João de Moraes Pereira (1855–1908): The first Portuguese member of the British Astronomical Association

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The first centenary of João de Moraes Pereira's death passed by as discreetly as he had lived. Moraes Pereira (1855 July 15–1908 January 4) lived on São Miguel island, Azores, a surprising location for a 19th century amateur astronomer. He started observing around 1892 while in his mid-thirties and consistently observed the sky until at least 1904. His main astronomical interests were sunspot and variable star observations. Moraes Pereira's name is not associated with any major discovery and as a consequence he is almost forgotten today. He was nevertheless a major early contributor to the BAA variable star and solar sections, as can be seen by the reports published in the Association's *Memoirs*. In this paper we will provide an overview of his life and work.

Portuguese astronomy in the last quarter of the 19th century

At the end of the 19th century there were three institutional astronomical observatories in Portugal: the Coimbra University astronomical observatory under the supervision of the Mathematics Faculty, the Royal Astronomical Observatory at Tapada da Ajuda and the Lisbon Polytechnic School observatory. The Coimbra observatory was built at the end of the 18th century and was still in use. Its main research interests were astrometric. A new Repsold meridian circle was installed in 1879, but despite the best efforts of the observatory director, the institution was fading to the role of a teaching facility.[1]

Both Lisbon observatories were of more recent construction. The Polytechnic School observatory was built in 1875–'76 with the purpose of doing research in the new fields of spectroscopy and photography. For reasons not yet entirely clear but probably relating to lack of funds this intention was not fulfilled.[1,2]

The Tapada da Ajuda observatory was constructed during the 1860s and early 1870s as a copy of the famous Pulkova observatory. Its aim was to provide a centre for astrometric excellence, and by 1878 the astrometric work was under way.[3]

On the amateur side the Portuguese situation was quite different from the British one. Nineteenth century Portuguese amateur astronomers are unknown before the 1880s, and the figure of the 'grand amateur' was entirely absent in the country. Portugal was, at the time, strongly influenced by French culture and although we are still researching this topic, we believe Camille Flammarion's (1842–1925) popularisation style provided a key stimulus for the first Portuguese amateur astronomers. Contrary to previous French popularisation efforts, Flammarion's books stimulated the reader to play an active rather than a passive role.[1,4] One of the most interesting examples of 1880s Portuguese amateur astronomers was João de Moraes Pereira, the first Portuguese member of the British Astronomical Association.

Figure 1. Group photograph circa 1900. João de Moraes Pereira is indicated by the circle.[5]

Family background and youth

Moraes Pereira (Figure 1) was born in Ponta Delgada, São Miguel island, Azores archipelago on 1855 July 15. His grandparents were born in the Pico and Fayal islands but at some point the family moved to São Miguel. From the small amount of information available we conclude that he belonged to a middle class family. His father, João Luiz de Moraes Pereira (1827–1905), was Ponta Delgada's town council secretary for forty years, while his uncle, José Moraes Pereira (1832–1899), was a merchant. Despite his economic status his father managed to mingle with the island's small elite by virtue of his cultural activities. João Luiz was an amateur actor, musician and composer. Several of

his songs, with lyrics by the Portuguese poet António Feliciano de Castilho (1800–1875), were local successes.

João de Moraes Pereira attended the four year course at the local secondary school. He did not pursue a higher education. Aged 19, he worked as an assistant in his uncle's clothing and fabric store, the 'José de Moraes Pereira Company'. On 1881 August 31, he married Etelvina Botelho Tavares (1859–1951) and his only son José was born on 1883 January 22.

