Physics in Brazil

Carlos H. de Brito Cruz

Scientific Director

Fapesp

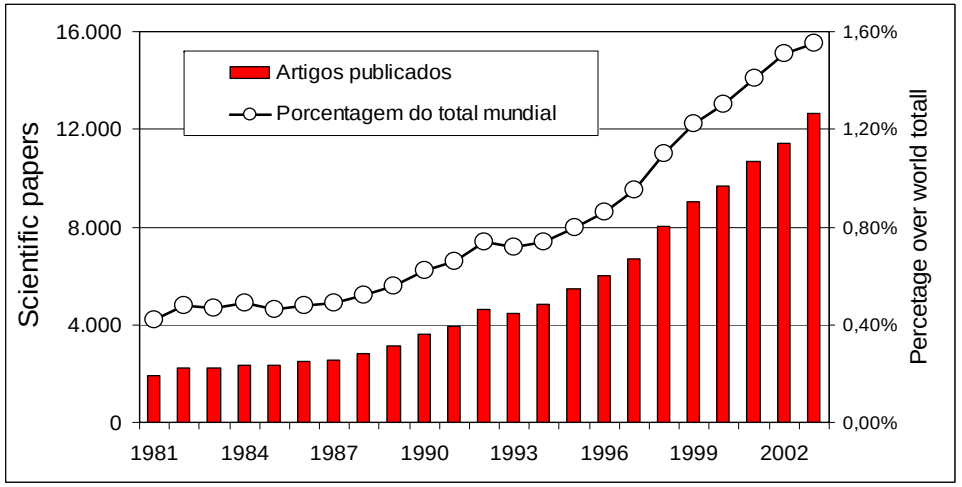
Physics in Brazil

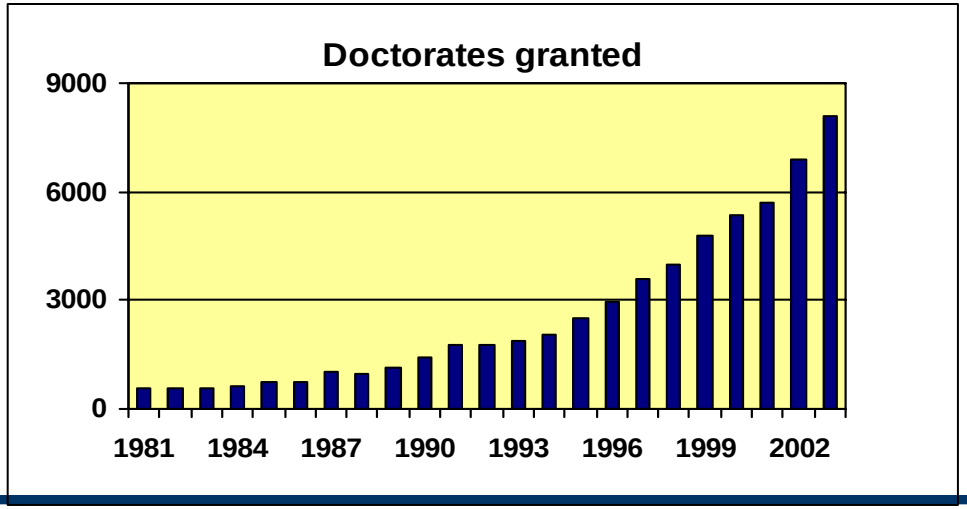
- Science in Brazil and Physics in Brazil;
- The development of Physics in Brazil
- Physics in Brazil - some numbers,
- National projects and some international collaborations
- Conclusion

Brazil: 180 million people, 9th GNP

Brazil

Brazil
Academic Research





Some of Brazil's knowledge based results

- Electronic elections
  - 100 millions voters, results by 11 P.M., same day
- Drilling oil at 5,000 ft under the sea
  - ~~80~~ 100% of Brazilian consumption
- Best commuter jets – Embraer
- Agrobussiness
  - Largest and most efficient Ethanol producer in the world
  - Most productive soybean in the world

