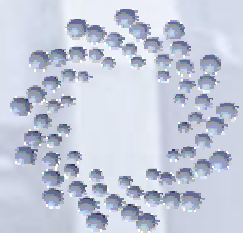


Is Physics the Privilege of Developed Countries?

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Physics in Latin America



Introduction

- At the beginning of the 21st Century, a large scientific gap still exists between Latin America and the developed countries in the North.
- One major reason for this is economic: poor economic conditions in most Latin-American countries have seriously restricted their capability to invest in science and technology.
- However, the rich natural resources of the region, provide a solid economic base and many countries are following the examples of Brazil and Mexico in recognizing that scientific research and technological development are necessary to achieve social and cultural progress.



A small physics community in a large region

- Latin America, a large geographic area of about 20 million square kilometers, includes 33 countries with a population of more than 500 million people, has at most 40000 physicists with at least a bachelors degree in physics.
- Only 10000 are involved in research.
- To compare, the US membership of the APS is more than 33000.
 - There exists 42000 APS members worldwide, most with PhD. About 650 reside in Latin America.



Groups by the Number of PhDs In Physics

Group 1

Argentina, Brazil and Mexico

Group 2

Cuba, Chile, Venezuela and Colombia.

Group 3.

Costa Rica, Peru
Uruguay, Ecuador
Bolivia, Guatemala
Nicaragua, Honduras
El Salvador, Panama
Dominican Rep.

Group 4.

The rest.



The Federation of Latin American Physical Societies

- In all the countries with active physicists, national physical societies have been organized, to foster academic activities and promote a scientific community.
- Connecting all the national societies is the Federation of Latin American Physical Societies (FELASOFI), founded in 1984.



FELASOFI
FEDERACIÓN LATINOAMERICANA
DE SOCIEDADES DE FÍSICA



The objectives of FELASOFI

- To promote scientific exchange among Latin-American physicists.
- To improve physics education.
- To promote research in areas of special regional interest.
- To advocate the construction and use of large research facilities in the most developed countries.



The Latin-American Center for Physics (CLAF)

- Another prominent contributor to the development of physics in the region is the Latin-American Center for Physics.
- It was founded in 1962 in Rio de Janeiro at the initiative of the Brazilian Government and UNESCO.
- Twenty countries were signatories to the agreement.
- Operating funds come from member nations, UNESCO, ICTP, and TWAS.



CLAF supports

- A permanent scholarship program.
- Supports academic meetings.
 - The Latin America School of Physics, held more than 35 times since 1959.
 - The Latin-American Symposium on Solid State Physics, held biennially since 1969.



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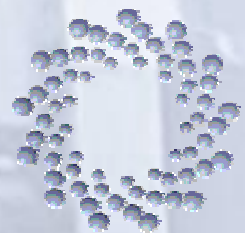
Latinamerican Symposium on Solid State Physics





Undergraduate and Graduate Programs

- Although some Universities in LA date from the 16th Century –Santo Domingo, 1538, Lima, 1551, and Mexico 1553- the European concept of university as a research center was implemented only about 50 years ago.
- Undergraduate programs first appeared in the 1940s and graduate programs appeared only in the 1950s.
- The number of institutions that offer undergraduate and graduate programs is very small.



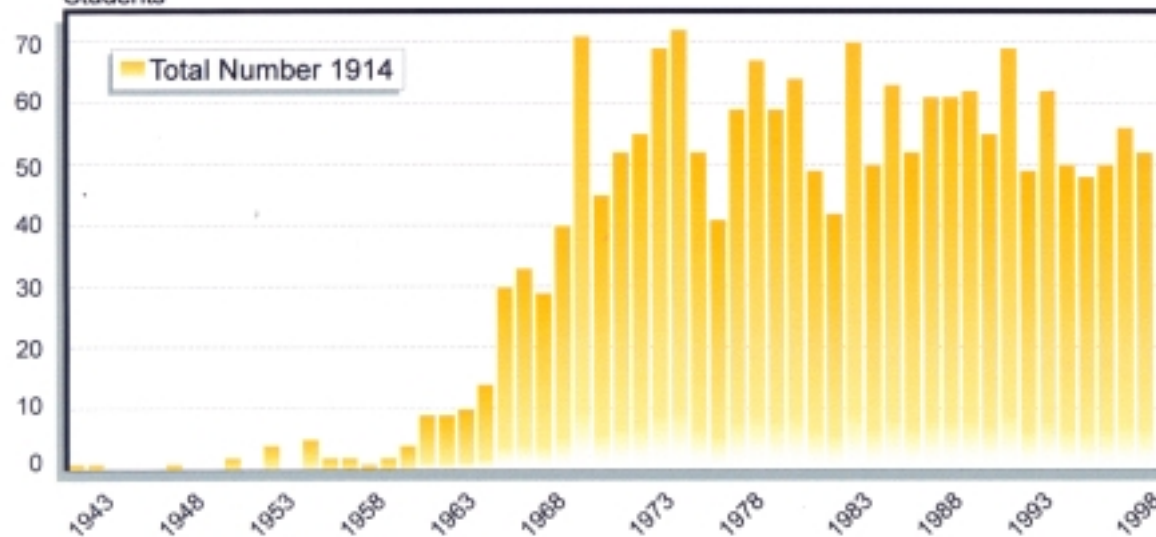
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Bachelors in Science (Physics)



