

# Occultation Astronomy in Brazil: History and Current State



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2012 IOTA Annual Meeting

- Part I
  - Brief history of occultation astronomy in Brazil: missing (and found) observations;
  - Brazilian observations in IOTA's archive: statistics.
- Part II
  - Current state.

## - Part I -

- First occultation in IOTA's archive: 1954.
- Missing observations:
  - George Marcgrave;
  - Louis Cruls;
  - José Brazilício de Souza;
  - First half of the 20th Century.

# George Marcgrave's occultations

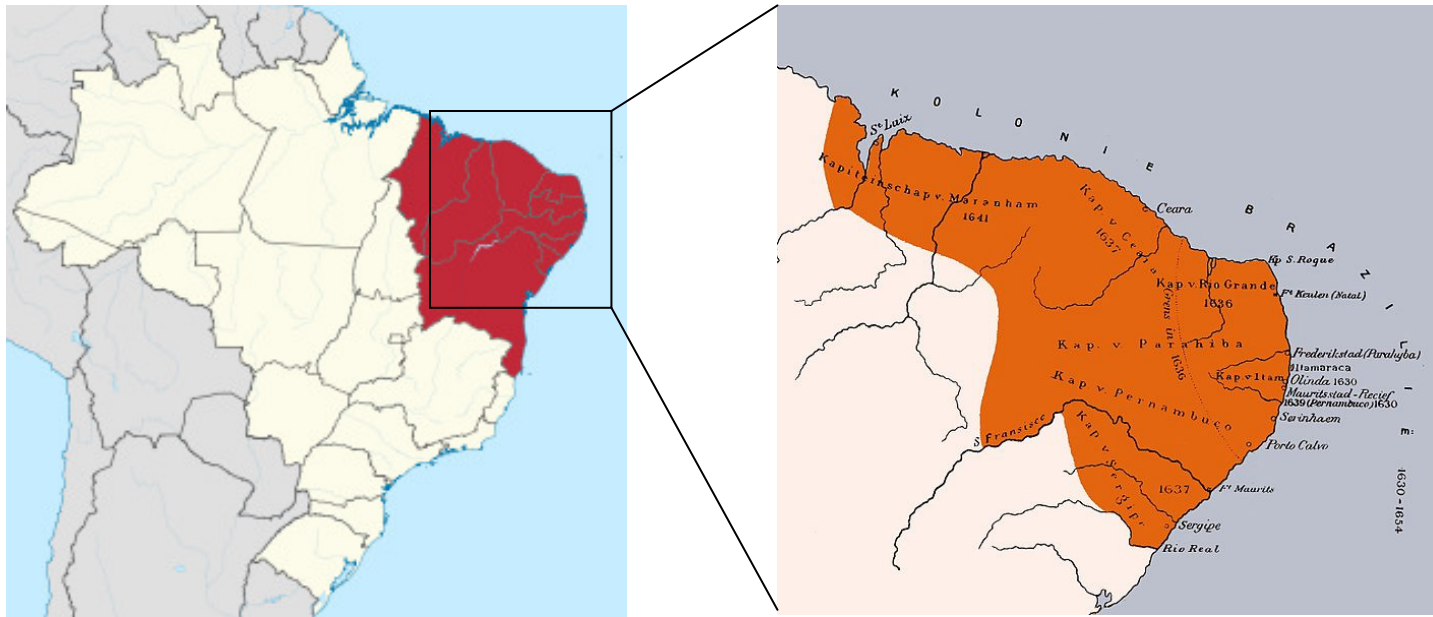


*Historia Naturalis Brasiliae*, 1st edition, 1648.

Willem Piso and **Georg Marcgrave** – *naturalists*.

# Dutch Brazil

- Portuguese arrived in Brazil in 1500
- Other European countries occupied parts of Brazil
- Dutch occupation in Nordeste: 1630 - 1654





- Dutch governor for Brazil: *John Maurice of Nassau*



1604-1679

- Nassau was enthusiastic about science.
- Artists and scientists were brought to Brazil during his government in order to better study and represent the "New World".



