Physics in Brazil: An overview of its history

Olival Freire Junior
Universidade Federal da Bahia, Brazil

2015 AAPT Summer Meeting
University of Maryland - College Park
July 25-29, 2015
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

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 1989 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
Gleb Wataghin  
1899, Kotovsk, Ukraine  
1986, Turin, Italy

Giuseppe Occhialini  
1907, Fossombrone, Italy  
1993, Milan, Italy

Mario Schönberg  
1914, Recife, Brazil  
1990, São Paulo, Brazil

César Lattes  
1924, Curitiba, Brazil  
2005, Campinas, Brazil
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
Compton in Rio de Janeiro. In the first line, from left to right, Wataghin and Compton are the 2\textsuperscript{nd} and the 4\textsuperscript{th}. Source: Academia Brasileira de Ciências

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

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

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

Lattes & Leite Lopes

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


- Freire Jr. O. Science and exile: David Bohm, the cold war, and a new interpretation of quantum mechanics, *HSNS*, 36(1), 2005


- Vieira, C.L. & Videira, A.A.P. Carried by History: Cesar Lattes, Nuclear Emulsions, and the Discovery of the Pi-meson, *Physics in Perspective*, 16, 3-36, 2014