Faculty of Science, National University, Mexico City

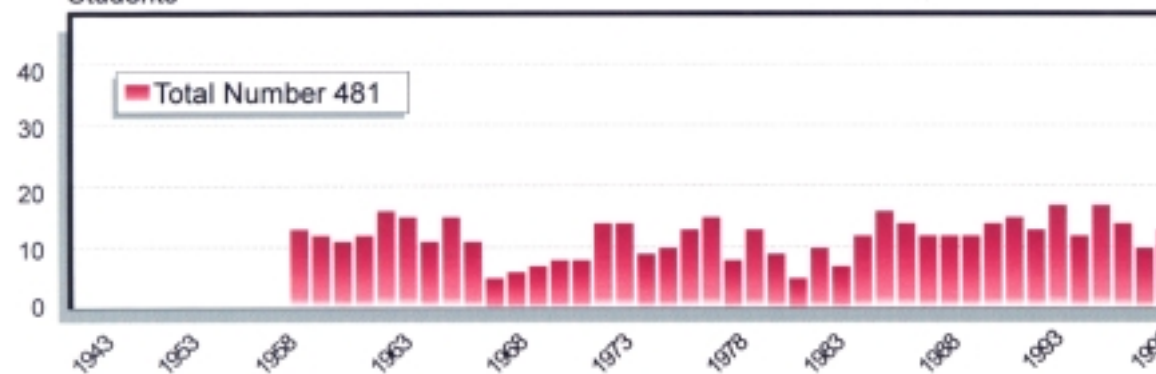
Students

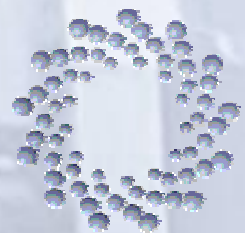


Instituto
Balseiro

Balseiro Institute, Bariloche, Argentina

Students





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Philosophy Doctors in Physics