Until 1886, João de Moraes Pereira worked at his uncle's store. At the end of the year he was invited to teach English at Ponta Delgada secondary school. We believe his knowledge of the English language was essentially acquired via his family. Both his grandmothers were known for mastering the language. His uncle José had commercial dealings with the important São Miguel island British community and made at least three commercial trips to England, in 1875, 1877 and 1882. João Pereira became the Ponta Delgada secondary school provisional English teacher in 1887. In 1889, following the required government exam approval, he was nominated the school's official English teacher.[1]

'Scarce' is the best way to describe João de Moraes Pereira's available personal information. His secondary school position would grant him a middle class income and the respect of the inhabitants of a small town. Keeping up with the family tradition, Moraes Pereira was also involved in several musical activities both at the association level and by singing at church services. By the end of his life he was probably quite well off financially since he was able to send his son to Italy to study music.[1]

João de Moraes Pereira seems to have been a modest likeable person. His manners were always polite and 'he was everybody's friend and surely [...] nobody had ill feelings towards him. There was no reason for them.'[6]

A former pupil remembered that his 'motto was that the student should know, regardless of how much he studied. He [Moraes Pereira] also had a great amount of demonstration material and a limitless patience that he put into use in complicated and practical demonstrations.'

In this student's opinion, Moraes Pereira was the best teacher he had ever had.[7] According to another witness he had only two flaws, he did not 'appreciate being talked about [...] and knows too well our scientific establishment which explains the reason he is not known in Portugal.'[5]

We know neither how nor when Moraes Pereira's astronomical interests developed. A possibility might be the influence of the Army officer Francisco Afonso da Costa Chaves e Mello (1857–1926). While Chaves is best known today for his later scientific contributions to the fields of zoology and meteorology, in the 1880s he seemed to be mainly interested in astronomy. He had an observatory in Ponta Delgada equipped with a Secretan 108mm aperture telescope and wrote popular articles for a local newspaper and letters to the *L'Astronomie* journal. In 1886 he gave a public lecture on 'Astronomy' in the town. The lecture was to be complemented with practical lessons for classes of 10 students given at his observatory. In 1888 he was the first Portuguese member of the recently created *Société Astronomique de France*. We do not know if Moraes Pereira attended Chaves' seminar, but the two men surely met at Ponta Delgada secondary school. Chaves was the provisional Chemistry and Physics teacher there between 1885–'88. We also know that both observed together the total solar eclipse of 1893 April 16, partial at the Azores. Later Chaves would carry one of Moraes Pereira's coffin ribbons.[1]

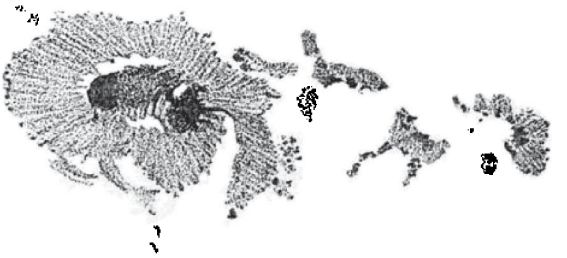

Figure 2. Sunspot group drawn by Moraes Pereira on 1894 June 6.[18]

First observations and equipment

The first known reference to Moraes Pereira's astronomical observations was published in *L'Astronomie* of 1892 March. Drawings of double stars, a zodiacal light effect and the February 6 Venus and Jupiter conjunction had been sent to the journal.[8]

Moraes Pereira's observatory was located in the backyard of his house in the centre of Ponta Delgada. He owned a Bardou 108mm aperture telescope, 'an excellent telescope one must say, it separates Antares perfectly', 50mm aperture binoculars, a Hughes sextant, a barometer, a thermometer and possibly three chronometers. We found no evidence that his observational equipment changed throughout his observational years.[1]

In 1892, he became a member of both the *Société Astronomique de France* (SAF) and the *British Astronomical Association* (BAA).[9,10] To the latter he was admitted in the session of 1892 December 28, seconded by Edward and Thomas Frid Maunder.

