

Chapter Title: Pannekoek's One Revolution: Anton Pannekoek and the Modernization of the Dutch Astronomical Community

Chapter Author(s): David Baneke

Book Title: Anton Pannekoek

Book Subtitle: Ways of Viewing Science and Society

Book Editor(s): Chaokang Tai, Bart van der Steen, Jeroen van Dongen

Published by: Amsterdam University Press. (2019)

Stable URL: <https://www.jstor.org/stable/j.ctvp7d57c.7>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



This book is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-nd/4.0/>.



Amsterdam University Press is collaborating with JSTOR to digitize, preserve and extend access to *Anton Pannekoek*

5 Pannekoek's One Revolution

Anton Pannekoek and the Modernization of the Dutch Astronomical Community

David Baneke

Abstract

When Anton Pannekoek left Dutch astronomy in 1905, he left a stagnating, uninspiring research community. When he returned a decade later, things started to change in the Dutch astronomical community. By the mid-1920s, De Sitter, Hertzsprung, Oort, Minnaert, and Pannekoek had built a flourishing discipline. Through their work and students, they shaped Dutch astronomy for the rest of the twentieth century.

This paper focuses on Pannekoek's return to astronomy and his role in Dutch astronomy in the Interwar period. First, I will provide a detailed reconstruction of his failed appointment at Leiden Observatory in 1918-1919. After that, I will analyse how he could play an influential role, even though he had little staff, students, or facilities at the University of Amsterdam.

Keywords: Anton Pannekoek, history of astronomy, science and politics, discipline formation, astronomy education

When Pannekoek left Leiden in 1906 to teach socialist theory in Germany – which he later referred to as his 'literary work'¹ – he did not only do so out of ideological zeal. He was also deeply disappointed in the way astronomy was done at the Leiden Observatory, where he worked. It was characterized by routine work and an obsession with precision that stifled all interesting research. In his memoirs, Pannekoek described the atmosphere at the institute as 'tomb-like, full of stagnation and boredom'.²

1 Pannekoek to De Sitter, 15 April 1919, WdS inv. 45.1: 'de tijd, dat ik in Duitschland literair werkzaam was'.

2 Pannekoek 1982, 237: 'katakombenlucht van doodse verstarring en verveling'.

Two decades later, in the 1920s, the situation had changed radically. The new director of the Leiden Observatory, Willem de Sitter, had assembled a new team of first-rate scientists, including the famous Ejnar Hertzsprung and a young Jan Oort. New research programmes were implemented following the insights of J.C. Kapteyn, the most prominent Dutch astronomer since Christiaan Huygens. Pannekoek also planned to work there after returning from Germany in 1914, but his appointment was blocked for political reasons. Instead, he went to Amsterdam. Together with Marcel Minnaert in Utrecht, he now established a new research school in astrophysics. All these men – Kapteyn, De Sitter, Hertzsprung, Oort, Minnaert, and Pannekoek – would receive the Gold Medal of the Royal Astronomical Society, one of the most prestigious recognitions in the field. They truly formed a remarkable generation.³

In this paper, I will describe how this generation changed Dutch astronomy, and what Pannekoek's role in these changes was. How was it possible that Pannekoek, would-be German revolutionary, could return to the career of an, eventually, highly respected Dutch astronomer? Did his political convictions influence his professional life in astronomy? What was his position within the astronomical community once he had become professor in Amsterdam? How did he manage to exert his influence with so few facilities and without any graduate students?

To answer these questions, we will analyse changes in the Dutch astronomical community in the decade after World War I. In this period, Pannekoek and his contemporaries reorganized the discipline on all levels: research, teaching, institutions, journals, and the discipline's international relations were all reconstituted by a new generation of astronomers. In the span of a few years, they laid the groundwork for a modern disciplinary infrastructure that essentially would last until well into the twenty-first century.⁴ They also reoriented themselves internationally towards American astronomy, which was emerging as the new superpower in the field. Pannekoek's story thus illustrates the consequences of the rise of American astronomy for a European community – and vice versa, as Dutch astronomers contributed in various ways to American astronomy as well, as we will see.