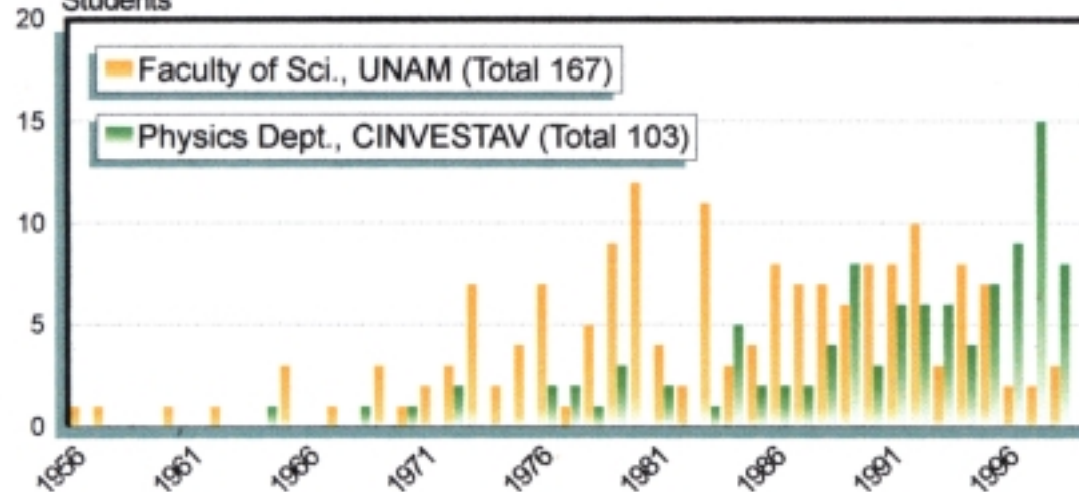


Faculty of Science, National University, Mexico City



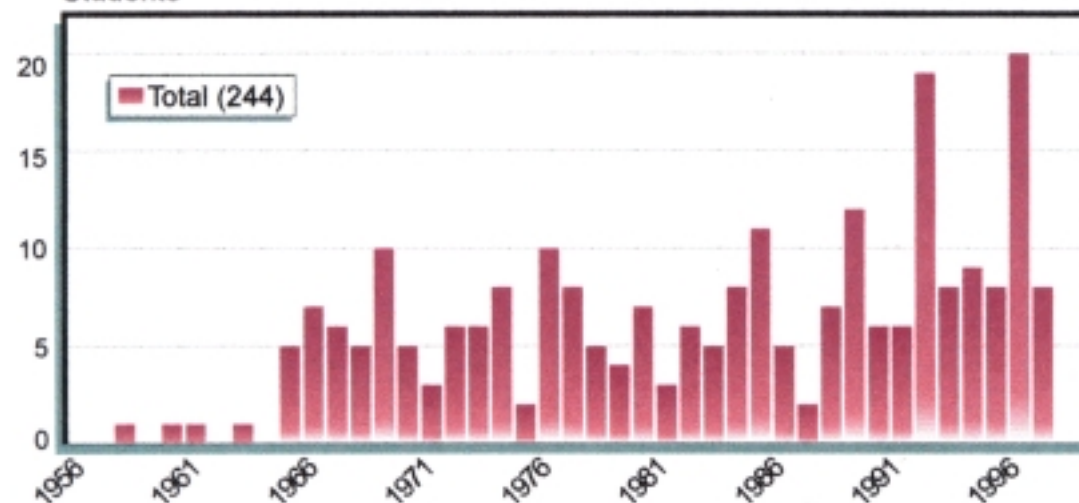
Department of Physics, Center for Research
and Advanced Studies, Mexico City

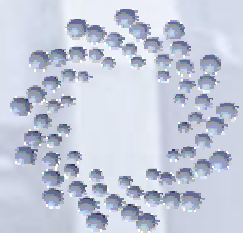
Students