During his first year of recorded observations, Moraes

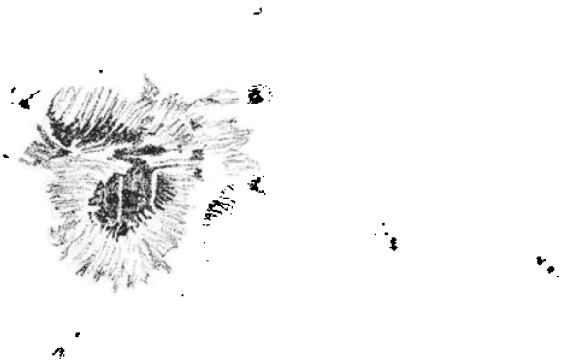

Figure 3. Detail of Moraes Pereira's 1898 October 6 sunspot drawing showing a bridge over a 'black hole'.[17]

Pereira drew pictures of Mars, Jupiter and Saturn, observed double stars and the February 6 Venus and Jupiter conjunction, and started observing variable stars. His earliest variable star observations were of *R Ursae Minoris* and *R Camelopardalis* and date from 1892 May 30. During 1892 Moraes Pereira studied at least 15 stars for variability during 20 observation nights.[11]

Astronomical work

In 1893 Moraes Pereira's astronomical involvement clearly increased. Not only did he observe a greater number of variable stars during more nights than in 1892 but he also started sending observations to the BAA Solar Section.[11]

Solar observations

In 1893 the solar cycle was approaching a maximum and as a consequence its surface features were particularly appealing. Moraes Pereira continuously observed and drew sunspots from 1893 to 1898. His contributions to the Solar Section were appreciated not only for their intrinsic value but also because Pereira's geographical location increased the chances of attaining a complete daily solar coverage. For instance, in the second Section report Elizabeth Brown (1830–1899) wrote: 'Tables and diagrams of position have been supplied regularly throughout the year by Mr. J. S. Townsend and by Rev. F. J. Eld, and have been admirably supplemented by Prof. Pereira, of the Azores, who has also included areas and excellent sketches, thus enabling the Director to fill up many missing dates which would otherwise have remained blank.'[12]

A particularly good example of Ponta Delgada's advantage was provided in 1897 where 'we have to record the unexpected appearance of a spot of enormous size [...] Unfortunately for observers, the persistence of cloudy or foggy weather all over Great Britain rendered observations few and far between, and but for the assistance of Prof. Pereira of the Azores, it would have been impossible to give any connected account of the changes.'[13]

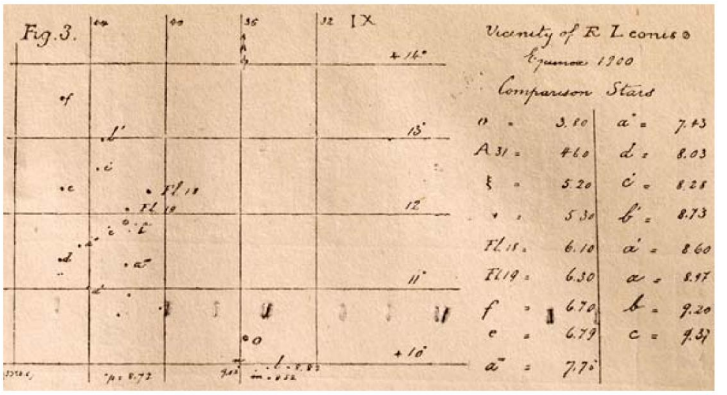

Figure 4. Moraes Pereira's chart of the *R Leonis* vicinity published in 1897.[24]

In fact 6 of the 10 days with observations obtained between January 3 and 14 were provided by Moraes Pereira. Between 1893 and 1896, inclusive, he was the only foreign observer contributing to the Section.[13] His drawings were published in the 3rd to 8th Section reports, of which Figure 2 is an example.[12,14–17]

Two of his observations stood out at the time. In 1894 April , he observed 'one of the largest nuclei in a large group in longitude 31°, latitude 20° N., as turning round its companion nucleus (situated to the N. of it) as on a pivot, the motion continuing for several days and becoming complete by the time of its approach to the W. limb. My own [E. Brown] drawings do not entirely bear this out, but that considerable proper motion was involved, in which the penumbra, as well as the nucleus participated, is undoubted.'[12,50]

