

Alice's astronomical ancestry

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Abstract. IAU242 was held in Alice Springs, a town of 28,000 in central Australia. In this paper the Alice after whom the town is named is identified, and her astronomical connections described.

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1. Introduction

Alice Springs was established as one of eleven telegraph relay stations between Adelaide and Darwin on the Overland Telegraph. The Overland Telegraph, completed in 1872, connected to the undersea cable from Java, providing the first telegraphic link from Australia to the rest of the world. Alice Springs was named after Alice Todd, whose husband, Charles, was Government Astronomer and Superintendent of Telegraphs for the colony of South Australia and who oversaw the planning and construction of the Overland Telegraph.

The township was originally named Stuart, with Alice Springs being the name of the telegraph station, but to end confusion between the two (and a reflection of the importance of the Overland Telegraph) the town of Stuart was officially renamed Alice Springs in August 1933.

Although there is no professional astronomical observatory in central Australia, a wide range of astronomical observations have been conducted from sites near the town, including balloon-borne studies at X-ray and gamma-ray energies (Leventhal *et al.* 1978, Pietsch *et al.* 1980, Zanrosso *et al.* 1981, Sood *et al.* 1988a, O'Neill *et al.* 1989, Covault *et al.* 1992, Chapuis *et al.* 1993, Greenhill *et al.* 1993, Leventhal *et al.* 1993, Barthelmy *et al.* 1994), studies of meteors using radar (Thomas *et al.* 1986), optical astronomy (Nozawa *et al.* 2000), and, at radio wavelengths, Very Long Baseline Interferometry (Preston *et al.* 1989). The Arrernte (also spelt Aranda, Arunda, Arunta) traditional owners of the area, like other aboriginal peoples, have a cultural tradition which incorporates astronomical legends and beliefs (see, e.g., Chapter 1 of Haynes *et al.* 1996). In this paper, however, we will briefly recount some of the endeavours and contributions to astronomy of Alice's husband, Charles Todd, her son-in-law, William Henry Bragg, and her grandson, William Lawrence Bragg.

2. Charles Todd

Charles Todd was born in London in 1826 and educated at Greenwich. He entered the workforce at the age of 15 as Astronomical Computer at the Royal Observatory, Greenwich, and later became Assistant Astronomer at the Cambridge Observatory, before returning to Greenwich in 1854 to take charge of the new galvanic department.

Todd was appointed, on the recommendation of the Astronomer Royal, G.B. Airy, as Astronomical Observer and Superintendent of Telegraphs for the young colony of South

Australia. South Australia was founded in 1836, forty-eight years after the arrival of the First Fleet at Port Jackson (Sydney). Before sailing from England, Todd married Alice Bell, ten years his junior. The family story of their “courtship” is recounted in Thomson (1999). They arrived in Adelaide in November 1855, and are pictured in Figure 1.

3. The overland telegraph

Todd’s first telegraph line, which connected the city with Port Adelaide, opened in February 1856 and used the magnetic telegraph system of Wheatstone and Cooke. The next line, between Adelaide and Melbourne, was completed in July 1858. The Superintendent of Telegraphs for the colony of Victoria was Samuel McGowan, who had been a student of Samuel Morse’s in the USA before moving to Australia, and so not surprisingly Morse code was adopted for the transmission on this (and all future Australian) telegraph lines. Sydney and Melbourne were connected in October 1858, providing a link between Adelaide and Sydney; a direct line was completed between Adelaide and Sydney in 1867.

Todd first proposed a telegraph line crossing Australia from south to north in 1859, but it was not until John McDouall Stuart’s crossing of the continent in 1861–62 that the idea started to receive support. In 1870, the South Australian Government committed to build a telegraph line across Australia to connect with an undersea cable being laid from Java (Indonesia).

Todd’s plan divided the construction of the line into three parts, with the southern and northern sections of the line assigned by contract, and the longest and most difficult central section constructed by Todd’s department. The department’s work was finished ahead of schedule, and the department went on to finish the work in the northern section when the contractors experienced severe difficulties with conditions imposed by the tropical wet season.

The line was finally completed in August 1872. The honour of sending the first message was given to Todd, who cabled “We have this day, within two years, completed a line of communications two thousand miles long through the very centre of Australia, until a few years ago a terra incognita believed to be a desert.” Taylor (1980) summarises the achievement: “In spite of almost overwhelming odds . . . [Todd] built a line more than three thousand kilometres long through country that had been crossed only once, that was for the most part uninhabited by white people, and had one of the most inhospitable climates in the world. Not only was it an outstanding achievement by any standard, but it had been accomplished in the remarkable time of one year and eleven months.” Detailed descriptions of the planning and construction of the Overland Telegraph are given by Clune (1955), Taylor (1980), Moyal (1984), and Harcourt (1987). A more recent account was given by Paul Davies on the ABC radio Science Show, the transcript of which is available at www.abc.net.au/rn/scienceshow/stories/2005/1515660.htm.

