



- Physics in Brazil: An overview of its history

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Colonial times (1500-1800)

- Pre-Columbian peoples used astronomy observation to organize aspects of their lives
- Portuguese colony: Jesuits taught some mathematics and practiced astronomy
- Stansel's observations of comets, in Salvador around 1650, were used by Newton
- Dutch Recife included practice of astronomy: Marcgrave built the first astronomic observatory in America
- However, there was no higher education in the colony, elites were trained in Portugal



Valentin Stansel

1621, Olmutz, Moravia
1705, Bahia, Brazil

**URANOPHILUS
CÆLESTIS PEREGRINUS**

SIVE
**MENTIS URANICÆ
PER MUNDUM SIDEREUM PEREGRINANTIIS**

**EXTASES
AUCTORE
VALENTINO ESTANCEL.**

DE CASTRO JULII, MORAVO.

E SOCIETATE

J E S U.

Olim, in Universitate Pragensi, deinde in Regia Olymposensium
Matheseos Magistro, demum Theologiae Moralis in Urbe
S. Salvatoris, vulgo Bahya Omnium Sanctorum
in Brasilia, Professor.

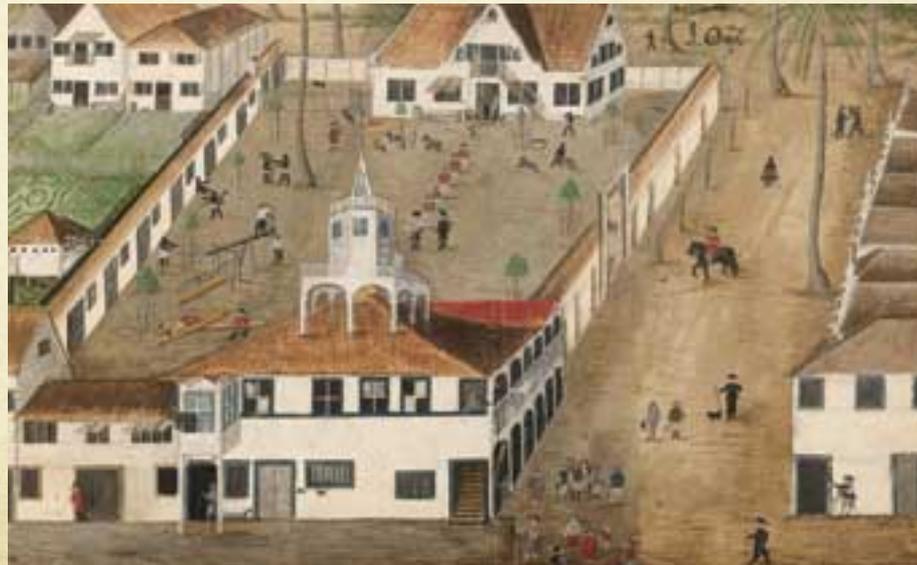
IHS



GANDAVI
Apud Heredes Maximiliani Graet,
PROSTANT ANVERPIÆ.
Apud Michaelen Knebbert.
M. DC. LXXIV.

Georg Marcgrave

1610, Liebstadt, Germany
1648, Luanda, Angola



19th century – From the escape of Portuguese royal family to Brazil to the Brazilian independence and empire.

Republic from 1889 on

- Engineering courses were opened offering training in mathematics and physics.
- The Observatorio Imperial was founded in Rio de Janeiro – 1st production of X-rays
- Medical schools included some physics, for instance X-rays were used for cancer therapy from 1905 in Salvador.
- José Gomes de Souza: Mathematician who published at the Academie des sciences de Paris

The escape of Portuguese royal family to
Brazil – Opening of the ports
By Candido Portinari



20th century – Brazilian republic and its many political upheavals

- Diffusion of relativity and quantum physics, in the 1920s. Research with radioactivity
- The watershed, however, was in the 1930s
- Wataghin and Occhialini came from Italy to the newly founded Universidade de São Paulo. They trained researchers to carry out innovative research in cosmic rays, including Lattes and Schönberg
- Gross and Costa Ribeiro worked on solid state in Rio de Janeiro

20th century - WWII

- WWII led Brazil to align itself with the Allies, breaking a previous balance between the US and Germany
- Science exchange with physicists in the U.S.
- Arthur Compton visited Brazil in 1941 sponsored by the OCIAA headed by Nelson Rockefeller
- Schönberg stayed in the US - Work with Gamow and Chandrasekhar
- Rockefeller foundation began to support physics in São Paulo
- After WWII, Brazilians went to the US for doctoral training: Leite Lopes, Jayme Tiomno, Sergio Porto, and Hervasio de Carvalho



Schützer, Yukawa, Lattes, Tiomno,
Leite Lopes, and Carvalho
Princeton, circa 1950
Source: CBPF Archive

Compton in Rio de Janeiro.
In the first line, from left to
right, Wataghin and Compton
are the 2nd and the 4th. Source:
Academia Brasileira de Ciências



After WWII

- Alliance among physicists, the military, nationalistic politicians and businessmen