In 1894 November, Flammarion concluded that as 'the result of recent observations, [he] regards the rotation of the nuclei of spots, on an axis normal to the surface, as an established fact.'[12]

Pereira's other talked-about observation was his confirmation of Revd William Rutter Dawes' (1799–1868) sunspot 'black holes'. In 1851 the famous 'eagle-eyed' Dawes had observed:

'In all spots which are tolerably symmetrical, and large enough to admit of accurate scrutiny, the umbra will be found to be perforated near its centre by a perfectly black hole, which I [Dawes] regard to be the true nucleus.'[19]

In the 1890s solar observers were still trying to understand the height of sunspot structures as well as the mechanism responsible for their appearance and evolution. For instance, at the second general meeting of the BAA on 1896 December 30, Edward Maunder presented a paper titled 'The level of sun-spots'.[20] In the ensuing discussion, Moraes Pereira's observations were mentioned by Elizabeth Brown as an indication that a slight depression of the centre of the sunspots was unlikely.[21] We now know that Maunder was right in questioning the Wilson effect.[22] Moraes Pereira's observations were also referred to by Agnes Clerke (1842–1907) in her famous 1903 book *Problems in Astrophysics*, where Figure 2 appeared as an illustration.[18] In 1898 October, Moraes Pereira reported a 'curious and perfect instance of a black hole, and over it a bridge'.[17] (Figure 3). This is the last year of Moraes Pereira's known sunspot observations.

Despite the large amount of data gathered over the years by different techniques – photography, spectroscopy and visual observations – the breakthrough in understanding of sunspot formation and evolution only occurred in 1908, when George Ellery Hale (1868–1938) linked these structures to the solar magnetic field.[23]

Variable star observations

In 1892 Moraes Pereira joined the Variable Star Section (VSS) of the BAA. He used Argelander's step method and Harvard magnitudes. The mean magnitude adopted was the arithmetic mean of two or more estimates. He used his 108mm refractor

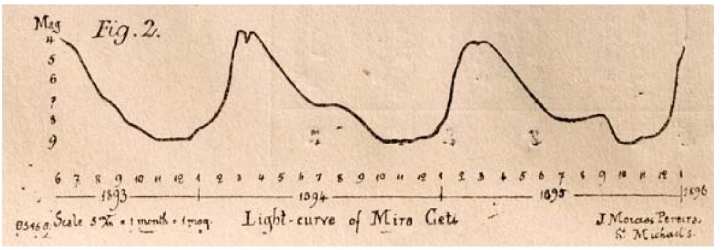

Figure 5. Moraes Pereira's proposed *o Ceti* (Mira) lightcurve between 1893 June and 1896 January.[24]

and 50mm binocular, but 'Whenever possible, naked eye comparisons were preferred.'[11]

Moraes Pereira was one of the main contributors to the second and third VSS reports, published in the 3rd and 5th volumes of the BAA *Memoirs* in 1895 and 1897 respectively. For instance, in 1893 he observed 57 stars on 167 observation nights, that is 45.8% of the year's total. In the third VSS report, in addition to his observations he supplies seven star finding charts and presents *o Ceti* (Mira) and *R Leonis* lightcurves (see Figures 4 and 5).[11,24]

In the BAA *Journal* we only find variable star observations by Moraes Pereira obtained between 1892 May 30 and 1896 February 17. Does this mean he stopped observing? If one analyses the VSS reports one realises that no record exists of observations dating from 1896 February to the end of 1899, despite a 1898 October announcement that 'The Report of the Section for the years 1896–'97 will be published shortly'.[25] The Section archive partially confirms these results, presenting zero observations for the years 1897 and 1898, and a small number of observations for 1896 and 1899.[26] Consequently we believe the lack of Pereira's published observations was probably due to the BAA's internal dynamics. This suggestion might also explain his different *modus operandi* from 1900 onwards. While previously he published in *L'Astronomie* and the BAA *Journal*, from this date onward he wrote, instead, to the *English Mechanic* journal and sent his variable star observations to the Harvard College Observatory.