Balseiro Institute, Bariloche, Argentina

Students





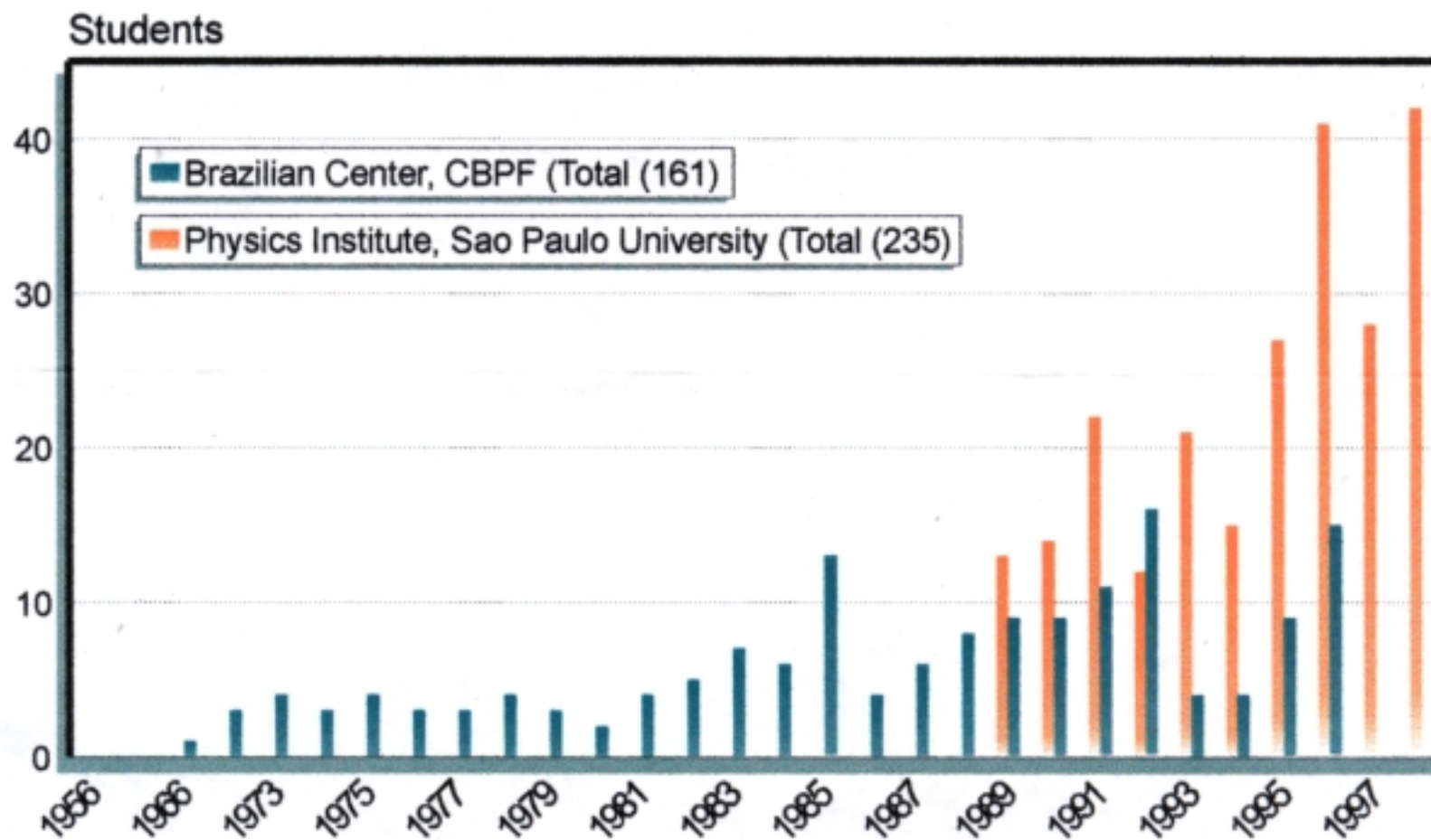
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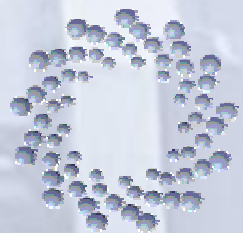
In the US, in 1998 alone, institutions awarded 3821 bachelors in Science and 1323 PhD.