*Zacharias Wagner, 1641*



*Frans Post*

# George Marcgrave

- 1610, Liebstadt, Germany - 1644, Angola.
- In 1636 moves to Leiden, Netherlands.
- Leiden University was the first one in Europe to have an astronomical Observatory.
- In 1638 came to Brazil.
- In 1639 built an observatory at Nassau's house. This was the first observatory of the Americas and the most modern at the time\*.

\*[Matsuura, 2010]





*Der Hof Sein Excellenz – Zacharias Wagner (~1640)*





- From this observatory Marcgrave observed lunar occultations of planets (for example: Mercury, 1639).
- In Leiden he also recorded lunar occultations (including stellar occ.).
- One of the first recordings in the period "after-Bullialdus".

# Louis Cruls' occultations



*Louis Cruls, 1848, Belgium – 1908, France*

- Imperial Observatory founded in 1827 by Dom Pedro I.



- In 1874 Louis Cruls started to work here.

- 1886 and 1886: Cruls published a series of articles on "Revista do Observatório" on a new method to calculate the times of an occultation. He made some predictions, but the observations didn't happen due to bad weather.
- 1899: he published a Portuguese-French booklet\* on the method, but there's no observational report.

\*[Cruls, 1899]



- Cruls has also joined (and coordinated) expeditions to Central Brazil and reported using occultations to determine position\*. These observations are also missing.



\*[Cruls, 1992]

# More occultations at National Observatory



*Observatório Nacional, 1921.*

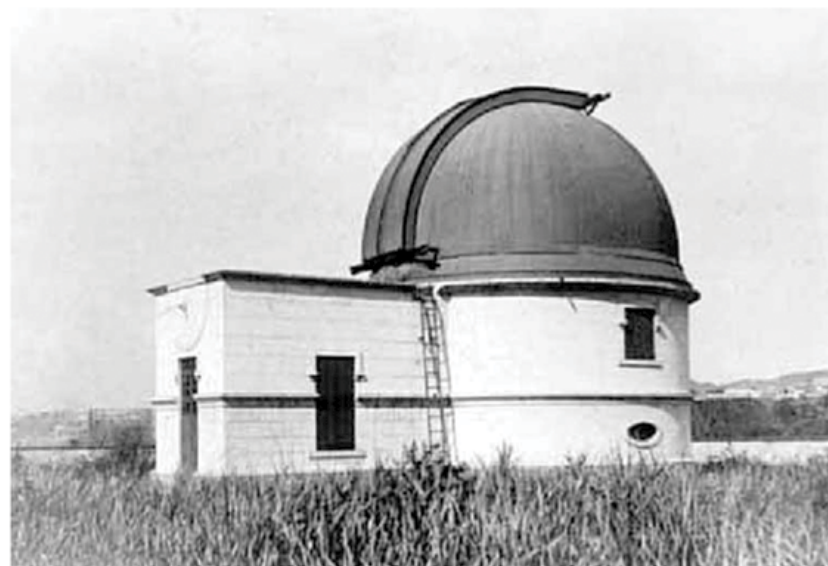
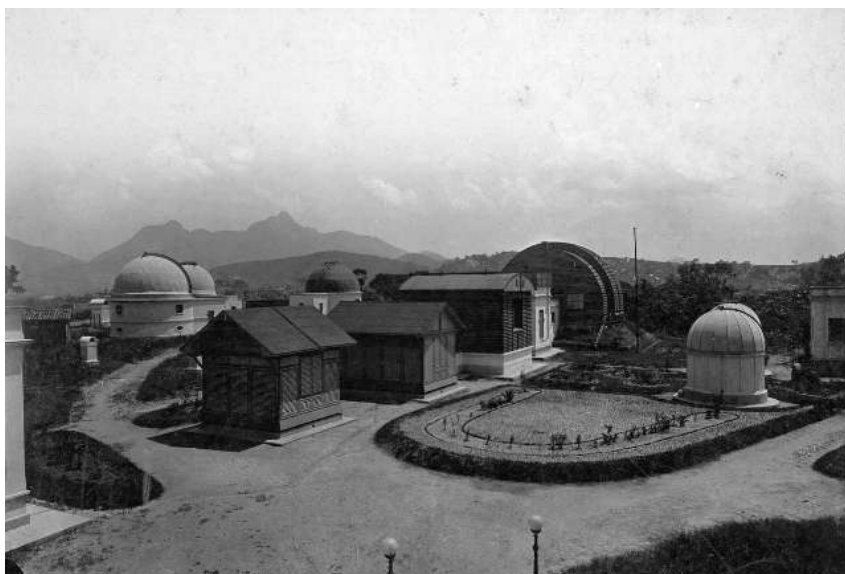