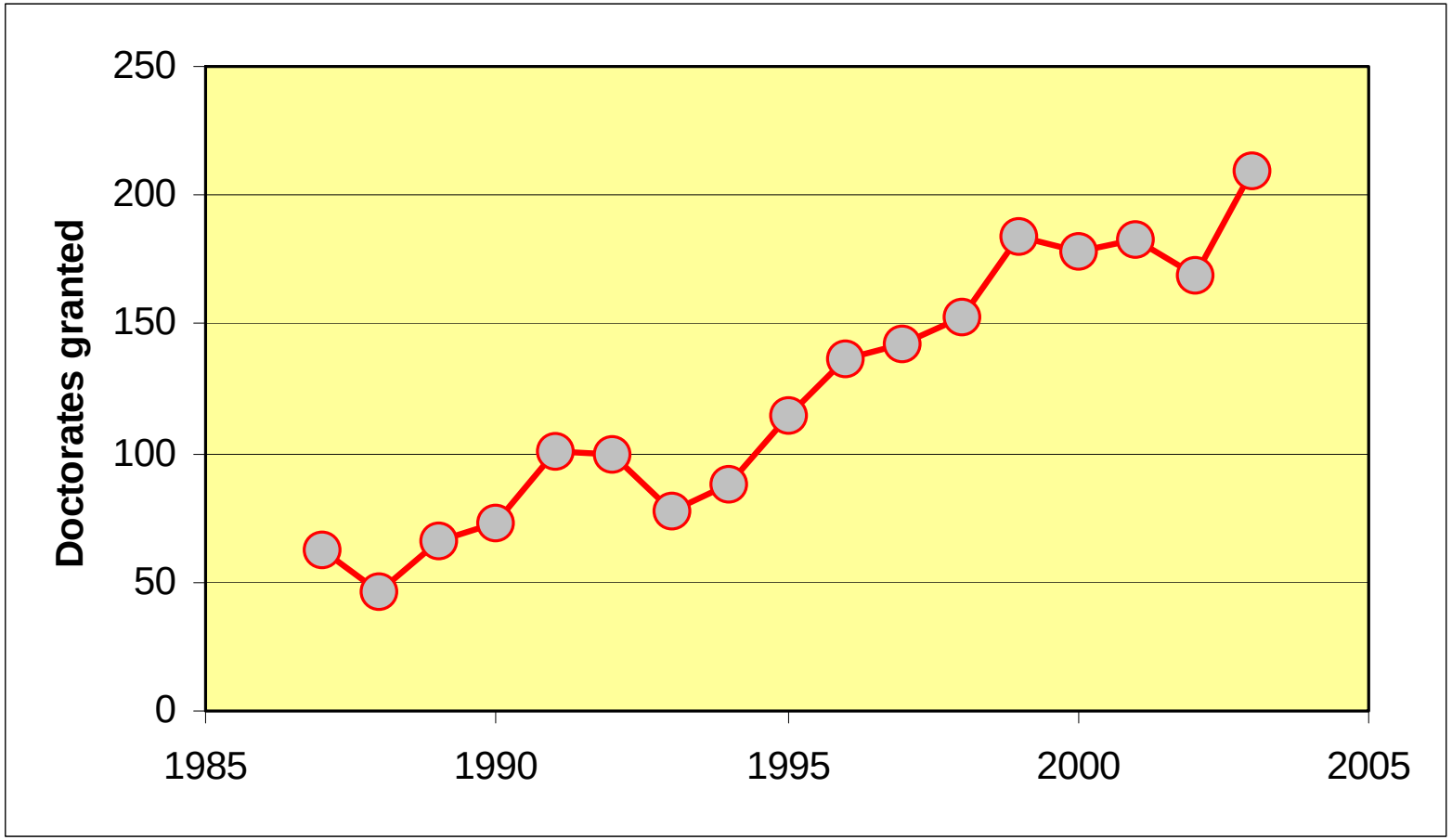
Physics in Brazil: people and institutions, I

- 1934: University of São Paulo, USP, founded
  - Inivited European scientists
  - Physics: Gleb Wataghin and Giuseppe Occhialini
    - C. Lattes (pion,1947), M. Schemberg, M. Damy
- 1947-51: Funding agencies
  - CNPq: National Council for Research
  - CAPES: qualification of university professors
  - Fapesp: SP State research foundation

