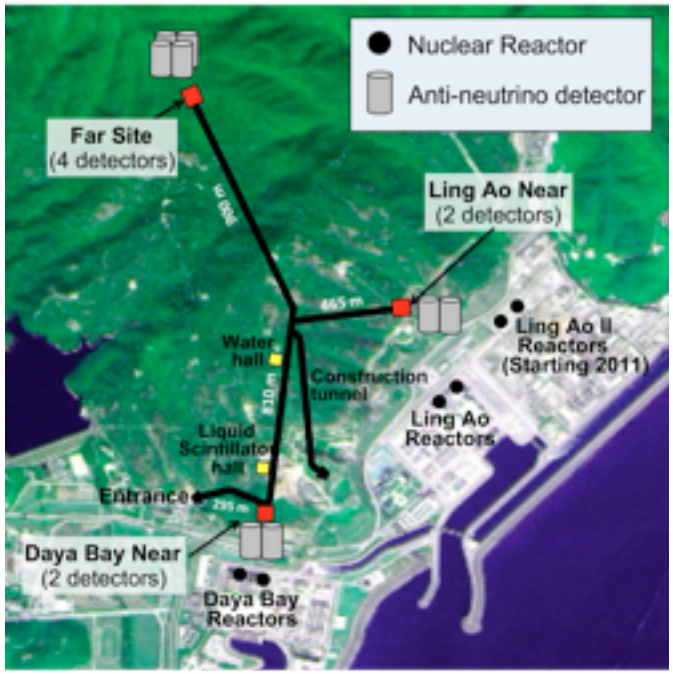
  - The collaboration worked very well. I don't recall any major problems having to do with citizenship or cultural differences.



My current experience: postdoc

- **I experienced a much greater cultural gap when it came to China:**
  - I'm currently working at the Daya Bay Neutrino Oscillation Experiment





  - My wife and I relocated there for 8 months
  - It has been a great and enriching experience, which I wouldn't change at all.
  - But there are definitely some big cultural gaps that must be crossed

My current experience: postdoc

- **Life-style:**
  - Language:
    - You are very limited for many practical purposes (restaurants, asking for directions… etc)
    - For work, language difficulties go both ways.
    - Adds to the fact that it is already difficult to do an experiments at a distance.
  - Food:
    - Food can be “exotic”
    - Very different from the high-carbs diet typical of US (which can be seen as an advantage)
    - Several people simply cannot adjust and cook for themselves everyday; but some of us really like the different food!
  - Day-to-day activities:
    - Subject to certain limitations (cannot drive, depend a lot on translators… etc)
    - People who are more self-conscious struggle a little bit more, as westerners draw attention.
    - Tighter control on accessible information.