Figura 3 – Pavilhão da Luneta Equatorial de 32 cm após sua construção, 1920 (MAST, Arquivo Iconográfico, autor desconhecido).



Figura 11b – Luneta equatorial após a restauração (MAST, Arquivo Iconográfico, fotos Durval C. Reis).

- In 1928 the National Observatory started to use 32-cm refractor telescope.
- It may have been used at that time to observe lunar occultations in order to study Earth's rotation\*; but we have no report of these observations.

\*[Granato, Brito and Suzuki, 2005]

# Brazilício's occultations



*José Brazilício de Souza*  
(1854-1910)



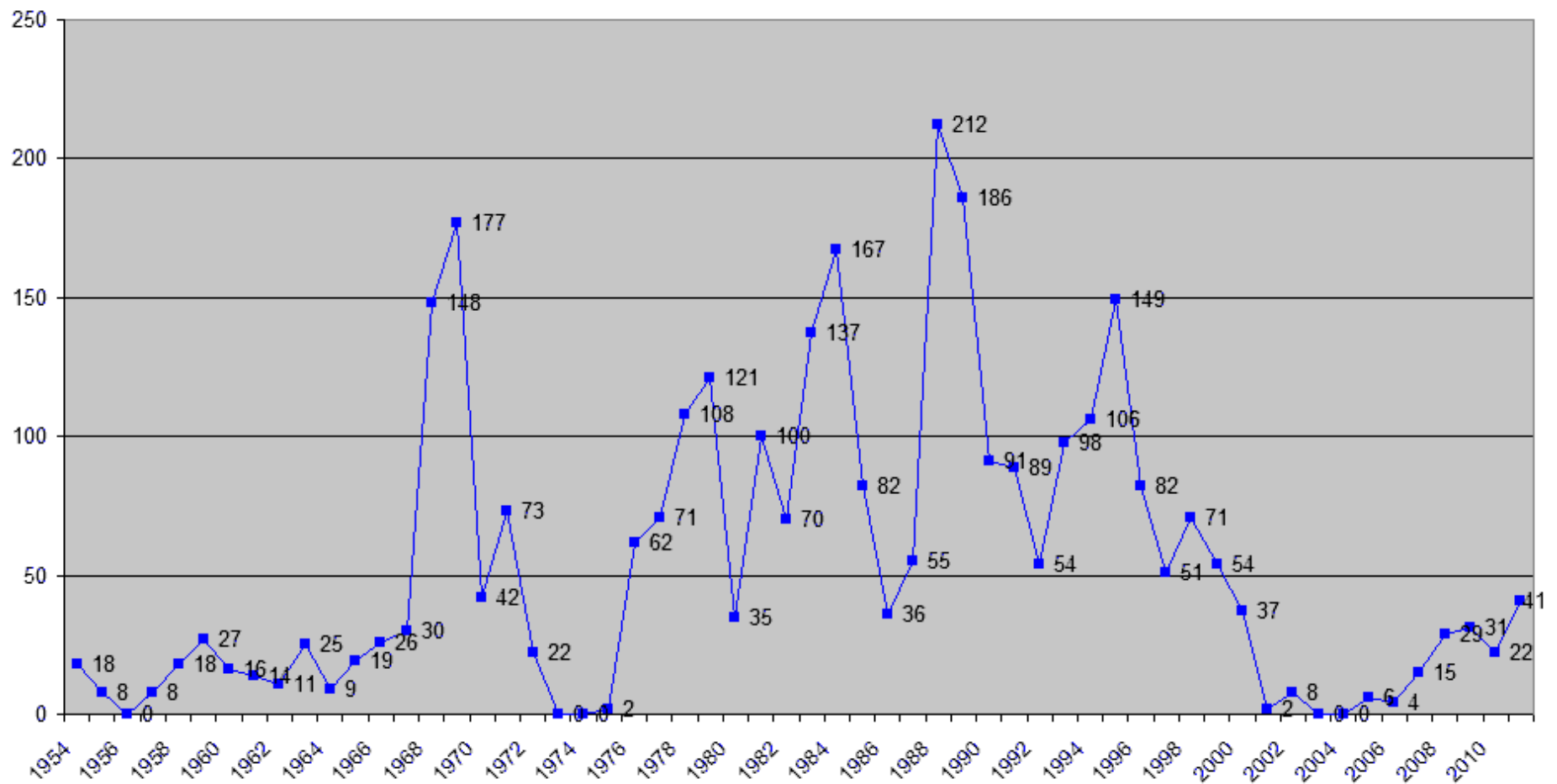
- Avid "astronomer in the free time".
- Made observations of eclipses, variable and double stars, comets, planets, asteroids, meteors, conjunctions, sunspots, **occultations...**
- First (known) reports of stellar occultations in Brazil!
- Among his writings there are references of 4 planetary and 6 stellar occ., between 1883 and 1898\*.
- Unfortunately there are huge uncertainties in his timings.