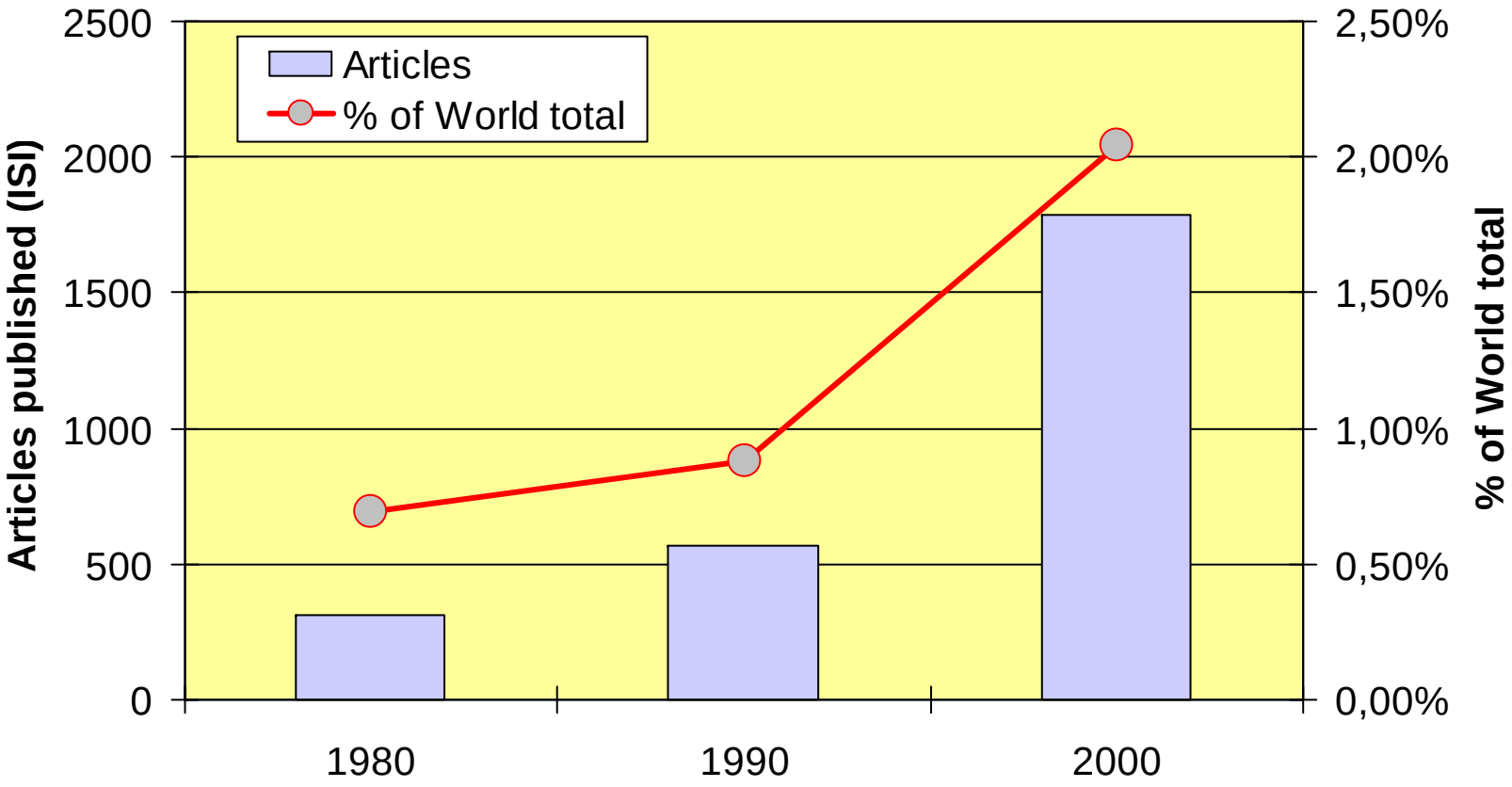
Physics in Brazil: people and institutions, II

- 1967: University of Campinas, Unicamp
  - Brazilian scientists returning from U.S
    - S.P.S. Porto, R.C. C. Leite, J.E. Ripper: solid state physics, lasers and optics
- 1969 - today: other Physics Departments
  - Faculty formed with funding by CAPES and CNPq