Brazilian Center for Research in Physics,
Rio de Janeiro, Brazil

Physics Institute, Sao Paulo University, Brazil





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Topics of Research



- The first physics research activity in Latin America dates from the late 1940s and early 1950s.
- With the exception of some experiments on cosmic radiation, early physics research was almost completely theoretical.
- The first groups were founded by persons who went to the US or Europe for graduate and postgraduate studies and then returned to their home country (Argentina, Brazil, and Mexico).
- Following World War II a few prominent scientists settled in LA:
 - Guido Beck (first nuclear physics group in Argentina)
 - Gleb Wataghin (first astrophysics group in Brazil)



The study of cosmic rays

- ❑ Many cosmic rays studies have been performed in the region, and now there is a project to conduct one of the most ambitious projects in the US and Argentina.
- ❑ One of the first international laboratories in LA was the Cosmic Ray Laboratory on Mount Chacaltaya in Bolivia.
- ❑ At a height of 5200 m in the Andean high plains, the Lab was established in 1952.
- ❑ Experiments carried on in this Lab lead to production of secondary mesons.
- ❑ These discoveries led to Yukawa and Powell receiving the Nobel prize.



The idea to perform experiments at Chacaltaya came from Cesar Lattes, a Brazilian physicist.





The Bristol group: Powell is standing, at the center, in a light blazer;
Lattes is in front of him (in the middle row).
Occhialini is the second from right to left, in the front row.



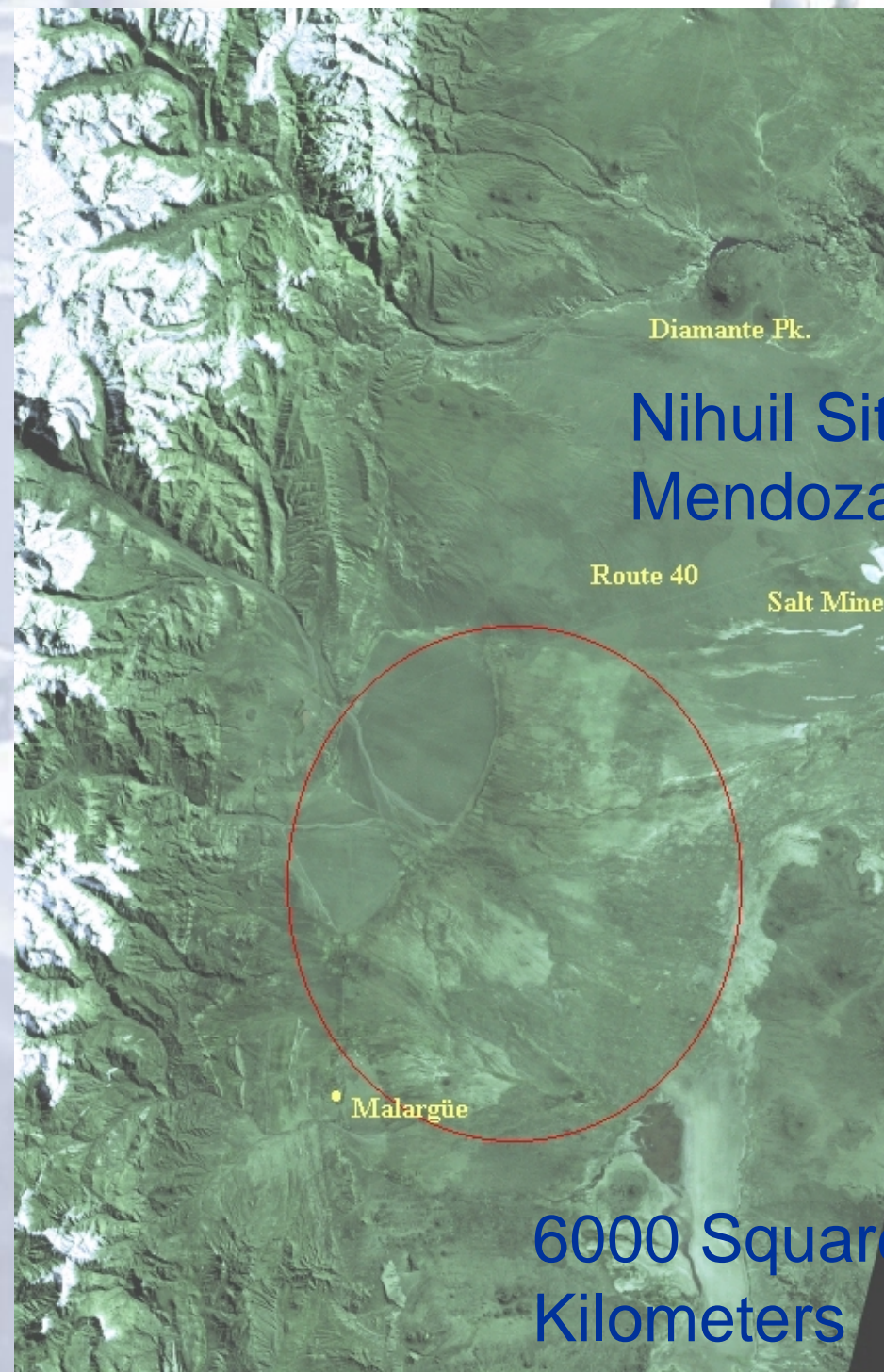
These pioneer studies motivated the foundation of the
Brazilian Center For Research in Physics (CBPF) in
Rio de Janeiro in 1948