\*[Amorim]

## Brazilian observations in IOTA's archive: statistics

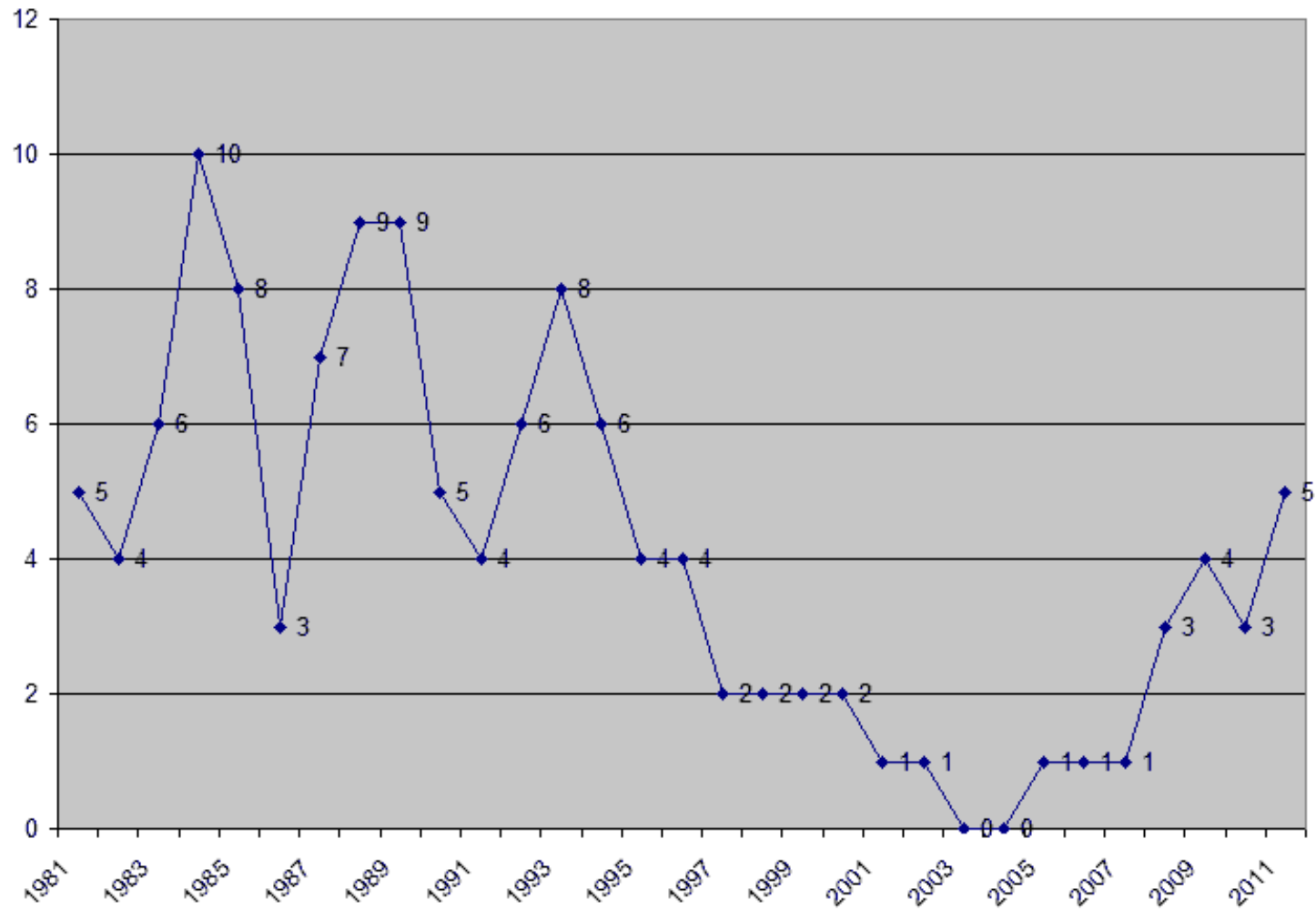
- First observation made in Brazil, according to IOTA's archive: 1954 (18 events observed from Rio de Janeiro).
- First asteroid occultation: 1982.
- Rising number of observers and recorded events.