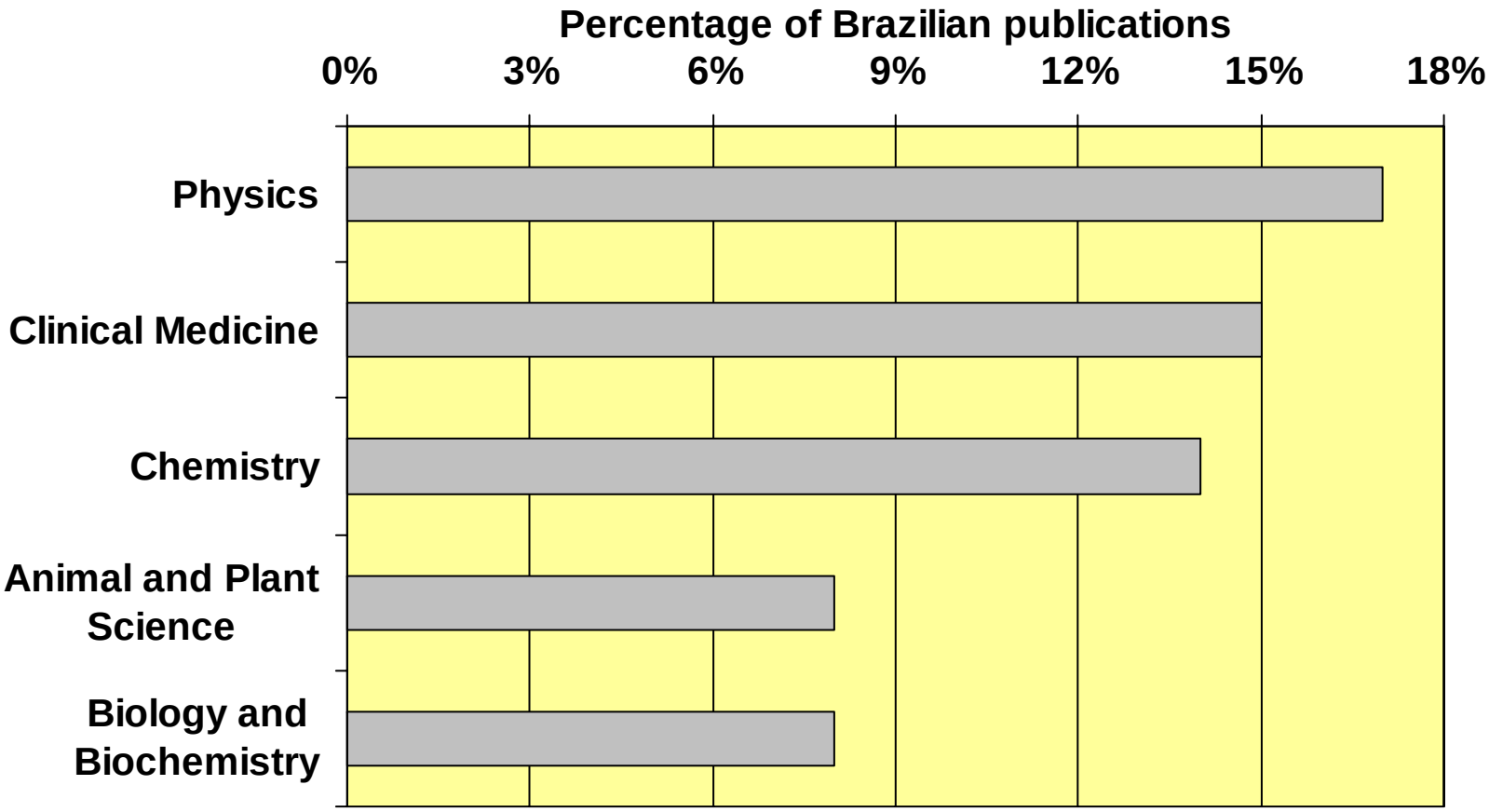
Brazil: Number of Physics PhD's granted yearly



Physics in Brazil: articles published



Physics in Brazil: 17% of Brazilian total publications



Physics in Brazil: special physics projects and collaborations

- Optical Communications
  - Unicamp, Telebrás
- Special Projects
  - Centers for Research and Innovation,Millenium Institutes)
- National Synchrotron Laboratory (LNLS)
- Pierre Auger Observatory
  - 16 countries
- SOAR: Southern Observatory for Astrophysical Research (4.1 m diameter mirror)
  - Michigan State, U. North Carolina Chapel Hill, CNPq, Fapesp