The Auger project (www.auger.org)

- The existence of ultra-high-energy cosmic rays poses several unsolved questions in astrophysics.
- An international group, the Pierre Auger Collaboration, has been established to carry out a systematic study of UHECR with energies greater than 10^{19} eV.
- The group consists of about 300 scientists from 18 countries, including Mexico, Argentina, Chile, and Brazil.
- The detection of UHECR require large area coverage. Two locations have been chosen one in Utah and the other in Mendoza, Argentina.





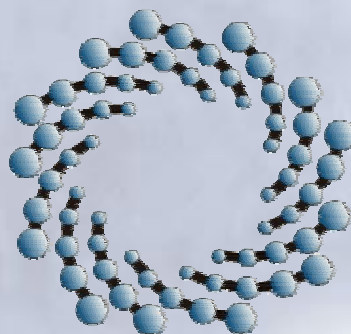


***“Inter-American Network for
Atmospheric/Biospheric Studies***

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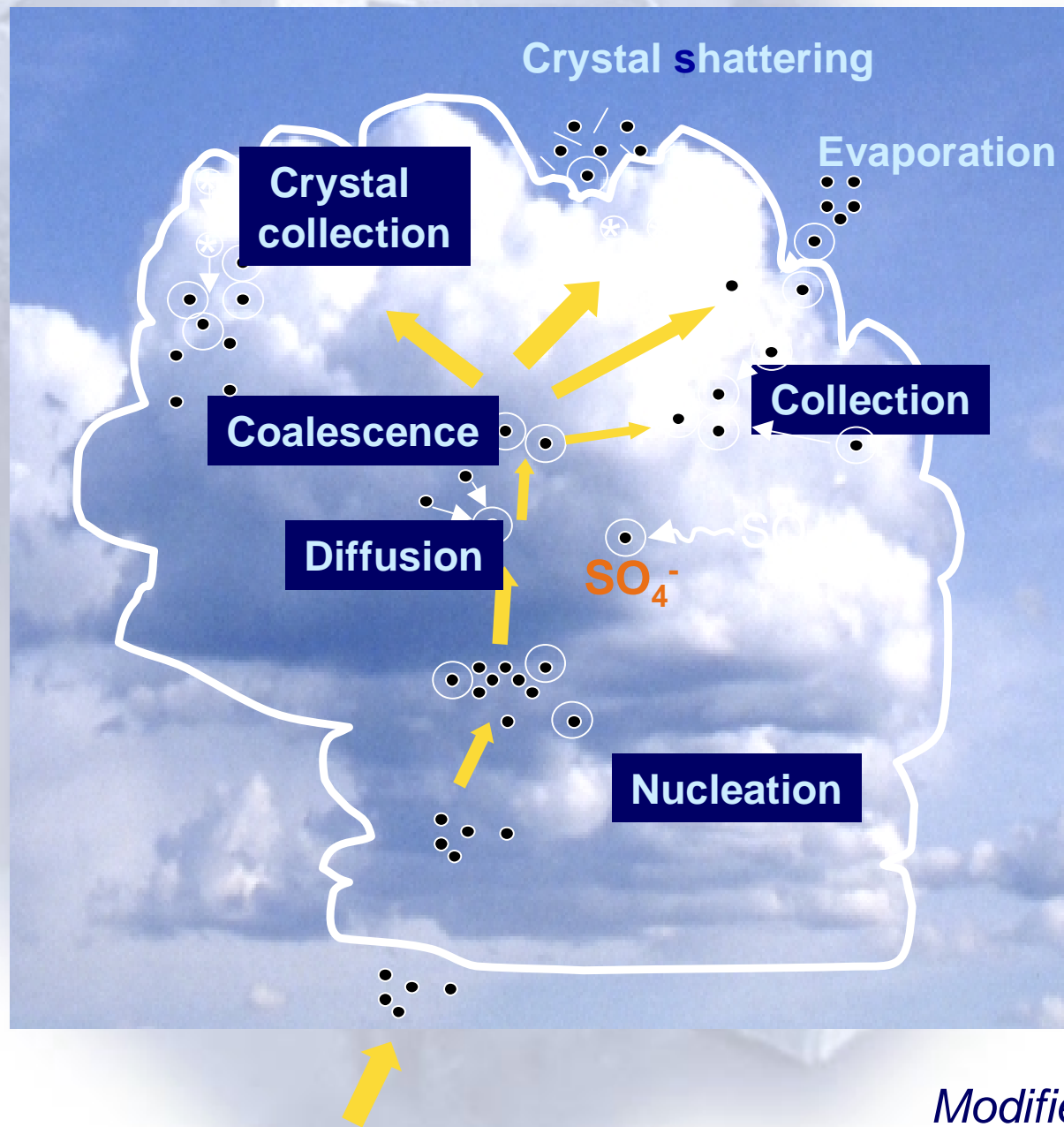
**José Luis Morán-López, Mario Molina
Elisabeth Huber-Sannwald**