I will start by discussing Pannekoek's attempts to return to astronomy in the context of the reorganization of Leiden Observatory. I will recount in some detail the circumstances of Pannekoek's failed appointment there. I will subsequently discuss how the loosely knit astronomical community

3 Baneke 2010; 2015, chapters 3 and 4.

4 Baneke 2015.

changed into a well-organized scientific discipline with a new international outlook. Finally, I will address the legacy of Pannekoek and his contemporaries in Dutch astronomy.

Reviving Leiden Observatory

The revival of Dutch astronomy started in Leiden. Leiden Observatory had been founded as a state-of-the-art observatory by Frederik Kaiser in 1861.⁵ His research programme of fundamental astrometry was continued by the brothers Hendrik and Ernst van de Sande Bakhuyzen, who explicitly regarded the 'new astronomy' of the late nineteenth century, which was based on spectrographic methods, as oversold. Surely the steady stream of easy discoveries would dry up soon, they thought, requiring serious astronomers to go back to the hard labour of precision measurements.⁶ High-precision astrometry was their ultimate goal; so much so, that the number of publications dwindled, since there were always more corrections to be made and potential errors to be checked. When the younger Bakhuyzen died in 1918, his successor Willem de Sitter reported that checking and calibrating the new photographic refractor from 1898 had taken so long that it had not been used for astronomical observations yet.⁷ This was the observatory that Pannekoek had fled in 1906. He was not the only one to leave: around the same time, Joan Voûte also left for a more adventurous life, seeking to establish his own observatory in the Southern Hemisphere.⁸

The most prominent Dutch astronomer at this time was J.C. Kapteyn. Kapteyn was professor in Groningen, famously working without an observatory of his own. The story of how he established an 'astronomical laboratory', collecting observations from observatories elsewhere, has been told many times.⁹ First, he established his reputation internationally with the *Cape Photographic Durchmusterung*, a star catalogue listing 454,875 stars, in collaboration with David Gill in South Africa. Later, Kapteyn turned to statistical research into the structure of the stellar system. His announcement in 1904 that he had found two 'star streams' in the Milky Way made him one of the most prominent astronomers of his day. It earned him the admiration and support of George

5 Zuidervaart 2011; van Herk, Kleibrink, and Bijleveld 1983.

6 van de Sande Bakhuyzen 1872.

7 De Sitter, report on the state of the Observatory, April 1918, WdS inv. 224.2.

8 He finally succeeded in Lembang, Java, Dutch East Indies. Zuidervaart 2008; Pyenson 1989.

9 See especially van der Kruit 2015; van der Kruit and van Berkel 2000.

Ellery Hale, who founded the Mount Wilson Observatory and many other American astronomical institutions. Yet however much success he attained, Kapteyn remained desiring an observatory of his own. He was frustrated when a new photographic refractor was installed in Leiden, as he felt he would be able to use it more productively than the Bakhuyzen brothers.

Kapteyn's student Willem de Sitter had been appointed professor of theoretical astronomy in Leiden in 1908, but in the next few years he had little to do with the day-to-day running of the observatory, which was supervised by Ernst van de Sande Bakhuyzen. Instead, he worked on theoretical issues, especially on his cosmological ideas in general relativity.¹⁰ When he was appointed acting director in 1918, it turned out that he had already given the future of the observatory a lot of thought, in close consultation with his mentor Kapteyn. Together, they planned to turn Leiden Observatory into the observatory Kapteyn had wished for but never had.

De Sitter obtained support from the Board of Trustees of the university to expand and reorganize the observatory.¹¹ One of the key elements of this reorganization was to assemble a new, first-rate staff. De Sitter quickly engaged a new lecturer, Jan Woltjer, to assist him in what he called the 'theoretical department'. Woltjer would become one of the main lecturers to Leiden's astronomy students, who taught a notoriously difficult course on celestial mechanics. He also introduced the new quantum physics to the curriculum.

De Sitter further wanted to appoint two associate directors – senior scholars who could lead research departments. One of his candidates was Pannekoek, who was to take responsibility for the main observing programmes, especially those focused on the meridian circle. De Sitter and Pannekoek had been in touch since Pannekoek had returned to the Netherlands in 1914 and had been trying to return to professional astronomy. De Sitter was impressed by Pannekoek's popular astronomy book *De Wonderbouw der Wereld* (1916). He arranged an appointment as *privaatdocent* (unpaid lectureship) in the history of astronomy, while remaining on the lookout for a better position. That opportunity arrived in 1918 with the permission to reorganize the Observatory and Pannekoek was eager to take it. His only condition was that he wanted to have a house with a garden, which was easy to arrange since directors would live in the observatory, which was situated in Leiden's botanical gardens.¹²

The candidate for a second associate director post was Ejnar Hertzsprung, who was already renowned for his work in astrophysics, and someone with a

¹⁰ Kerszberg 1989; Guichelaar 2009.