Optical Communications in Campinas

1971: Research on Optical Communications at Unicamp – J.E. Ripper, N. Patel

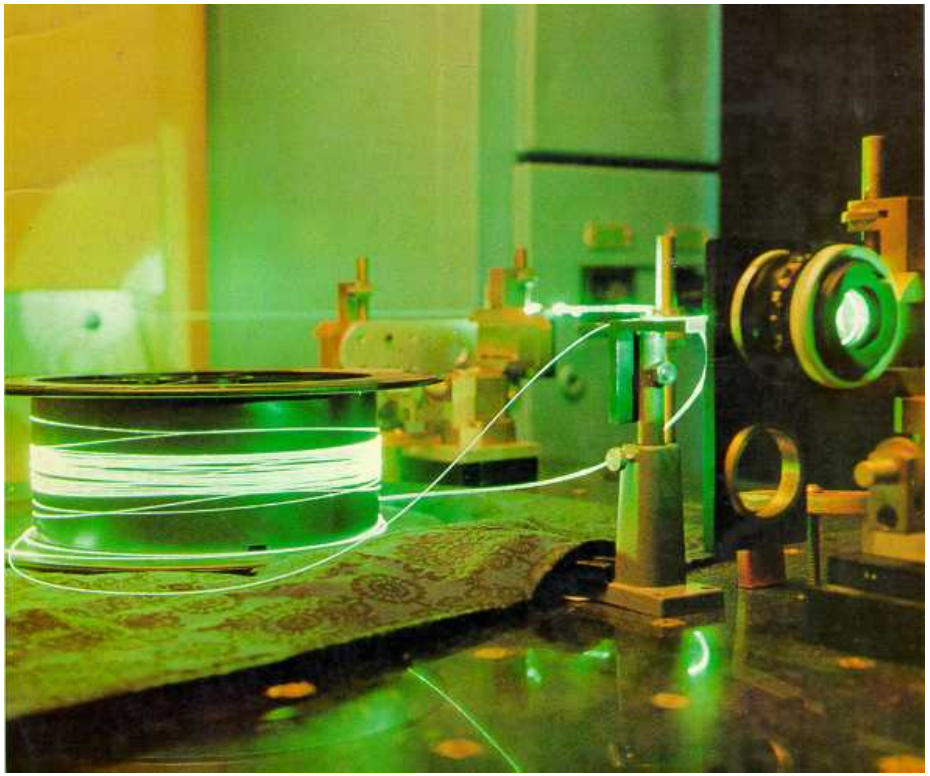
1973: IFGW-Telebrás contract: Study of Optical Comunication Systems

1976: Telebrás R&D Ctr

1982: ABC Xtal (now XTal FCore)

1986: AsGa Microeletrônica

2000: Optics and Photonics Research Center



Today: the spin-off companies born from the Physics Institute at Unicamp have revenues in excess to US$ 120 million

Centers for Research and Innovation, Fapesp

- Long term funding: 5 yr + 3 yr + 3 yr
  - Optics and Photonics Research Center
    - Optical communications, Laser cooling, Materials, Nonlinear Optics, Photonic Fibers
    - 10,4 M$/5 yrs + 3,3 M$/3yr
      - http://www.ifi.unicamp.br/foton/index-en.php
  - Structural Molecular Biology
    - Protein crystallography, biotechnology
    - 5,4 M$/5yrs + 1,2 M$/3yr
      - http://cbme.if.sc.usp.br/inicial_ing.html

Millenium Institutes, CNPq

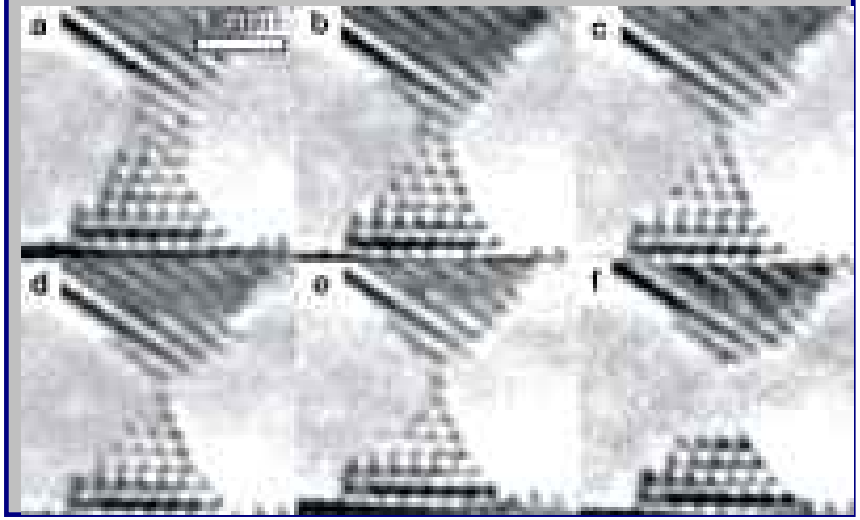
- Millenium Institutes
  - Funds from World Bank loan
    - Quantum Information
    - Nanoscience