My current experience: postdoc

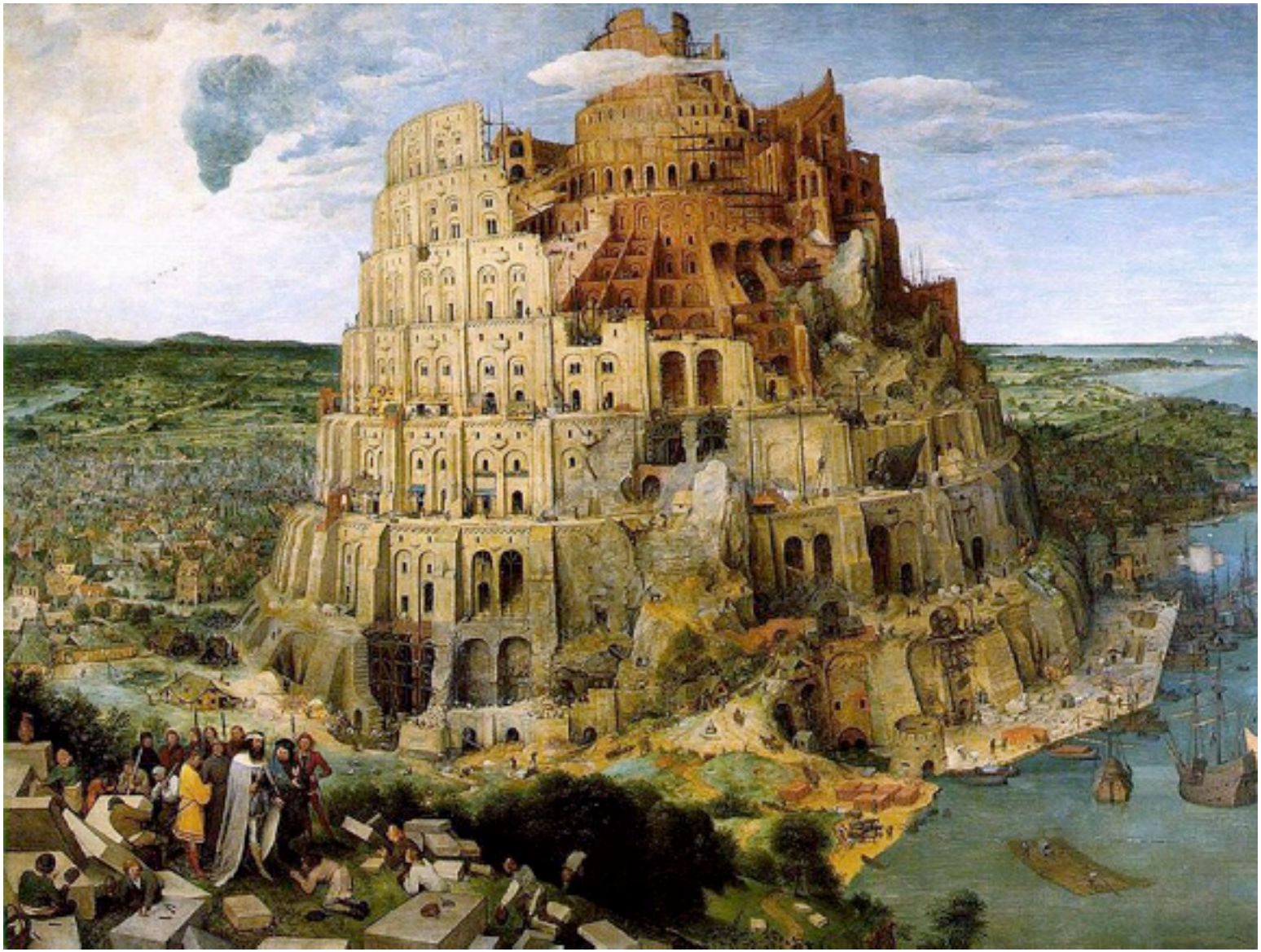
- **The working culture is also very different from ours:**
  - Cultural and language differences inevitably push towards dissociation of the two main groups:
    - Effort to step out of comfort zone and to reach out is important.
  - Differences in customs and work strategies:
    - For example, work during Christmas vs. work during Chinese New Year.
    - Having additional safety standards required by DOE (and not by the Chinese agencies) has introduced a number of complications.
    - Differences in working styles (e.g. very strong top-down style of leadership, importance of seniority, national pride, etc).
    - Bureaucracy obstacles (e.g. customs, funding, .. etc).
- **But it is great to work in a country like China**
  - People are very friendly, and there are lots of extremely talented scientists

Summary

- Science is becoming an increasingly international endeavor.
- Scientists must inevitably bridge gaps between different nations when doing their work:
  - Cultural gaps involve differences in language, work strategies and customs.
    - Effort to step out of comfort zone and to reach out is important.
    - Also important to be aware of sensitivities.
  - Socio-economical gaps can be, in my opinion, a bigger obstacle:
    - There is a lot of talent in countries like Mexico, but it is frequently not harvested.
    - The opportunities to learn about science and to develop a career in it are more limited, especially in countries in Latin-America and Africa.
    - The problem starts at the school level.

Some thoughts….

- What can be done to bridge the social-cultural gap?
  - No quick fix, but there are many programs that can (and do) make a difference:
    - Exchange programs: give students at the high-school and college levels an experience outside of their home culture and institution.
      - Main issue is funds; typically depend on more developed countries to help.
      - Maybe focusing on the teachers would be more effective? (a teacher exchange program?)
      - For example, APS just started a new Brazil-US exchange program, for students but also for professors: http://www.aps.org/programs/international/programs/brazil.cfm
    - Research fellowships: give students an exposure to forefront science.
      - For example, the program I participated in with CERN.
    - Travel and Lectureship awards: opportunities to attend and speak at conferences.
      - APS does something like this; see for example http://www.aps.org/programs/international/programs/index.cfm.
    - What about an outreach to students and teachers through the internet?
      - An approach of the sort might be more cost effective.