# Number of reported events vs. year

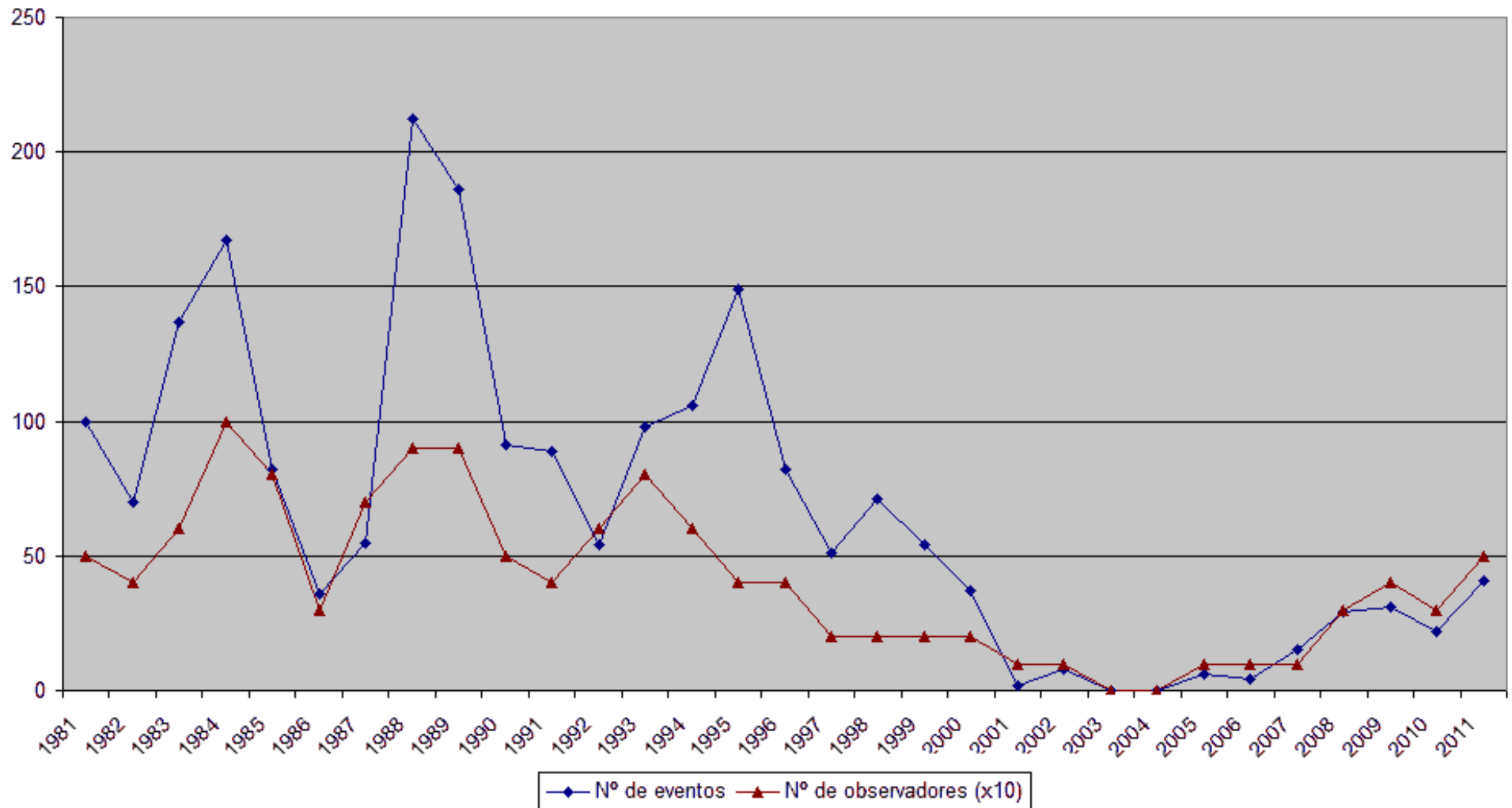


Total number of events (1954-2011): 3,175.