There are two additional reasons why we believe Moraes Pereira had not lost his interest in variable star studies. Firstly, the two articles that appeared after the 1896–'99 publication hiatus dealt with photometric observations of several Orion stars and *o Ceti* (Mira).[27,28] Secondly, in 1903, there is strong evidence that Moraes Pereira was actively planning to pursue this research.[29] On July 7, he ordered the 55 negative plates of the Harvard sky map. These negatives had a 30° square field of view, included stars of magnitude 12 and brighter and cost 15 dollars plus shipping costs. The expense represented approximately 4% of the annual salary of a secondary school Portuguese teacher at the time. Moraes Pereira also boasted in the letter sent to Pickering that 'My material for variables is growing an important one'.[29] We also found that he owned the following publications:[29–34]

Bonn Southern Durchmusterung and maps;
Uranometria Argentina and maps;
Cordoba Durchmusterung and maps;
Annals of Harvard College Observatory (Photometric Catalogues, A Catalogue of 1520 Bright Stars);
Harvard College Observatory Circulars;
Harvard College Observatory Bulletin.

Moraes Pereira's 1902 October to 1904 December observations were sent to Harvard. They were published, in 1907, in the *Second Catalogue of Variable Stars*: 'Since 1904, the list of variables of long period observed visually at this Observatory [Harvard College] has been increased to 309 stars. Monthly observations of these objects have been made by Mr. Leon Campbell with the 5-inch or 24-inch telescopes, and by the writer with the 6-inch telescope. Observations have also been sent to this Observatory from the Halsted, Leander McCormick, Vassar, Mt. Holyoke, and Whiteside Observatories, and from Mr. J. H. Eadie and Señor Pereira.'[35]

Moraes Pereira was the only foreign contributor to the catalogue. He observed 21 stars on 87 nights. In Figure 6 we present an *o Ceti* (Mira) lightcurve for the period 1902–'05 highlighting Moraes Pereira's observations, using the *American Association of Variable Star Observers* (AAVSO) database.

Figure 7 summarises all Moraes Pereira's variable star observations as deduced from published sources. As such the figure represents only minimum values.

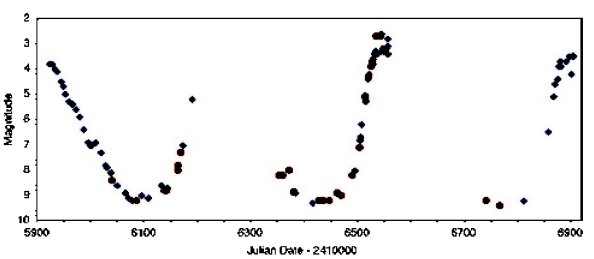

Figure 6. AAVSO database *o Ceti* (Mira) photometric data available for the period 1902 to 1905. Circles indicate Moraes Pereira's observations.

Other observations

In 1901 Moraes Pereira unexpectedly determined two longitude differences via the telegraphic method. A submarine telegraphic cable linked Europe and the Azores in 1893. A connection to the American continent started to be considered from the 1890s. Finally in 1900 connections were established between the town of Horta on Fayal island and Germany, Canada and the USA.

In 1901, Moraes Pereira was spending his summer holidays in Horta when he had the opportunity to meet S. Miller Wood, the director of the *Europe and Azores Telegraph Company*. Wood introduced him to the director of the *Commercial Cable Company*, who in turn presented him to Clement Henry McLeod (1851–1904), Director of Canada's Montreal Observatory. McLeod was already experienced in telegraphic determination of longitude.