(The Tower of Babel, by Pieter Bruegel the Elder)

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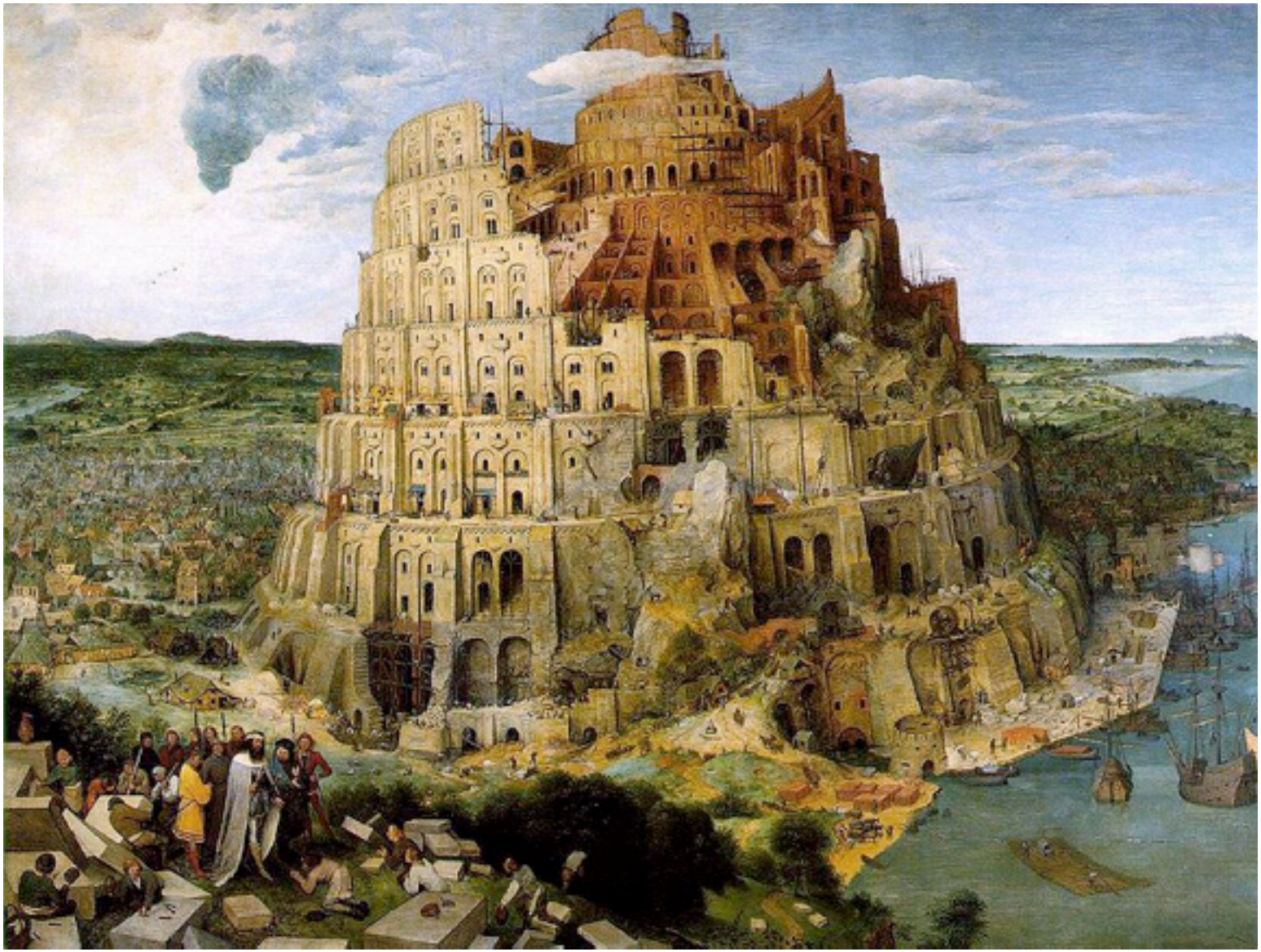