National Synchrotron Laboratory

Energy:	1,37 GeV
Injection:	500 MeV
Current	250 mA
Radius	30 m
Light lines	12

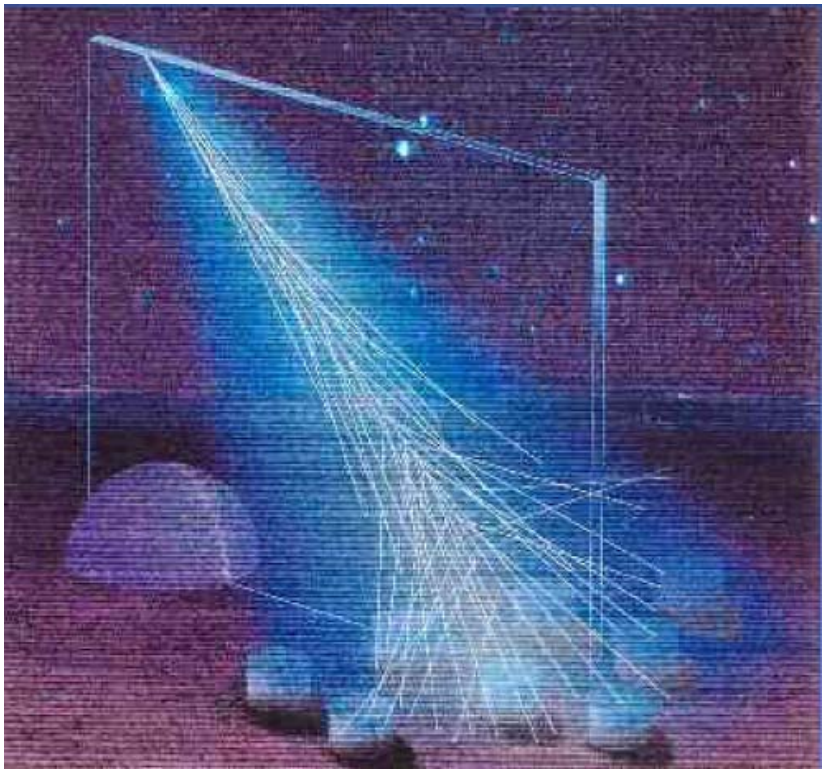
Hexoquinase

Gold nanowires



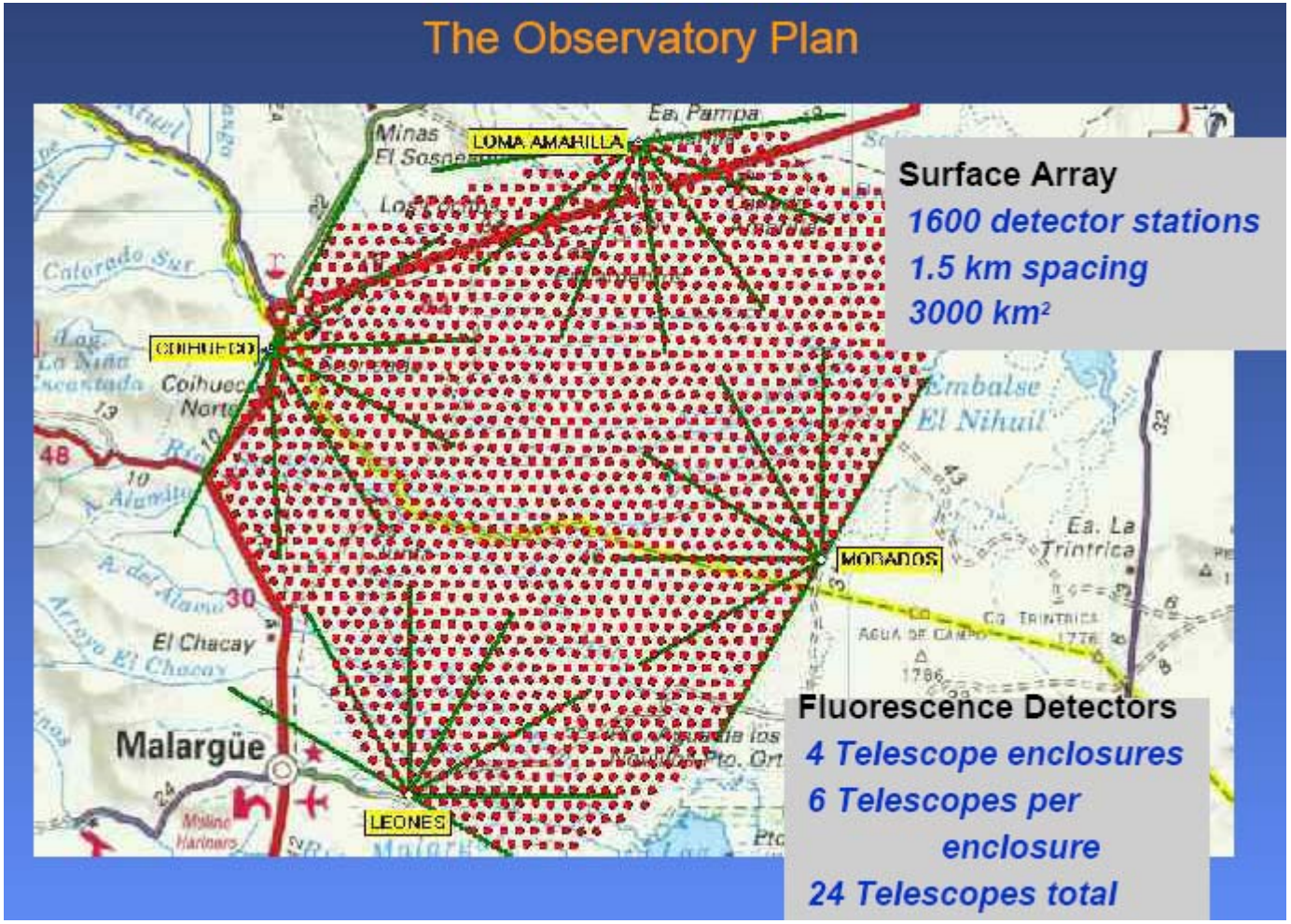
Laboratory works as a national facility
Users submit projects
Structural Molecular Biology, Nanoscience