'In the 1880s McLeod borrowed telegraph lines to determine longitude in this way, relative to Harvard College. In the '90s, he borrowed the [*Commercial Cable Co.*] Atlantic cable

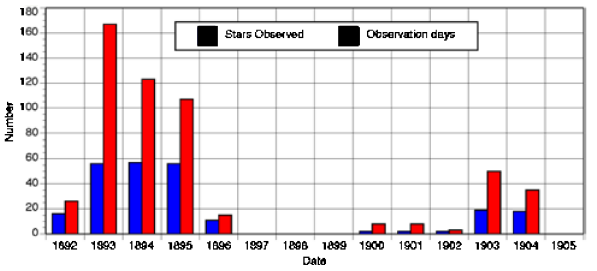

Figure 7. Moraes Pereira's variable star observations per year, according to published sources.

to determine it relative to Greenwich. Putting the two together, he was able to improve slightly the figures for Harvard itself, and so for the whole North American continent.'[36]

On August 4, McLeod sent the time from his observatory through a relay in Canso to the recorder in the Horta station. 'There Mr Hughes had devised a key, by means of which the time of my [Moraes Pereira's] chronometer was marked on the ribbon, together with the siphon marks from Montreal. Local time was determined by means of a very good aluminium 7in. sextant, No. 3336 by Hughes & Son, London, corrected at Kew, and a simple mercury horizon without any roof whatever.'[37]

As a result the longitude of Horta Castle was found to differ by 3s from the value previously determined by Admiral A. T. E. Vidal (1792–1863) in the 1840s.[37] The result was published in the *English Mechanic* and the *Bulletin of the American Geographical Society* and was later adopted by the *Connaissance des Temps*.[37–39]

In that same summer Moraes Pereira also determined telegraphically the longitude of his Ponta Delgada observatory. The value obtained differed by 5s from his previous determination and agrees well with the modern value.

In the interval from 1901 to 1904, besides his variable star researches, Moraes Pereira published observations of Jupiter's satellites and Borelly's and Encke's comets.[34, 40–42] His last article dates from 1905 June 15 and reports his thoughts concerning the variability period of *48 Aurigae*.[33]

João de Moraes Pereira died, unexpectedly according to the local press, at his Ponta Delgada home on 1908 January 8.[43]

Epilogue

João de Moraes Pereira was, as were so many of his fellow amateur astronomers at the end of the 19th century, motivated by a genuine love for the scientific study of the heavens. Possessing a modest experimental apparatus he dedicated almost twelve years of his life to celestial observation. Like many amateur astronomers he observed the surfaces of the Moon, Mars, Jupiter and Saturn; solar and lunar eclipses; transits and eclipses of Jupiter and Saturn's satellites; sunspots; and variable stars. All of his observations were visual. Drawing was extensively used as a recording medium. His passion led him to learn techniques well beyond his formal secondary school education and his English teaching job. He quickly and efficiently took advantage of opportunities as they arose, as the Horta Castle telegraphic determination shows. He was also confident enough not to be hindered by his geographical location and background. In fact, his location was a valuable asset by diversifying observing conditions and yet another proof of the advantages to be had by international collaboration in astronomical observational programs. For a while he was the only foreign contributor to the BAA Variable Star and Solar Sections. He was also one of the earliest foreign observers to send photometric data to Harvard College Observatory variable star program.

Throughout his career we did not find any evidence that Moraes Pereira attempted to explain his observations. Instead he contributed to a data collecting effort that maybe would lead, as defended by Pickering, to a greater understanding of the phenomena under study.

Very little was known about Moraes Pereira's life before we started our research. Many questions remain unanswered due to the scarcity of written documents available, but we hope to have shone some light on his achievements. We finish with a Moraes Pereira quote that summarises quite well, we believe, his enthusiasm towards astronomical research:

'Determination of the brightness of faint stars is difficult. If it were not, would it be so fascinating?'[27]