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Aerosol conversion reactions in clouds

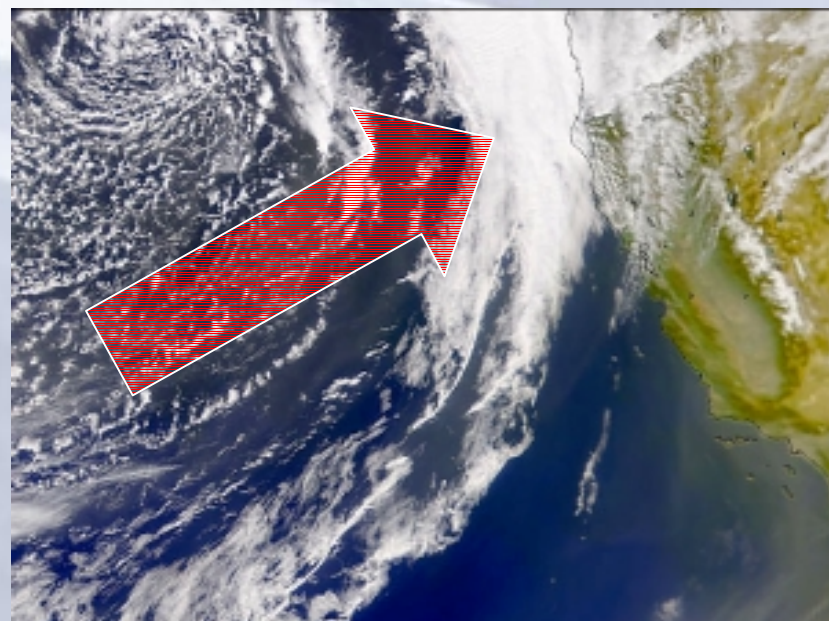
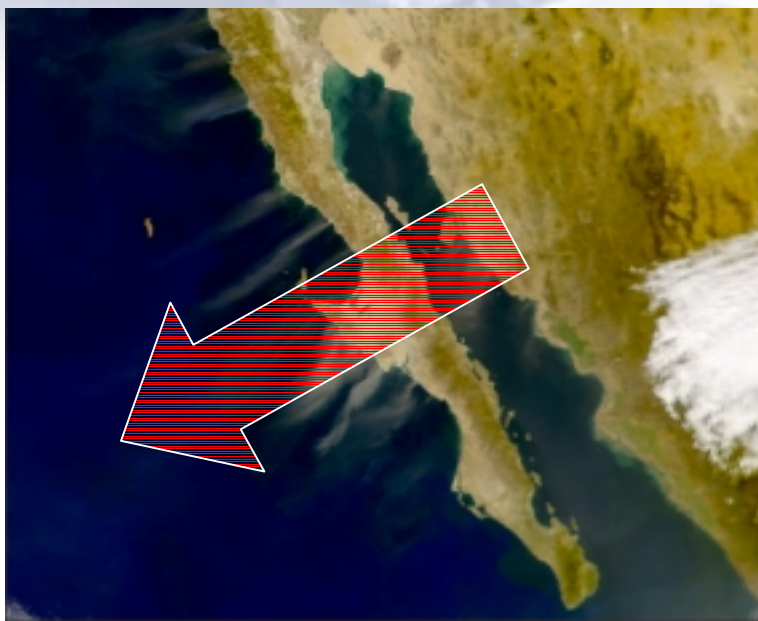
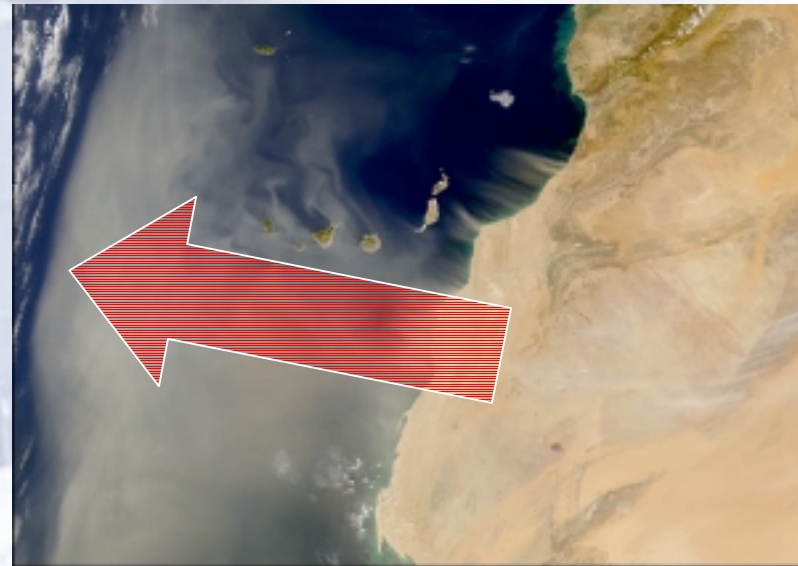
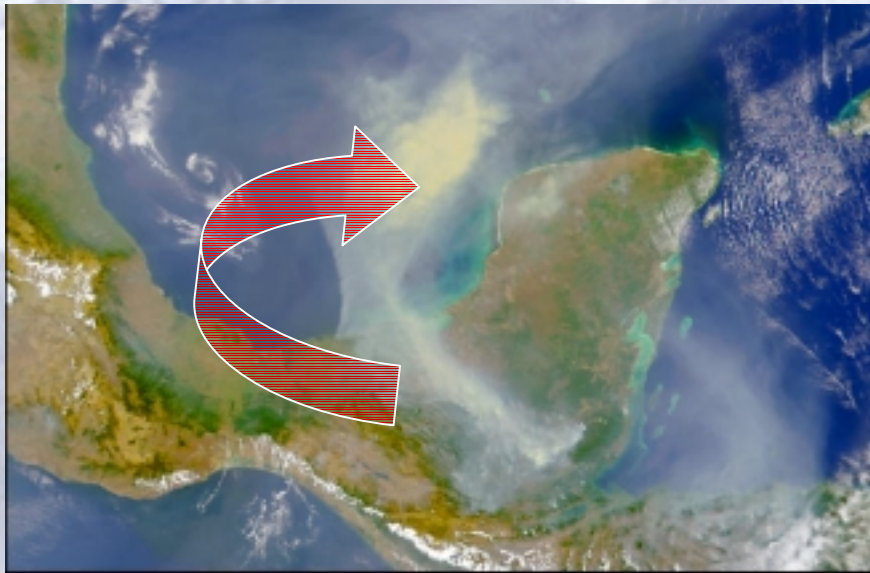
Primary and secondary aerosols



Modified after Hegg 2001

Spatio-temporal distribution of aerosols?

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Images, Courtesy of NASA



Objetives

Establish network of aerosol monitoring stations equipped with state-of-the-art LIDAR technology across N-S American transect

- Study the sources, sinks, atmospheric transportation, and distribution of aerosols
- Characterize chemical, optical, and microphysical properties of atmospheric aerosols
- Study aerosol effects on cloud formation, precipitation, regional hydrological cycles



Long-term time series of aerosol data in combination with meteorological information for improvement of global climate models