Pierre Auger Observatory



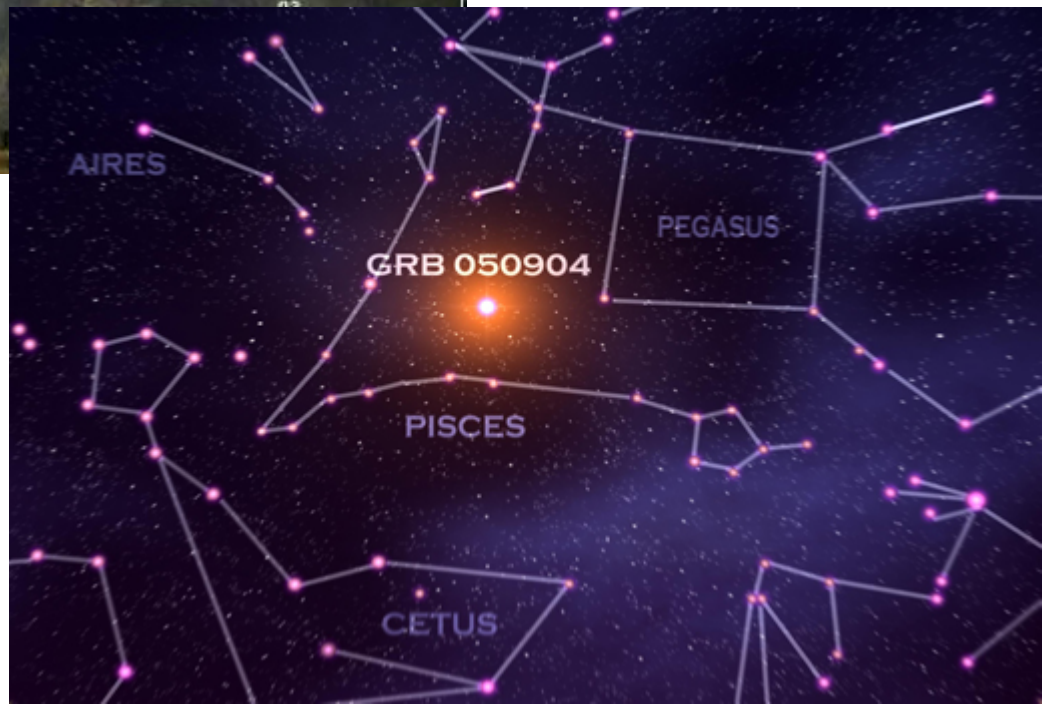
- In Malargue, Argentina
- Cosmic ray spectrum above 10^{19} eV
- Arrival direction distribution
  - Search for departure from isotropy – point sources
- Composition
  - Light or heavy nuclei, photons, neutrinos, exotics

Pierre Auger Observatory



SOAR: Southern Observatory for Astrophysical Research

J.B. Haislip et al., "A photometric redshift of *z* = 6.39 0.12 for GRB 050904", Nature 440, 181-183 (9 March 2006).