Following the construction of the Overland Telegraph, communication with England took a matter of hours, compared with the several months it had previously taken for mail delivered by ship – a factor of ~ 500 improvement – with obvious benefits to Australian industry, trade and government. In his book “The Victorian Internet,” Standage (1998) draws interesting parallels between the information age brought about by the rapid spread of the telegraph over 120 years ago, and that brought about by computer networks over the last 20 years.

There is an ATNF connection to the Overland Telegraph: Ron Ekers’ (the former Director of the Australia Telescope National Facility) great-grandfather worked on its construction! And the husband of Ron’s great-great-Aunt worked at Barrow Creek, the

first relay station north of Alice Springs, losing his life there in 1874 in an incident known as the Barrow Creek massacre.

The Australia colonies were all finally linked in 1877 with the completion of the line linking Adelaide to the Western Australian capital, Perth. That year, South Australia became the first colony to join the International Telegraph Union, and in 1885 Todd attended the Union's international conference in Berlin.

4. Astronomy

Although the construction and operation of telegraphs, and later the postal service, took much of Todd's time, he also made significant contributions to astronomy and meteorology (Edwards 1993). Todd established the Adelaide Observatory, which provided the time service for the colony, and which conducted a variety of astronomical observations. Todd and his assistant Alexander Ringwood (who had previously worked as a surveyor during the construction of the Overland telegraph) started a long series of observations of the planet Jupiter, and of eclipses, occultations and transits of the Galilean satellites. They noted occasions where satellites were visible through Jupiter's limb for a short time after their occultation, which they interpreted as evidence for an extensive gaseous atmosphere on Jupiter.

Todd also participated in observations of the transits of Venus in 1874 and 1882 (Edwards 2004), which it had been hoped would enable the measurement of the Astronomical Unit to be refined. The 1874 transit was observed at the Adelaide Observatory with a new eight inch (20.3 cm) Cooke & Son equatorial. Todd and Ringwood both noted during the egress of Venus from the sun's disk that the portion of the planet outside the solar disk remained visible and clearly defined. Like many other observers who observed this phenomenon, they were surprised by this evidence of the dense Venusian atmosphere, although there had been reports of it during the previous transits in 1761 and 1769.

Todd observed the 1882 transit from Wentworth in south-western NSW, with an 4.5 inch (11.4 cm) equatorial that had previously belonged to Charles Babbage (Edwards 2004). The following year, the Overland Telegraph line was used to transmit time signals from Singapore in order to more accurately determine the longitudes of Australian sites for the analysis of results from the 1882 transit of Venus.

5. Time zones

Conference participants cannot have failed to notice that the Northern Territory, like South Australia, is in an unusual half-hour time zone. Todd was instrumental in the introduction of time zones in Australia, initially arguing for a simple implementation with a single time zone, 9 hours ahead of Greenwich Mean Time (GMT), for the whole of Australia (see, e.g., Edwards 1996). The eastern states did not accept this proposal, electing to move to GMT + 10 hrs, but when time zones were introduced in 1895, South Australia (which until 1911 included the Northern Territory) adopted the zone GMT + 9 hrs. However, the South Australian Chamber of Commerce claimed that local commerce was suffering from the fact that their eastern states competitors had one hour to respond to the cables received overnight from England before local merchants received them in the morning. As a result of their lobbying, parliament amended the standard time bill so that from May 1st, 1899, South Australia was 9 hours 30 minutes ahead of Greenwich — corresponding to a longitude that does not even run through the state! The Astronomical Society of South Australia unanimously passed a resolution that “. . . if in the commercial



Figure 1. Alice (1836–1898) and Charles (1826–1910) Todd (reproduced from *The Chronicle*, February 4, 1905)

interest of South Australia any change is desirable, it should be in the alteration of the nominal hours of business rather than in the present standard time . . .”, but in vain.

6. Todd and Bragg

In February 1886, William Henry Bragg arrived in Adelaide to take up the position of Professor of Mathematics and Physics at the University of Adelaide. Bragg met Todd on his first full day in Adelaide and became a regular visitor at the Observatory, marrying Alice and Charles’ daughter Gwendoline in 1889 (Jenkin 1986). The Braggs had two sons, William Lawrence, born in 1890, and Robert Charles, born in 1892.