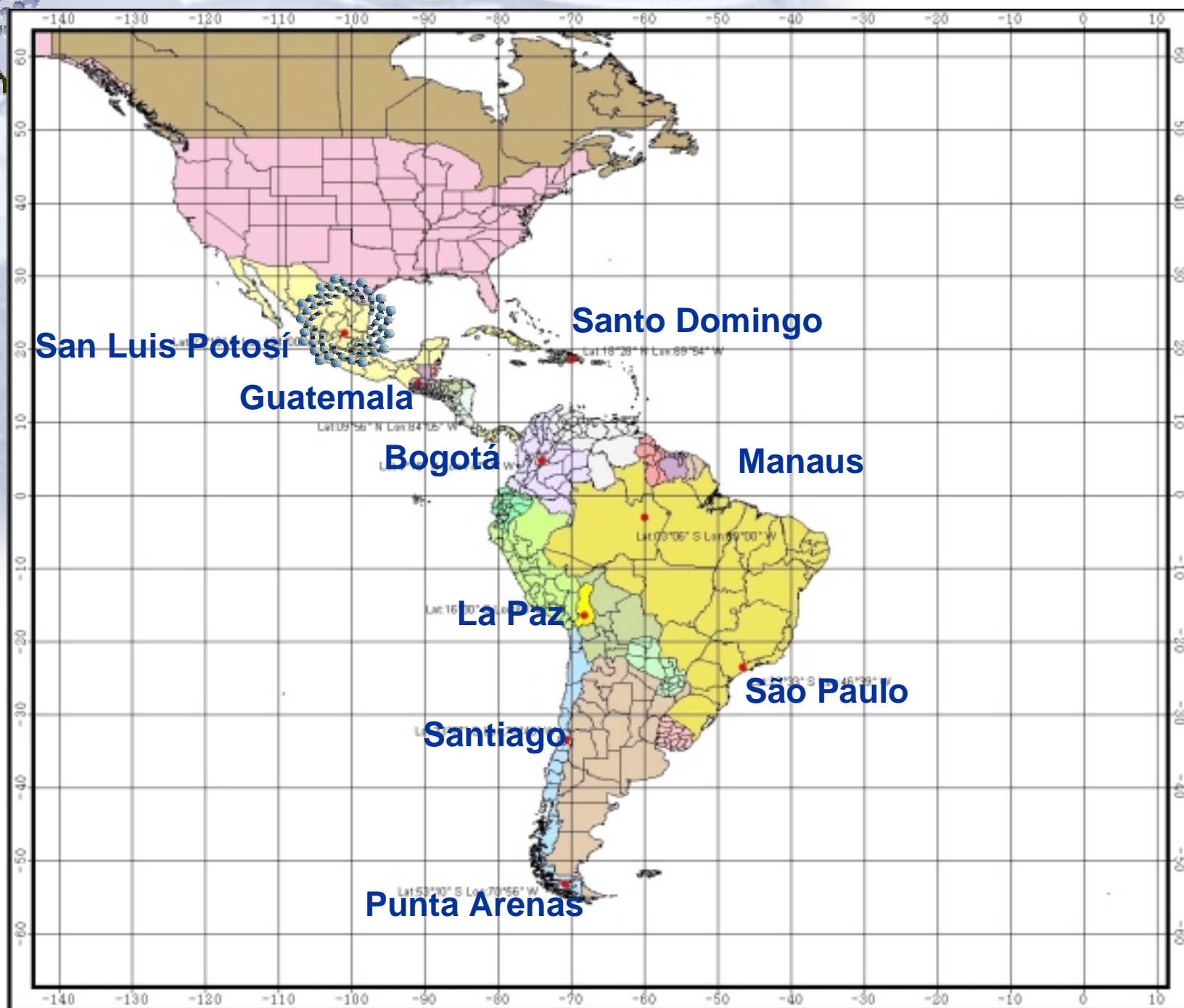
Establishment of Multidisciplinary Research Centers for Atmospheric/Biospheric Studies across Latin America



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Brazilian National Synchrotron Light Laboratory





- Brazil LNLS is the first synchrotron light source constructed in the Southern Hemisphere (1997).
- The source is based on a 1.3 GeV electron storage ring designed and built by Brazilian staff.
- LNLS has 10 beam lines that collectively span the photon spectrum from 10 eV to more than 10 keV
- Beam lines are available for x-ray structural and spectroscopic studies, ultraviolet and soft x-ray spectroscopy.
- The facility is offered to international use.

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Physics is not only the privilege of developed countries.

- Implementing a set of planned actions involving national and foreign scientists and financial institutions, a developing country can achieve a critical mass of physicists that can contribute to the social and economical development of their country.

- ❑ To establish undergraduate programs in physics.
- ❑ To establish international collaboration programs to form physicists at the graduate level.
- ❑ To promote the foundation of National Councils of S&T, and to support the exiting ones.
- ❑ To keep the collaboration after the PhD return to their home country.
- ❑ Once a critical mass is obtained to open graduate programs.



- With a critical mass to organize national organisms, linked to other similar organizations.
- To create with international funds centers similar to the International Centre for Theoretical Physics in Trieste, Italy.