

History of Astronomy in Portugal: *Institutions, Theories, Practices*

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The United Nations 62nd General Assembly, in order to celebrate the 400th anniversary of Galileo's first telescopic observations, has declared 2009 as the International Year of Astronomy (IYA2009). This celebration was intended to make widely known the importance of Astronomy as a science and as a technique. Among the different strategies proposed to reach this aim, the Portuguese National Committee of the IYA2009, formed by the Portuguese Society of Astronomy, emphasized the need to promote events related to the history of Astronomy.

The Conference on the "History of Astronomy in Portugal: Institutions, Theories, Practices", held at the University of Lisbon Science Museum, from September 24 to September 26, 2009, coinciding with the 22nd meeting of the National Seminar for the History of Mathematics, was an excellent opportunity for scholars and Portuguese researchers on the history of astronomy not only to debate these matters among themselves but also to listen and to talk to some of the best international researchers in this area, contributing to include Portugal in the international net of history of astronomy researchers.

The meeting was organized by researchers of the National Seminar for the History of Mathematics and of the Museum of Science of the University of Lisbon (MCUL), with the support of these two organizations, of the Centro Internacional de Matemática (CIM), of three of the main Portuguese Mathematics centres, CMAF (U Lisbon), CMUC (U Coimbra) and CMUP (U Porto), of the Portuguese Societies of Mathematics and of Astronomy, of the Inter Universities Centre for the History of Science and Technology (CIUHCT) and was sponsored by the Foundation for Science and Technology (FCT).

José Francisco Rodrigues, director of CIM, at the opening ceremony emphasized the reciprocal influence between Mathematics and Astronomy on measuring and understanding space and time throughout human history. This, he said, can be seen as far as the early calendars, with their numerical problems about the counting of days, seasons and years, or the ingenious method of Eratosthenes to measure with remarkable accuracy the circumference of the Earth. Three other signifi-

cant examples of this historical and scientific interaction were also referred: Kepler's laws of planetary motion, which first two were published also in 1609; Le Verrier's 1846 prediction of the existence of the then unknown planet Neptune, using only mathematics and astronomical observations of the planet Uranus (Galle and d'Arrest later confirmed these predictions within 1° of the foreseen location); and the confirmation in 1919, by a team led by Eddington, of Einstein's prediction of gravitational deflection of starlight by the Sun with the photographs of a solar eclipse taken at dual expeditions in Sobral, northern Brazil, and in Príncipe island, then a Portuguese colony in Africa, showing the distortion of the structure of spacetime by matter, a conclusion from the theory of General Relativity, which was built upon earlier contributions to Differential Geometry by mathematicians like Riemann or Levi-Civita.



Figure 1: *The Scholar Observatory of the Polytechnic School is now integrated in the Science Museum of the University of Lisbon (Photo M. Heller, MCUL)*

In Portugal, throughout its history, Astronomy was developed in the context of Mathematical Sciences. During the times of Portugal's Maritime Discoveries, astronomical navigation was based on spherical trigonometry, and therefore it was the mathematicians who taught astronomy to the pilots. During the 19th century the new centres of science teaching, as the Polytechnic School in Lisbon (Figure 1), or the Polytechnic Academy in Porto, developed astronomy teaching and research in the context of the mathematics subjects.

The inheritors of these 19th century institutions, respectively the Faculties of Sciences of Lisbon and Porto, upheld this tradition during the 20th century and continued to consider astronomy as a subject to be taught in their mathematics departments.

The conference organizers decided to have a program that echoed a wide time span, from the dolmen builders of south-west Europe to the echoes in Portugal of Einstein's theory of relativity. There were 17 talks, nine of them by Portuguese researchers. Eleventh-hour problems prevented three of the speakers, Michael Hoskin, Jim Bennett and José Vaquero, from attending the conference, but their texts were read, and the complementary slides for each talk were shown during their readings.

The opening talk, "The cosmovision of dolmen builders of south-west Europe" by Michael Hoskin (St Edmund's College, Cambridge) analyzed the astronomy factor in the dolmens orientation in south-west Europe. In Portugal, for instance, all dolmens faced within the range of sunrise or moonrise. José Chabas (Pompeu Fabra University, Barcelona), in "Traditions in Computational Astronomy in the Iberian Peninsula in the late Middle Ages" presented a review of the traditions in mathematical astronomy that had a major impact on Portuguese astronomical activity, with a special emphasis on authors associated with Portugal, including Abraham Zanut and Judah Ben Verga towards the end of the 15th century. "Giovanni Lembo's lessons in S. Antão" was the theme of the talk by Ugo Baldini (Padua University). These lessons (1615-1617) are known for documenting the first knowledge in Portugal of Galileo's telescopic observations and for spreading non-ptolemaic models for planetary motions. Baldini centered his talk in other topics in Lembo's lessons which were unusual either in S. Antão's courses or in the mathematics teaching in other Jesuit colleges around Europe (hydraulic engines, hydrography of the Mediterranean sea, etc) showing that Lembo's lessons conveyed information on some aspects of the "inner" mathematical practice of the Society of Jesus specialists in the major colleges which went far beyond the official teaching programs and the contents of Jesuit mathematical handbooks prior to 1630/40. Carlos Ziller Camenietzki (Rio de Janeiro Federal University) in "Restoration astronomers" discussed the work of some of the Portuguese astronomers after the regaining of independence from Spain in 1640, in particular discussing Guilherme Casmach, Manoel Gomes Galhano Lourosa and António Pimenta. Luís Tirapicos (MCUL) in "Instruments and Astronomical Observations at the Jesuit College of Santo Antão o Novo, 1724-1759" presented a preliminary survey of the instruments used in Santo Antão and characterized the observations in which they were used, putting this data in the context of eighteenth century astronomical observatories in Europe. Fernando