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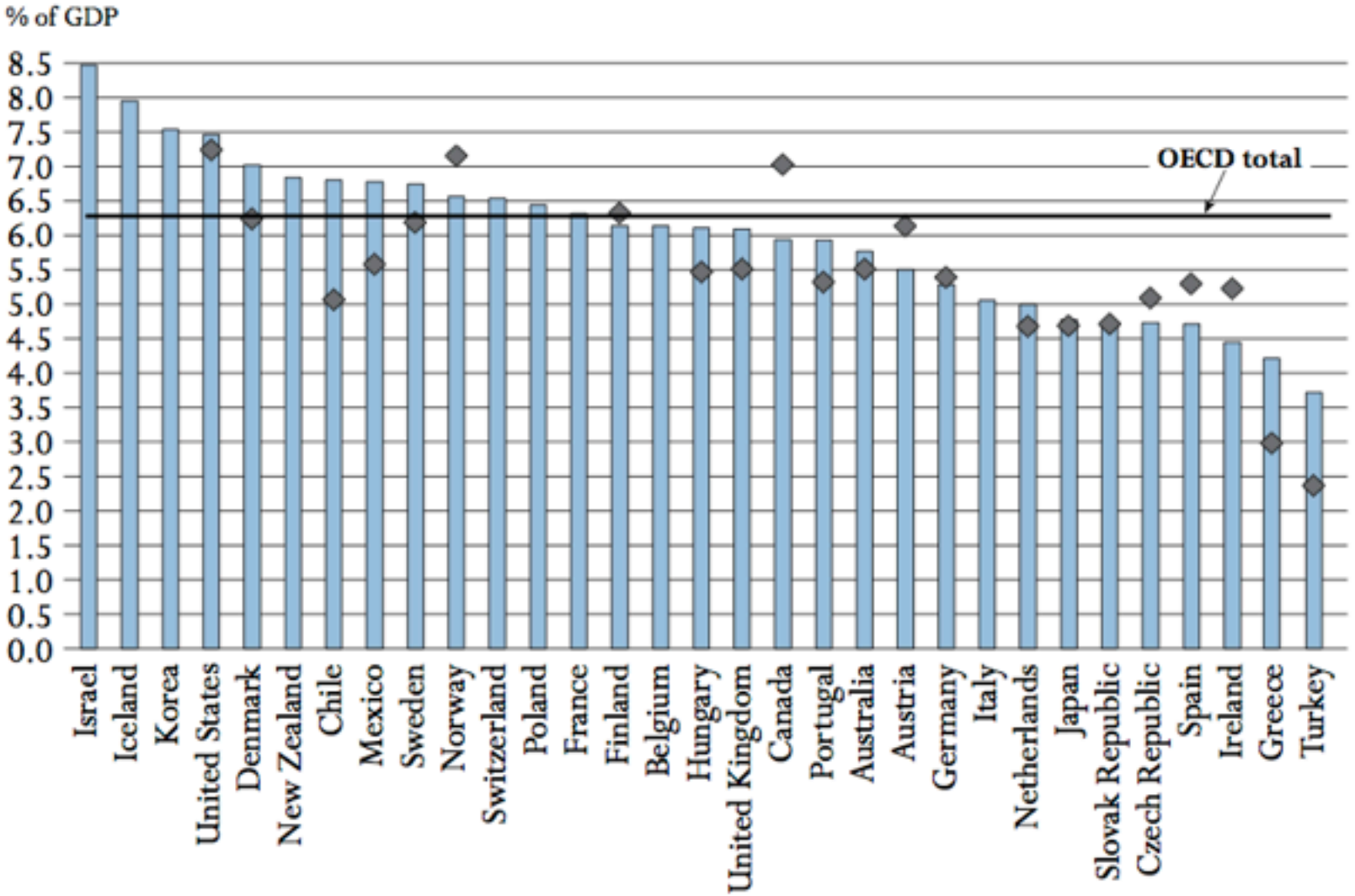
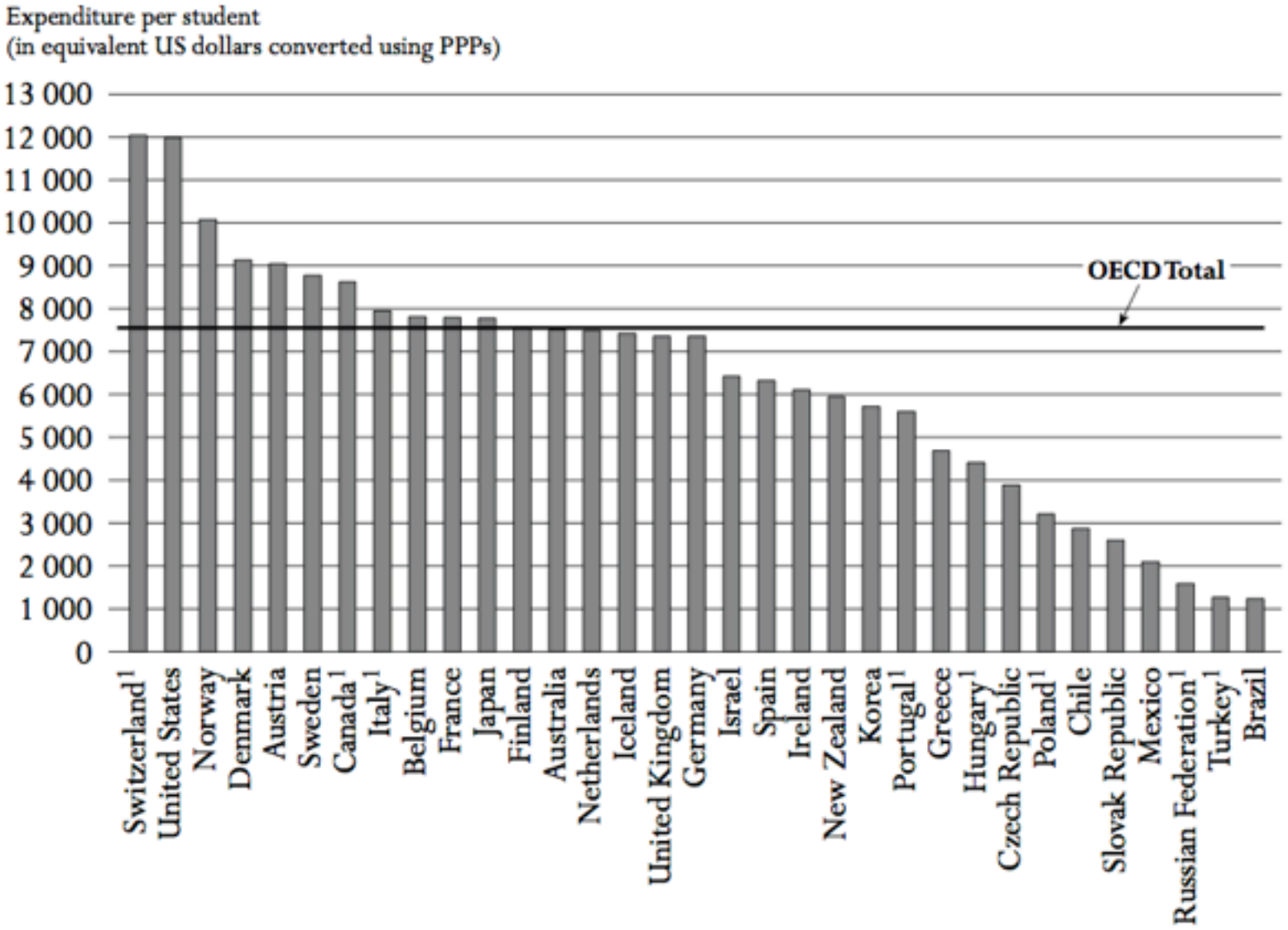