Acknowledgments

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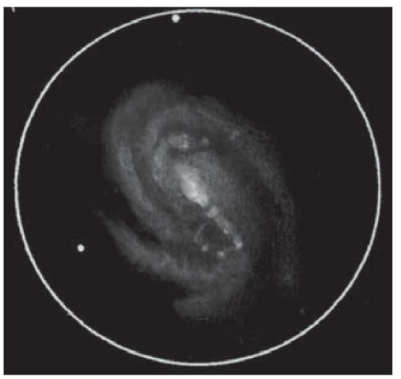
References

1 Bonifácio V., *Da Astronomia à Astrofísica. A perspectiva Portuguesa (1850–1940)*, Ph.D. thesis, Departamento de Física, Universidade de Aveiro, 2009
2 Rivotti R. & Sepúlveda A., *Faculdade de Ciências da Universidade de Lisboa: passado/presente perspectivas futuras*, chap. Astronomia e Engenharia Geográfica na Escola Politécnica e Faculdade de Ciências, 179–185, Lisboa: Faculdade de Ciências da Universidade de Lisboa, 1987
3 Raposo P., *A vida e obra do Almirante Campos Rodrigues*, Master's thesis, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, 2006
4 Sheets–Pyenson S., 'Popular Science Periodicals in Paris and London: the Emergence of a Low Scientific Culture, 1820–1875', *Annals of Science*, **42**, 549–572, 1985

NGC 2903 – the galaxy Messier missed

Although Charles Messier and his colleagues recorded most of the bright northern deep sky objects when searching for comets, a few escaped their gaze and one of their brightest misses was galaxy NGC 2903 in Leo, discovered in November 1784 by William Herschel. At RA 9h 32.2m and Dec +21° 30' (2000.0) the galaxy lies 1.5° due south of lambda Leonis, the magnitude 4.3 star which forms the top of the Sickle asterism and which juts out westwards from brighter epsilon. On a clear night from a dark location with Leo high in the sky it can be seen in 10×50 binoculars as a small patch of faint nebulosity, but a telescope of 15cm aperture or greater is needed to show any detail and do justice to the galaxy.



Dale Holt

NGC 2903 is a barred spiral oriented to our line of sight at 24° from edge-on, and similar in many respects to our own Milky Way galaxy. It lies at a distance of around 25 million light years in the Leo spur of galaxies with a mass estimated at 60 billion Suns, and subtends an angular size on the sky of 12×5.6 arcminutes. When William Herschel first observed this galaxy he recorded it as a double nebula and gave it two numbers – 56 and 57 in his class I (bright nebulae) category, possibly confused by brightness concentrations from HII regions in the central bar structure. Because of this it was subsequently given two numbers by Dreyer, NGC 2903 and NGC 2905, when he compiled the New General Catalogue. It was Lord Rosse and his team with the 72-inch Birr reflector who first determined the galaxy's spiral structure, showed detail in the central bar and confirmed it was all one object.

Martin Mobberley

NGC 2905 is now designated as a bright knot in the galaxy's north eastern spiral arm. Interestingly, both Smyth and Webb also saw