Figueiredo (Coimbra University) focused on "Astronomy in the Faculty of Mathematics of Coimbra University after Pombal's Reform (1772-1820)" and in particular on the founding of the Astronomical Observatory of Coimbra University (Figure 2), analysing the work and astronomical research of Monteiro da Rocha, its first director and the main force behind the founding and publication of Coimbra's Astronomical Ephemeris. António Costa Canas (Escola Naval) in "The introduction of the Nautical Almanach in Portugal" analysed the problem of computing longitude at sea and the proposed solutions, using chronometers and lunar distances. The Nautical Almanach had pre-computed values of lunar distances. In his talk, Canas contextualized the introduction of this almanach in Portugal and the role of the Portuguese mathematician and astronomer José Monteiro da Rocha (1734-1819), presenting other Monteiro da Rocha contributions to solve the longitude problem.

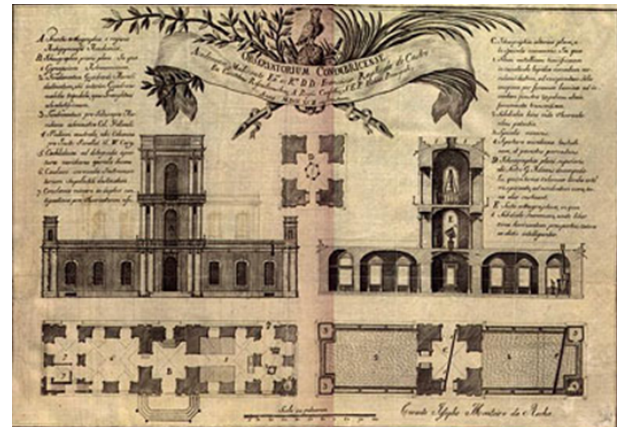


Figure 2: The Astronomical Observatory of Coimbra (1799-1951) was created by the 1772 Reform of the University and had the mathematician J. Monteiro da Rocha as its first director.

Pedro Raposo (St. Catherine's College, Oxford) presented "Observatory of Lisbon: the last "big science" undertaking of Classical Astronomy?", an observatory whose cornerstone was laid in 1861. This observatory (Figure 3), which represents and embodies the agenda of stellar astronomy prior to the rise of astrophotography and astrophysics, was strongly modelled on the Pulkovo Observatory in Russia, an observatory which in the first half of the nineteenth represented the foremost astronomical instrumentation and practice. Paulo Crawford (CAAUL) and Ana Simões (CIUHCT) analysed the theme of "Portuguese astronomers and the Principle of Relativity". In their talk they showed that the small network of astronomers of the Astronomical Observatory of Lisbon and those somehow related to them had a positive approach to the theory of relativity, being strongly stimulated by the aspects of that theory which were related to their scientific practice. In particular, by being involved in the founding and development of observatories which were responsible for

the time service and legal time they became actively interested in the new concepts of space and time and in the principle of relativity as initially formulated by Einstein.



Figure 3: *The Astronomical Observatory of Lisbon was founded in 1861 at a remarkable site in the capital. (Photo OAL-FCUL)*

Besides these talks, there were interesting presentations by Sérgio Nobre ((UNESP) on “The astronomy presented by Isidore of Seville in his *Etymologiae* (7th century)”); José Vaquero (Extremadura University) on “Long-term evolution of the sun from Iberian historical

documents”; Henrique Leitão (CIUHCT) on “A mathematical and astronomical miracle: the dial of Achaz”; Jim Bennett (Museum of History of Science, Oxford) on “Portugal and the European consensus of eighteenth-century astronomy”; Roberto Martins (UNICAMP) on “The interaction between academic thought and nautical knowledge in Portugal and Spain”; Helmuth Malonek (Aveiro University) and Teresa Costa (Montejunto Secondary School) on “Francisco Miranda da Costa Lobo- a Portuguese astronomer and his attempt to open Portugal to the scientific world”; Isabel Malaquias (Aveiro University) on “Between astronomy and instrumentation: João Jacinto de Magalhães (1722-1790), a remarkable case”; and Vítor Bonifácio (Aveiro University) on “The beginning of Astrophysics in Portugal”.

For the record, we state the composition of the Organizing Committee: Luis Saraiva (CMAF/MCUL), Luis Miguel Carolino (MCUL/CIUHCT), António Leal Duarte (CMUC), Marta Lourenço (MCUL/CIUCHT), Samuel Gessner (CIUHCT/MCUL), Vasco Teixeira (MCUL), Paula Gualdrapa (MCUL), Carlos Sá (CMUP). As a final comment, this was a very good meeting, with plenty of stimulating talks and debates. We are looking forward to read the Proceedings of this Meeting, which will be published during the second half of 2010, with the support of CIM.

COMING EVENTS

April, 16-18, 2010: 2nd Porto Meeting on Mathematics for Industry,

Department of Mathematics, University of Porto.

ORGANIZERS

Pedro Freitas (UTL/GFM)

Diogo Pinheiro (CEMAPRE/CMUP)

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For more information about the event, see

<http://cmup.fc.up.pt/cmup/mathindustry/2010/>

April, 19-23, 2010: Educational Interfaces between Mathematics and Industry,

Fundação Calouste Gulbenkian and Universidade de Lisboa.

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For more information about the event, see

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