# Number of observers vs. year



# Number of observers( $\times 10$ ) and events vs. year



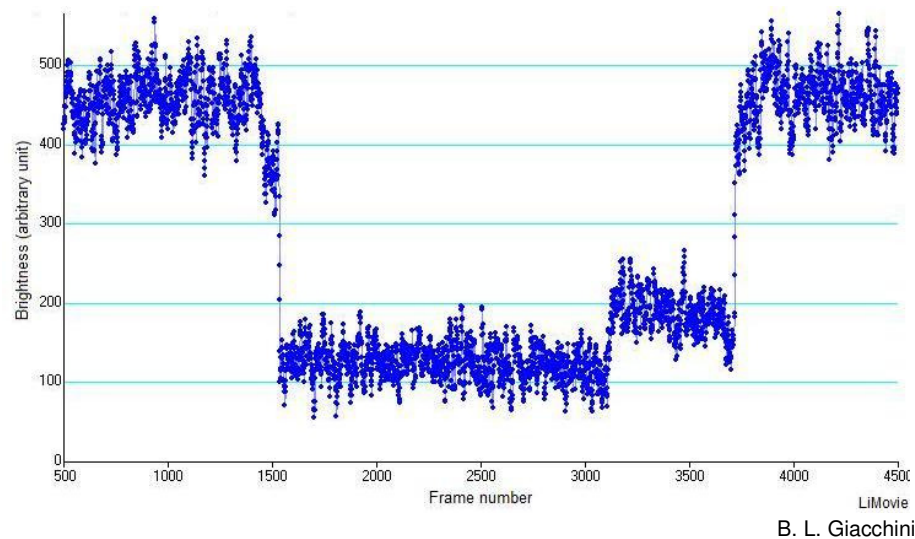


- Part II -

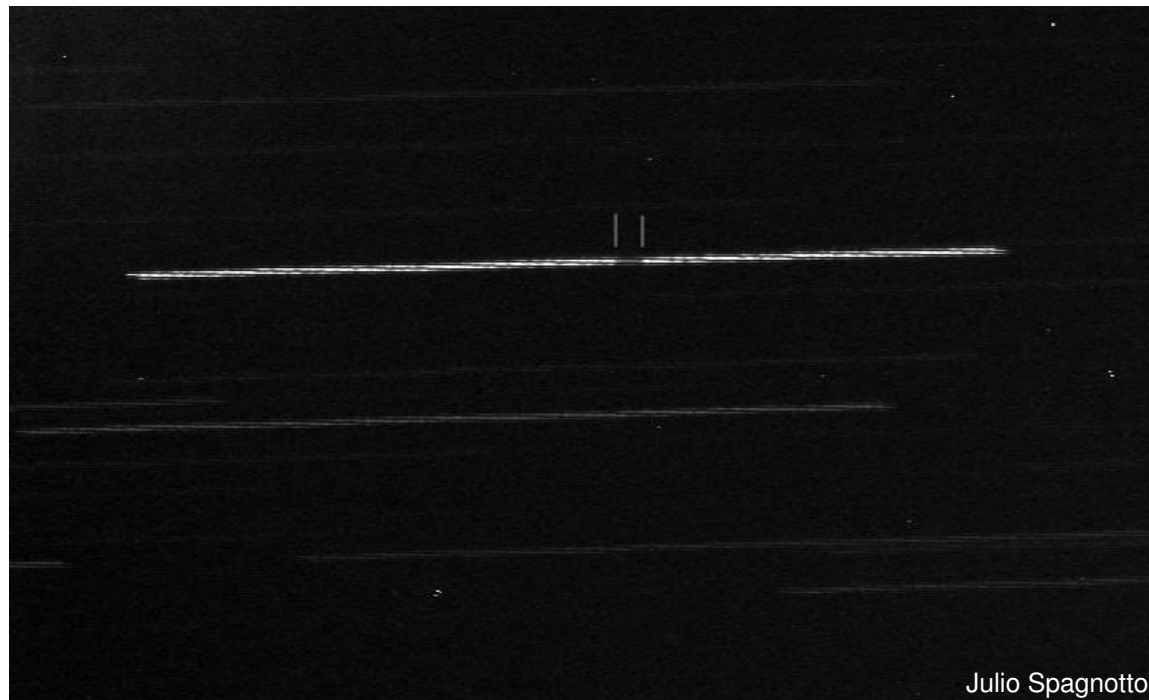
Current state

# This year's activities

- More than 43 lunar occ. events observed, by 6 observers.
- 2 positive asteroid occultations [and 1 miss]:
  - (52) Europa (double star discovery) - Giacchini



- (38) Leda (miss) - Giacchini.
- (72) Feronia (two chords, Brazil and Argentina) - Felipe Braga Ribas, Frédéric Vachier and Julio Spagnotto.





SEÇÃO DE OCULTAÇÕES

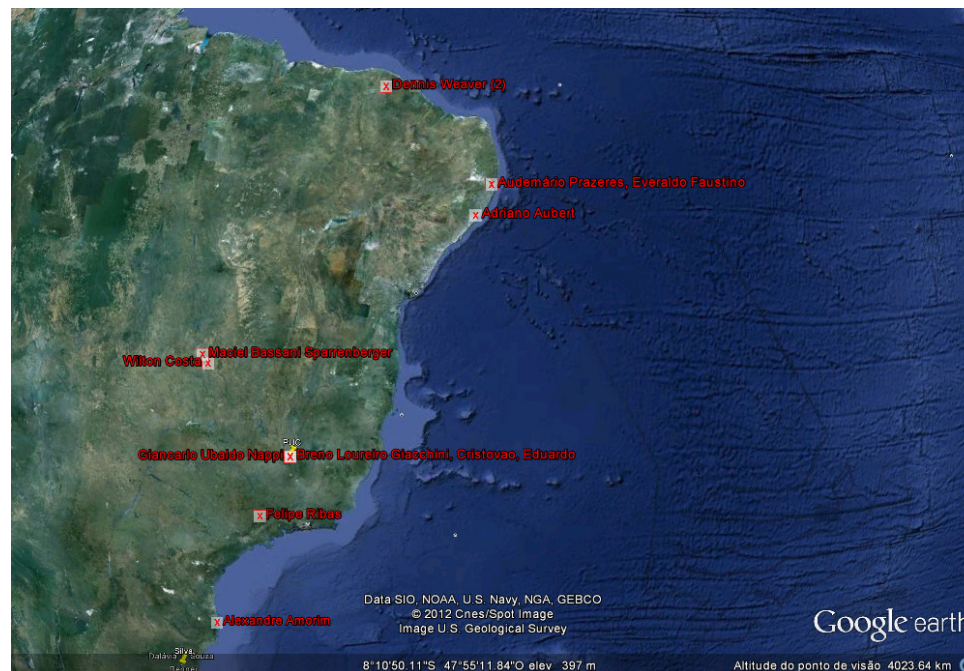
[www.rea-brasil.org/ocultacoes](http://www.rea-brasil.org/ocultacoes)