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5 Simas M. S. de M., *Album Açoriano*, chap. João de Moraes Pereira, 241–242, Lisboa: Anuário Commercial de Portugal, 1903
6 Anonymous, 'João de Morais Pereira', *Diário dos Açores*, 2, 1908
7 C. A. J., 'O Dr. Luiz Francisco Rebello Bicudo e a literatura contemporanea', *Revista Michaelense*, **3**, 874–894, 1926
8 Armelin G., 'Société Astronomique de France, Séance du 2 Mars 1892', *L'Astronomie*, 136–141, 1892
9 Anonymous, 'Membres admis, séance de rentrée du 2 Novembre 1892', *Bulletin de la Société Astronomique de France*, **6**, 1892
10 Anonymous, 'Candidates for Election as Members of the Association', *J. Brit. Astron. Assoc.*, **3**, 56–57, 1893
11 Pereira J. de M., 'Observations of variable stars from May 1892 to January 1894', *Mem. Brit. Astron. Assoc.*, **3**, 37–47, 1895
12 Brown E., 'Section for the Observation of the Sun – Third Report of the Section', *ibid.*, **3**, 1895
13 Anonymous, 'The Large Sun-spot of January 1897', *J. Brit. Astron. Assoc.*, **7**, 204, 1897
14 Brown E., 'Section for the Observation of the Sun – Fourth Report of the Section', *Mem. Brit. Astron. Assoc.*, **4**, 1896
15 Brown E., 'Section for the Observation of the Sun – Fifth Report of the Section', *ibid.*, **5**, 1897
16 Brown E., 'Section for the Observation of the Sun – Sixth Report of the Section, 1896', *ibid.*, **6**, 1898
17 Brown E., 'Section for the Observation of the Sun – Eighth Report of the Section, 1898', *ibid.*, **8**, 1900
18 Clerke A. M., *Problems in Astrophysics*, London: Adam & Charles Black, 1903
19 Dawes W. R., 'On the observation of the solar spots with large telescopes', *Mon. Not. R. Ast. Soc.*, **11**, 181–184, 1851
20 Maunder E. W., 'The level of sun-spots', *The Observatory*, **20**, 93–95, 1897
21 Anonymous, '1896 December 30 meeting of the British Astronomical Association', *The Observatory*, **20**, 89–92, 1897
22 Benestad R. E., *Solar Activity and Earth's Climate*, Chichester: Springer–Praxis, second ed., 2006
23 Meadows A. J., *Early Solar Physics*, Oxford: Pergamon Press, 1970
24 Pereira J. de M., 'Observations of variable stars from January 1894 to January 1896', *Mem. Brit. Astron. Assoc.*, **5**, 20–28; 47–48, 1897
25 Anonymous, 'Variable Star Section', *J. Brit. Astron. Assoc.*, **8**, 391, 1898
26 Anonymous, 'BAA VSS Archive 13 May 2001', **www.britastro.org/vss/** accessed 2009 April 6
27 Pereira J. de M., 'Small stars in Orion, Etc', *English Mechanic*, **72**, 673–674, 1901
28 Pereira J. de M., 'Letter to the editor', *English Mechanic*, **73**, 119, 1901
29 Pereira J. de M., 'Letter to Edward Pickering, June 7', 1903, uAV 630.17, Harvard College Observatory, Director's Correspondence, E. C. Pickering, 1903–1910, Mos-Pf
30 Pereira J. de M., 'Letter to the editor', *English Mechanic*, **73**, 291, 1901
31 Pereira J. de M., 'Dr. Schwab's new algol variable', *ibid.*, **75**, 76, 1902
32 Pereira J. de M., 'Star Magnitudes', *ibid.*, **80**, 91, 1904
33 Pereira J. de M., 'The variable 48 Aurigae', *ibid.*, **81**, 476, 1905
34 Pereira J. de M., 'Encke's Comet', *ibid.*, **80**, 499, 1905
35 Cannon A. J., 'Second catalogue of variable stars', *Annals of Harvard College Observatory*, **55**, 1–94, 1907 (p.3)
36 Marshall J. S., 'Three McGill Weather Observatories', Website, 1968, URL **www.radar.mcgill.ca/3McGillObs.pdf**
37 Pereira J. de M., 'The longitude of Horta, Fayal, Azores Islands', *English Mechanic*, **74**, 275, 1901
38 Pereira J. de M., 'Notes and News. Longitude of Horta, Azores', *Bulletin of the American Geographical Society*, **33**, 386, 1901
39 *Connaissance des Temps pour l'an 1907*, Paris: Gauthier–Villars, 1905
40 Pereira J. de M., 'Jupiter Satellites', *English Mechanic*, **74**, 257, 1901
41 Pereira J. de M., 'Borelly's Comet', *ibid.*, **78**, 14, 1903
42 Pereira J. de M., 'Callixto–Comet Borelly', *ibid.*, **78**, 63–64, 1903
43 Anonymous, 'Fatalidade', *A Persuasão*, Jan 8, 3, 1908

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