Infrared afterglow observation after a GRB - unveils the explosion which happened 13 billion years ago

IAG, USP; IF, UFRGS
Fapesp, CNPq

Fapesp – State Foundation for supporting R&D

- Annual budget
  - 1% of all state taxes
  - US$ 300 M
- Academic R&D
- Fellowships
- Industry R&D
  - Small bussiness R&D
    - **450 SBE's – SBIR like.**
  - **Cooperative R&D**
    - **Embraer, Natura, Vilares, Petrobras ...**

Including for foreign students: LatAm, Africa,..

www.nytimes.com
The New York Times ON THE WEB

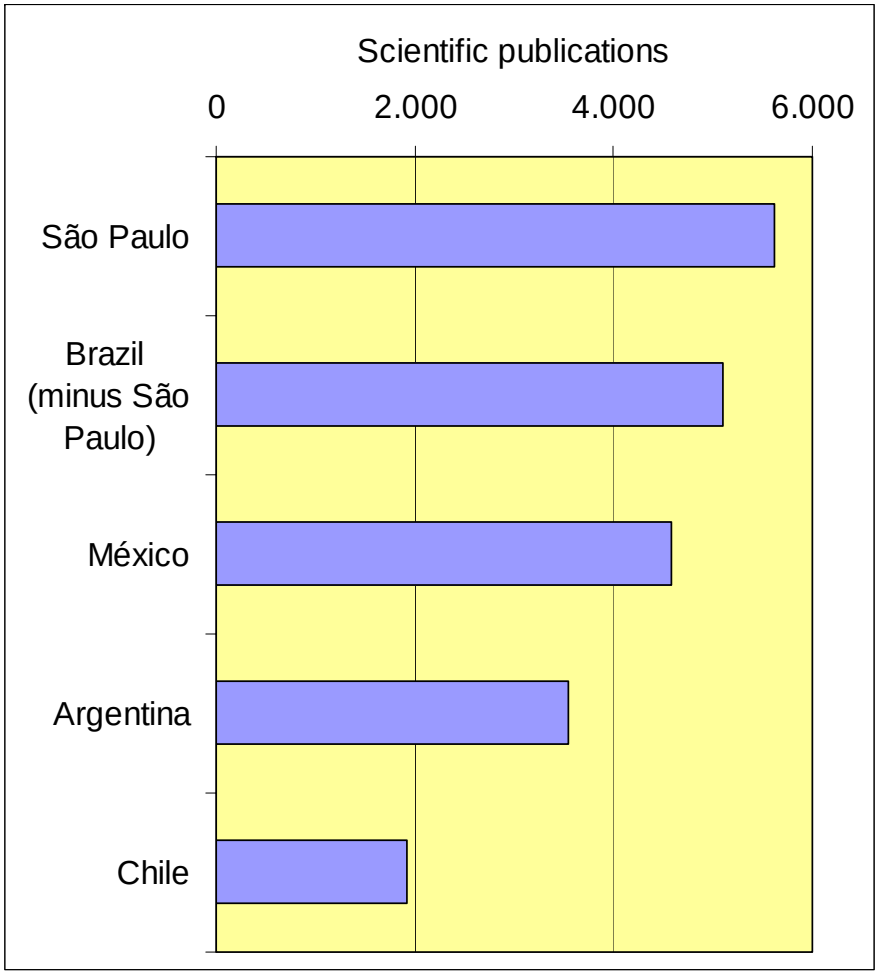
April 24, 2001

Model for Research Rises in a Third World City, By LARRY ROHTER

Increasingly, Fapesp's accomplishments are also making it the standard for scientific research in the third world. In an editorial last year, the magazine Nature called the genome work here "a political as well as a scientific achievement" that refutes the "common misconception that only advanced industrialized nations have the wherewithal and skilled human resources needed to achieve cutting edge science."

http://www.fapesp.br/english/index.php

State of São Paulo, Brazil



Three State Universities
USP, Unicamp and Unesp
10,000 faculty/130,000 students

Brasil	EUA	Doutorados
USP		2.013
	U. CA Berkeley	799
Unicamp		743
	U. WI-Madison	649
	U. CA Los Angeles	642
	U. TX at Austin, The	637
	OH State U.-Main Campus, The	616
	U. MI-Ann Arbor	607
	U. IL at Urbana-Champaign	603
	U. MN-Twin Cities	565
	Harvard U.	552
Unesp		540
	PA State U.-Main Campus	539
	Stanford U.	526
	MA Institute of Technology	501

Conclusion (almost)

- Science in Brazil benefited from long term (State, not Government) policies for public higher education development
  - Graduate courses and research
    - Academic standards
  - Sending students and researchers abroad
- Weak link: low intensity of industry R&D

Summing-up

- People and institutions
- "Stable" funding
  - "Stable" more important than "abundant"
  - Environment: meritocratic institutions x politics, short-termism, unionism,.....
- Connection to the world of science;
- And to Brazilian society – in a complex way, as science – society connections are