Source: OECD, Education at a Glance, http://www.oecd.org/dataoecd/44/35/37376068.pdf



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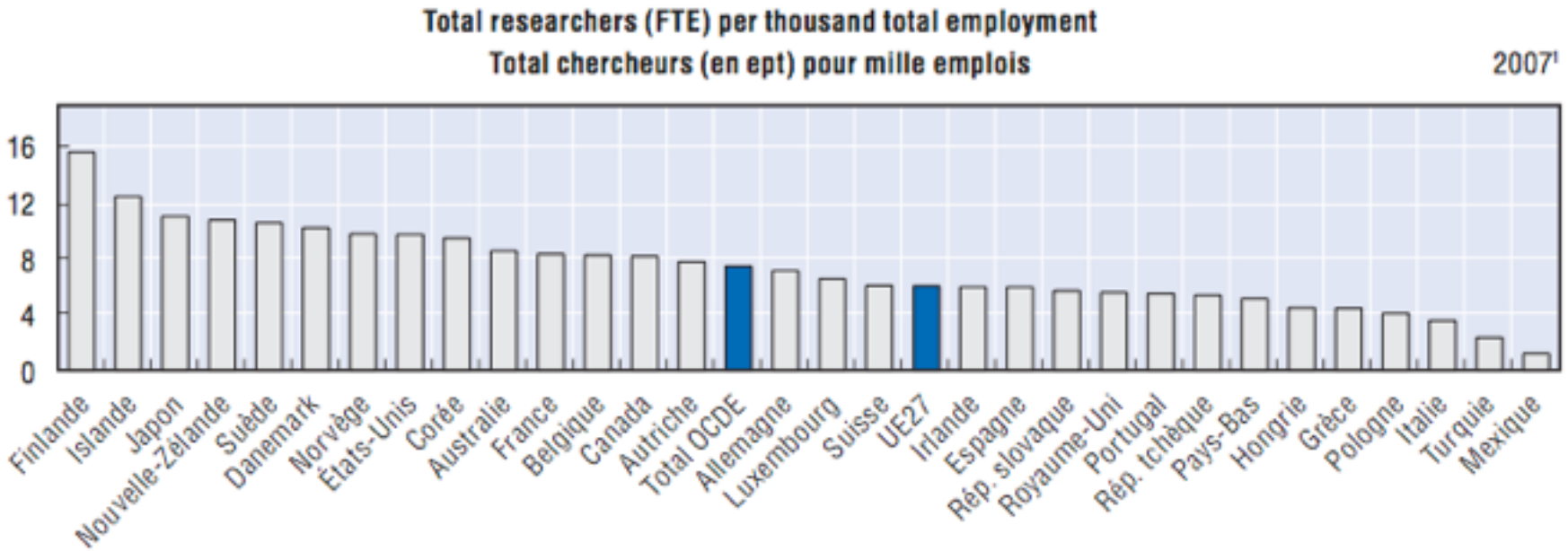

Source: OECD, Main Science and Technology Indicators, Vol. 2009/1, http://www.oecd-ilibrary.org/docserver/download/fulltext/9409013e.pdf?expires=1300921930&id=0000&accname=ocid195467&checksum=6A4F4C62888791EDA4358508EDC8B6CD

The globalization of science

The ATLAS collaboration

(see Rishiraj Pravahan's talk about life in a big collaboration)

examples abound in fields other than

- International Space Station
- Antarctic research (astrophysics, meteorology, geology, biology … etc)
- International Fusion Reactor Project (ITER)
- Astronomy (Hubble telescope, Gemini observatory, Planck spacecraft, … etc)

- Between 1988 and 2007, the percentage of world S&E articles with international co-authors increased from 8 percent to 22 percent (NSF, http://www.nsf.gov/statistics/nsb1003/)

The globalization of science

- For one, the complexity and cost of the projects require increased collaborat

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The Globalization of Science

- Collaboration exists not only between US and Europe, but also with other countries which play an increasingly active role.
- For Asian countries, scientific impact more than doubled in one decade.