# REA's Occultation Section

- Created in 2009. Objectives:
- To inform people about occultations and their importance;
- To stimulate the observation and recording of occultations;
- To stimulate the contact between the Brazilian observers, and also with other observers in South America and around the world;
- To collect Brazilian reports of occultation observations;
- To establish a dialog with the observers to correct any problems that may eventually occur in the reports and ensure they are suitable to IOTA's standards;
- To forward the reports to IOTA;...

# Current state

- Historic research in progress;
- Creation of a network of observers
  - Varuna occultation, Feb. 2010: more than 26 observers.

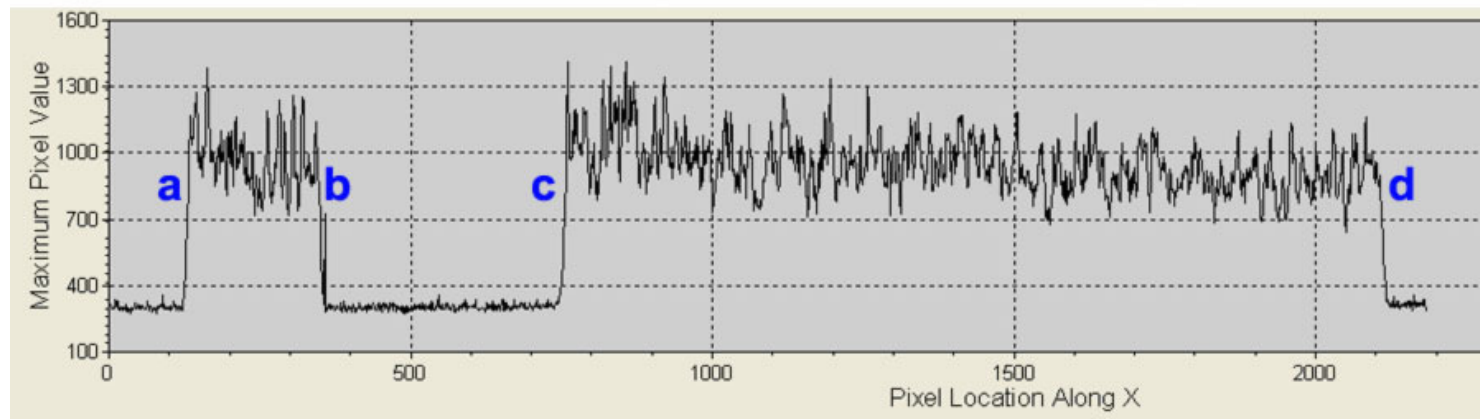






- Increasing international collaboration;
  - U.S.A.;
  - France;
  - Argentina...

**Ocultación de la estrella TYC 0709-00538-1 por el asteroide (891) Gunhild**  
12 de octubre de 2012 - Sergio Morero - Carlos Colazo - OAEGG (I19)



**a - Inicio de la captura**  
**b - Inicio de la ocultación**  
**c - Final de la ocultación**  
**d - Final de la captura**

**Tiempo de inicio de la ocultación: 07:33:08,5 (TU)**  
**Tiempo de finalización de la ocultación: 07:33:18,8 (TU)**  
**Duración de la ocultación: 10,3 segundos**  
**Longitud W: 64 35 34,41**  
**Latitud S: 31 21 24,58**  
**Altura: 862 m (s.n.m.)**

- Rising number of observed events, observers and interested people;
- Increasing accuracy of the recordings;
- Increasing number of papers, presentations, discoveries, etc, on the subject.

## TNO Occultations

- Research group at Observatório Nacional and Observatório do Valongo - "Rio Team".
- Prediction, observation, reduction.
- Partnership with Observatoire de Paris-Meudon.



SEÇÃO DE OCULTAÇÕES

[www.rea-brasil.org/ocultacoes](http://www.rea-brasil.org/ocultacoes)

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*Obrigado!*

*Thank you!*

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