¹¹ Baneke 2010; 2015, chapter 3.

¹² Pannekoek to De Sitter, 29 March 1918, WdS inv. 45.1.

deep knowledge of astronomical instruments and photographic technology (he had started his career in photochemistry).¹³ At the time, Hertzsprung worked at Potsdam Observatory, but he was happy to leave Germany. His mentor Karl Schwarzschild had died, and the situation in Germany at the end of World War I was far from easy. Moreover, he was married to a Dutchwoman: Henriette Kapteyn, daughter of the astronomer Kapteyn. They had one daughter, Rigel.

Leiden also had some professional advantages for Hertzsprung, most notably the promise of a vibrant scientific community. De Sitter would be there, and Kapteyn would be close. But by leaving Potsdam, Hertzsprung also made a significant professional sacrifice: he gave up access to the large telescope there. In Leiden, he would mainly use the 10-inch photographic refractor, which was nowhere near comparable. Furthermore, it did not seem likely that a new large telescope would be installed in Leiden. Instead, Hertzsprung requested access to a telescope in the Southern Hemisphere. This was very important to him.¹⁴ De Sitter promised to do his best.

Hertzsprung would bring international attention to Leiden – he was better known than De Sitter at this time.¹⁵ He also became the most important supervisor for students, who learned to do observations and measurements according to his exacting standards. Together with the theoretical lectures by Woltjer and, later, Oort, his teaching would lay the foundation for the famous Leiden school of astronomy.¹⁶

The Leiden affair¹⁷

Hertzsprung looked forward to working with Pannekoek.¹⁸ They had corresponded and met while Pannekoek was in Germany.¹⁹ Hertzsprung admired Pannekoek's work, but he had little patience for his political interests: 'I received several papers from Pannekoek (Nova Aquilae and 11 magn-stars). Pity that all this productivity still leaves time for political action', he wrote to

13 Herrmann 1994; DeVorkin 1984.

14 Hertzsprung to De Sitter, 10 June 1919, WdS inv. 23.2: 'Als er op mijn conto besnoeid en bespaard moet worden, omdat Pannekoek bolschew- of soms ergens-istische artikelen schrijft, laat het dan op een ander punt dan het zuiden zijn.'

15 Adriaan Blaauw, interview with the author, 16 March 2009.

16 Baneke 2010.

17 This section is mostly based on Baneke 2004.

18 Hertzsprung to De Sitter, 24 October 1919, WdS inv. 23.2.

19 Pannekoek 1982, 241-242.

de Sitter.²⁰ His dislike for Pannekoek's political activities was not (or at least not just) motivated by political considerations. Hertzsprung was mostly worried that they would get in the way of his prime concern: science. Hertzsprung was a notorious workaholic, who valued a good measurement above anything else. In this case, his fear was justified. Obtaining formal approval for the appointment of the new directors turned out to be very difficult.

A procedure for appointing new professors involved several steps. First, the candidate had to be nominated by the *faculteit*, the assembled professors of the department (in this case Science). Then the Board of Trustees of the university had to approve. It usually asked the advice of experts from other universities. Finally, any professorial candidate at one of the state universities (Leiden, Groningen, and Utrecht) had to be approved by the national government.

The problems started already with De Sitter's formal appointment as director. Jan van der Bilt, a former Naval officer who worked at Utrecht Observatory, unexpectedly started a lobby to become director himself. He had influential supporters in Leiden's Board of Trustees and the government.²¹ At the time, De Sitter was away from Leiden, spending more than a year in a Swiss sanatorium for a lung condition.²² This did not help in advancing his own appointment. Hertzsprung's appointment was also delayed, because of his salary demands and because some objections had been raised against appointing a foreigner. The latter were easily countered, however: there clearly was no Dutch candidate of Hertzsprung's stature. Pannekoek's case was more problematic, however. The Utrecht astronomer A.A. Nijland (Van der Bilt's boss) wrote the Board of Trustees that appointing Pannekoek 'would be a somewhat dangerous experiment, given his extraordinary views' – a thinly veiled reference to his political positions.²³ Nevertheless, the Trustees ultimately did approve the candidacy of De Sitter, Hertzsprung, and Pannekoek on 16 May 1918, in no small measure due to Kapteyn's influence.