The demonstrations by Hertz in 1887–88 of electromagnetic radiation were replicated in laboratories around the world. Todd and Bragg became interested in the possibility of wireless telegraphy, and Bragg used a letter of introduction from Todd to meet William Preece and Guglielmo Marconi while in London on study leave in 1898 (Jenkin 1986). On returning to Adelaide in 1898, Bragg and his assistant, Arthur Rogers, succeeded in transmitting radio messages over increasing distances, and ultimately the 8 km from the Observatory to Henley Beach.

These experiments with radio ended in 1900 as other interests took priority, Bragg working with others in Adelaide to follow up Röntgen’s discovery of X-rays. Lawrence Bragg broke his arm at the age of five, and the X-ray taken in his father’s laboratory at the University is said to be the first surgical use of X-rays in Australia.

The Braggs left Adelaide in 1909, with WH Bragg becoming Cavendish Professor of Physics at the University of Leeds. WL Bragg, who had completed his undergraduate degree at the University of Adelaide with first class Honours in mathematics, enrolled at Cambridge.

7. WL Bragg and radio astronomy

WH Bragg and WL Bragg were awarded the Nobel Prize for Physics in 1915 “for their services in the analysis of crystal structure by means of X-rays.” From 1919 to 1937, WL Bragg held the position of Professor of Physics at the Victoria University of Manchester. After the second World War, he returned to Cambridge where, following the belief that “the ideal research unit is one of six to twelve scientists and a few assistants,” he split the Cavendish Laboratory into research groups.

Molecular biologist Max Perutz wrote “Bragg’s period of office in Cambridge coincides with the decline of the Cavendish Laboratory as the world’s leading centre of atomic physics. This was an inevitable consequence of the war and the transformation of atomic physics to ‘Big Science’, to which the tradition and structure of Cambridge University were ill-adapted. Rather than fight a rearguard action, Bragg decided to back two new applications of physics in which the Cavendish was again to lead the world.” One of these was molecular biology, the field in which Perutz shared the Nobel Prize for Chemistry in 1962. “The other new application of physics which Bragg helped to initiate at the Cavendish Laboratory was Radio Astronomy” (see <http://www.phy.cam.ac.uk/cavendish/history/years/molbiol.php>).

Martin Ryle recalled the efforts of establishing the radio astronomy group at Cambridge, “During these early months, and for many years afterwards, both Ratcliffe and Sir Lawrence Bragg, then Cavendish Professor, gave enormous support and encouragement to me. Bragg’s own work on X-ray crystallography involved techniques very similar to those we were developing for “aperture synthesis”, and he always showed a delighted interest in the way our work progressed” (see http://nobelprize.org/nobel_prizes/physics/laureates/1974/ryle-autobio.html).

Bragg’s choice of radio astronomy as one of the new fields to develop was undoubtedly made carefully and rationally, but it is interesting to speculate whether his grandfather’s work may have had some subtle influence on his decision. The Adelaide Observatory, that Todd established, closed in 1952 (Edwards 1994). On learning of this, WL Bragg wrote “I was very grieved to hear that the Adelaide Observatory has ceased to function. So many of my most vivid early memories are bound up with the old building and my grandfather’s work there: and I deeply regret that nothing has been created to take its place and carry on its magnificent early pioneer work in the Southern Hemisphere.” The collaboration and competition between Cambridge and the CSIRO Division of Radiophysics was certainly instrumental in spurring on the “magnificent early pioneer work” in the new field of radio astronomy.

8. In conclusion

Charles Todd, best known for his association with the Overland Telegraph, carried out a range of astronomical observations over his career. Alice Springs is named for Todd’s wife, while the Todd River and Todd Mall bear his name. A number of other roadways in the town bear the names of people who worked on the Overland Telegraph, such as Patterson Crescent, Babbage St, Harvey St, Knuckey Ave, McMinn St, Mills St, and the Ross Highway. Fittingly, as Todd also served as Postmaster General, the Overland Telegraph is commemorated on several Australian philatelic items: the centenary of the Overland Telegraph was marked by the issue of a 7c stamp in 1972, the Alice Springs telegraph station is pictured on a 27c stamp issued in 1982, and Todd is pictured on the 45c pre-stamped envelope issued in 1997. It is known that Charles Todd travelled along

the overland telegraph route. It appears, however, that Alice Todd never had the chance to visit the town named after her.

In summary, Todd was an active astronomer, studied astronomical atmospheres (albeit planetary rather than stellar), contributed to the development of the cosmological distance ladder, experimented with radio waves, employed the most rapid methods of communication for astronomical research, encouraged an interest in astronomy in his children and grand-children, and travelled to international conferences. He would have felt right at home at IAU Symposium 242!

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