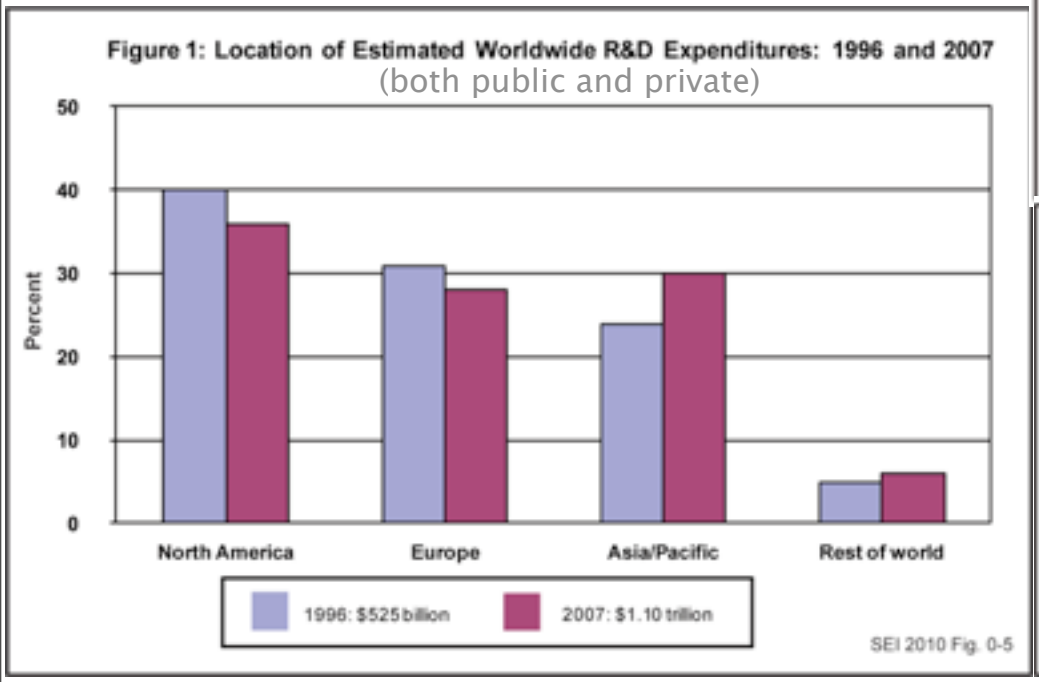
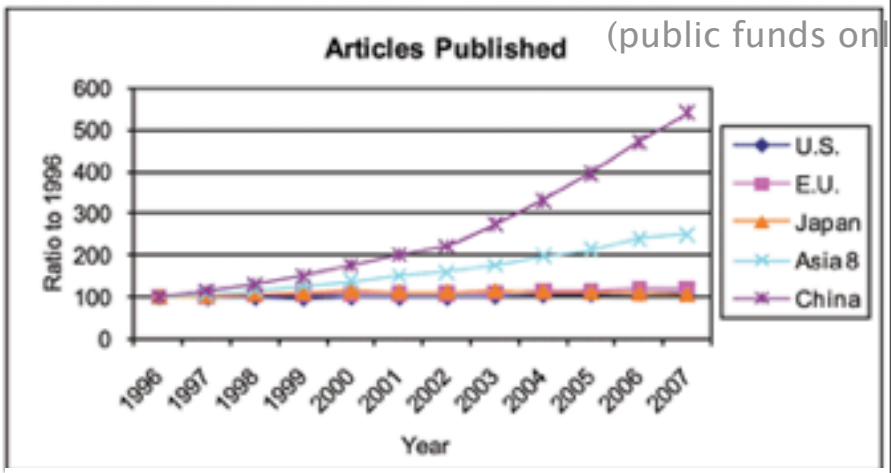
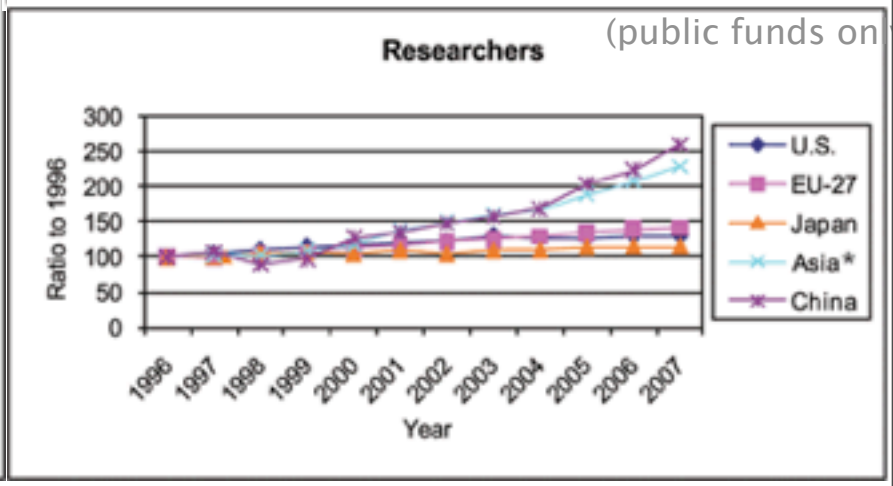


Figure 3: Normalized Growth in S&T Globalization:
Data are indexed as a ratio to 1996 = 100





(source: NSF, http://www.nsf.gov/statistics/nsb1003/)

Additional Info

http://mexidata.info/id1349.html

- Foreign-born faculty in colleges & universities in the US account for 24% of the total (U.S. Census Bureau, 2001, 2002).

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- How diverse is the faculty at the US?
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Additional Info

- A good article on Mexico's educational system and the corruption within:

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