Brazilian resources in radioactive raw materials

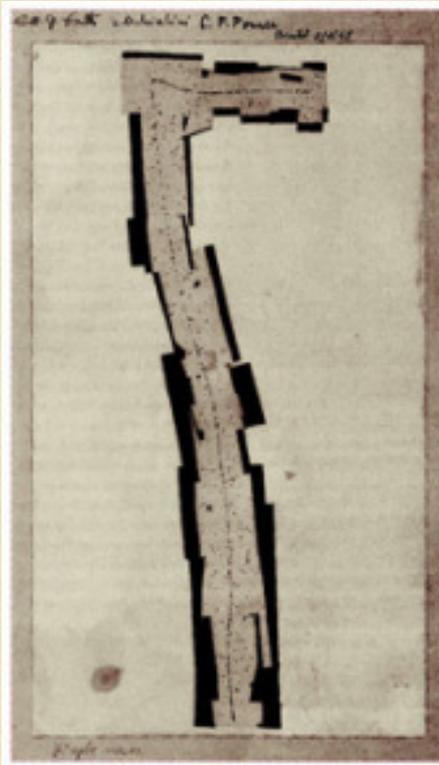
The impact of Lattes' discovery of pi meson in Bristol with Powell and Occhialini and its production at Berkeley, invitation by Gardner

- Founding of new institutions:

Centro Brasileiro de Pesquisas Físicas - CBPF - Rio de Janeiro; Instituto Tecnológico da Aeronáutica - ITA - São José dos Campos - São Paulo; Instituto de Física Teórica - IFT - São Paulo

After WWII

- Creation of science funding agencies: CNPq and CAPES
- Physics in Brazil at that time was mainly high energy physics and nuclear physics
- Foreigners who visited or stayed in Brazil in the 1950s: Richard P. Feynman, David Bohm, Guido Beck, Mituo Taketani ...



Pi meson
Lattes, Muirhead, Occhialini,
& Powell - 1947



Lattes & Leite Lopes



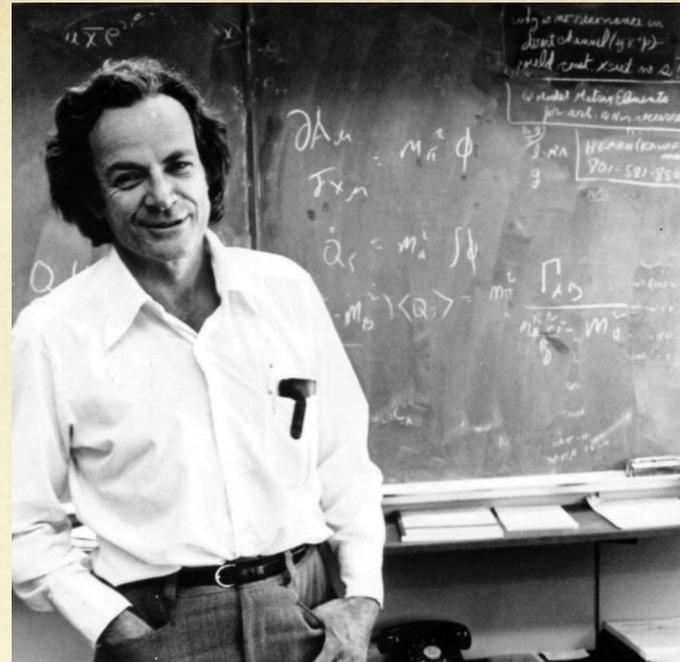
President Vargas,
Costa Ribeiro, &
Admiral Alvaro Alberto
CNPq - 1952



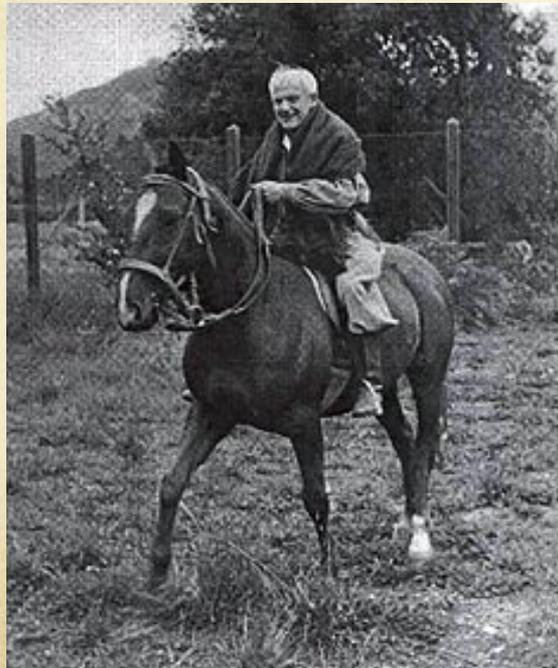
Centro Brasileiro de Pesquisas Físicas
CBPF - 1949 - Rio de Janeiro



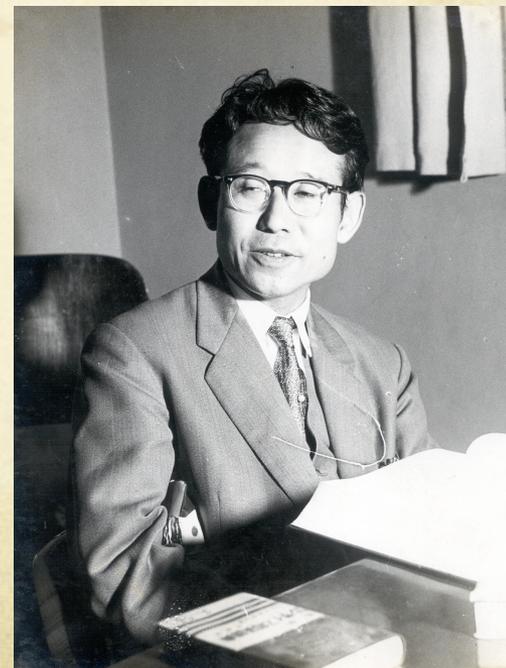
David Bohm



Richard Feynman



Guido Beck



Mitsuo
Taketani

The 1960s - Brain drain

- Economic crisis, inflation, and later the military dictatorship led to a brain drain among Brazilian physicists
- Some of the physicists who chose to work abroad:

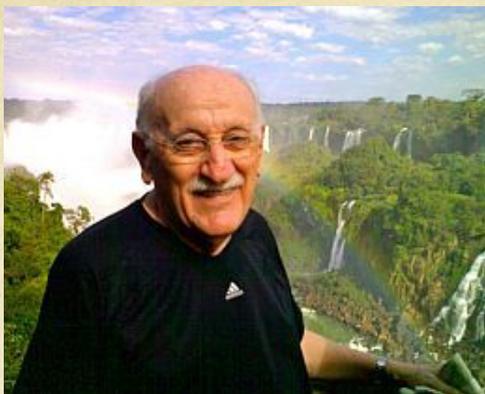
H. M. Nussenzveig - Rochester

S. Porto, R. C. C. Leite - Bell Laboratories & Southern California

F. S. Barros - Carnegie Mellon

S. MacDowell - Yale

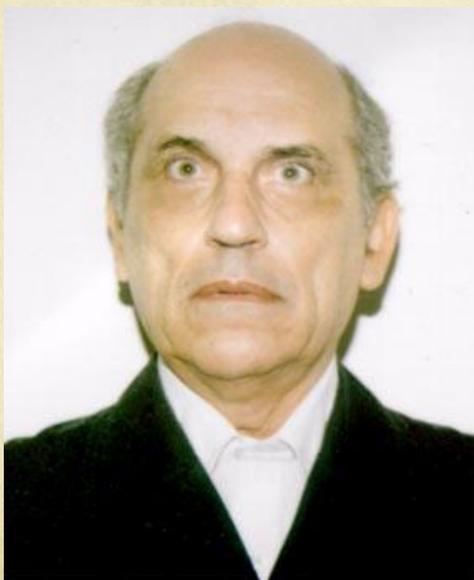
R. Salmeron - Ecole Polytechnique - Paris



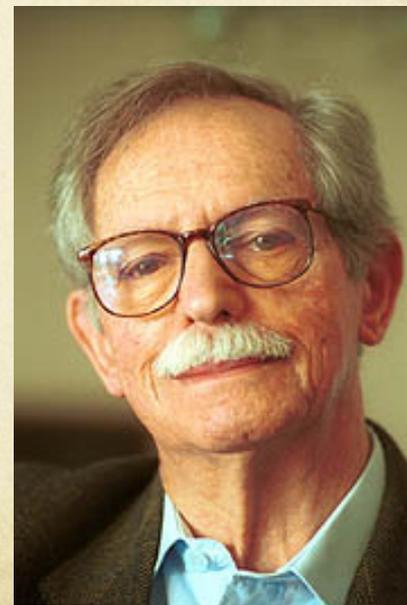
H. M. Nussenzveig
1933, São Paulo, Brazil
Rochester University



Sergio Porto
1926, Niteroi, Brazil
1979, USSR
Bell Labs &
University of Southern California



Samuel MacDowell
1929, Pernambuco, Brazil
Yale University



Roberto Salmeron
1922, São Paulo, Brazil
CNRS - France

Military dictatorship (1964-1984) and its conflicting effects on Brazilian physics

- The 1964 military dictatorship interfered with physics in contradictory ways.
- Physics Leaders, such as Lopes, Schönberg, Frota Pessoa, and Tiomno were persecuted and prevented from working in Brazilian public institutions. Others were persecuted, e.g., E. and A. Hamburger were imprisoned. L. Davidovich and S. Salinas went to study abroad to escape persecution
- In the 1970s, there was an increase in funding for science, the universities were reformed, and graduate studies created

Contemporary times

- After the military dictatorship, there have been ups and downs concerning the funding of Brazilian physics and the creation of new institutions
- Due to this reason, as a whole, current Brazilian physics was shaped from the 1930s to the 1970s
- Research and training in physics is a late arrival in Brazilian history. However it has already exhibited its strengths and it has been practiced as a highly internationalized activity

Some literature hints

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