Still, final confirmation had to come from the government in The Hague. But since new elections were due on 3 July, the responsible minister decided to wait. In the Dutch system of coalition governments, it can take a long time before a new government is formed after elections. Time and again, encouraging signals from The Hague were accompanied by the message that

20 Hertzsprung to De Sitter, 10 June 1919, WdS inv. 23.2.

21 A detailed analysis of the reorganization can be found in Baneke 2005.

22 Guichelaar 2009.

23 Nijland to Board of Trustees of Leiden University, 3 May 1918, AC inv. no. 1840: 'met zijn zeer bijzondere kijk op de zaken een iets [sic] of wat gevaarlijk experiment'.

formal approval remained withheld until a new minister was installed.²⁴ As it turned out, the new cabinet would be the first in Dutch history to have a dedicated Minister for Education and Science. The good news was that this was expected to be J.Th. de Visser, who was a member of the same political party (*Christelijk-Historische Unie*, CHU) as jhr. N.C. de Gijsselaar, President of the Board of Trustees of Leiden University, Mayor of Leiden, and member of the Senate. But when De Visser was finally installed, he immediately announced that he wanted to seek parliamentary approval for the appointment of the astronomers. By now it was late October, and again the matter was delayed.²⁵

The timing was extremely unfortunate. World War I was ending and Germany seemed on the brink of a communist revolution, after one had already taken place in Russia. Even in the Netherlands, which had remained neutral during the war, political tensions were mounting. On 12 November, Socialist leader Pieter Jelles Troelstra declared revolution in Parliament. His attempt failed within hours – the episode has gone into history as ‘Troelstra’s Mistake’ – but Pannekoek was furious, since Troelstra had violated all his ideas about how a genuine revolution should commence. The most important consequence of Troelstra’s action was that the new and rather conservative government, made up of Christian political parties under the leadership of a Catholic nobleman, jhr. Ch.J.M. Ruijs de Beerenbrouck, became convinced of the threat to the political order that communism posed.

Ever since he had decided to return to academia in the mid-1910s, Pannekoek had tried to keep a low profile, publishing his political work mainly under pen names. By the end of the decade, it seemed more important than ever to avoid public association with revolutionary communism. But in February and March 1919, his name turned up in several Dutch newspapers, linking him to rumours about illegal transfers of money from Bolshevik Russia. Someone sent a newspaper clipping to President of the Board of Trustees De Gijsselaar, who forwarded it to De Sitter, adding a worried note.²⁶ Pannekoek denied any involvement and suggested that the rumours may have been spread on purpose to harm him. He even suggested that some of Jan van der Bilt’s allies could be behind it.²⁷ In April, his name turned

24 De Sitter, *dagboek reorganisatie*, WdS inv. 223.

25 Minister De Visser to Board of Trustees of Leiden University, 26 October 1918, AC inv. no. 1840.

26 De Gijsselaar to De Sitter, 16 March 1918, WdS inv. 224.1. The clipping came from the *Haagse Post*, 22 februari 1919.

27 Pannekoek to De Sitter, 18 March 1919, WdS inv. 45.1; Pannekoek to De Sitter, 15 April 1919, WdS inv. 45.1. Pannekoek’s suspicions were shared by Trustee J. Oppenheim: Oppenheim to De Sitter, WdS inv. 224.1.

up again. This time, a newspaper claimed that a certain 'Panekoch' had been appointed as honorary president of a prestigious committee of the short-lived socialist regime of Béla Kun in Budapest. Surely that meant Anton Pannekoek, the paper added.²⁸

At this point, Pannekoek started to expect that the government would object to his appointment after all.²⁹ According to his memoirs, De Sitter was losing his patience too: 'What are you,' he snapped, 'astronomer or communist?'³⁰ Pannekoek answered in a letter of 18 April: since his return from Germany, he had completely returned to science. His commitment to the Leiden Observatory was complete – he had even turned down a position as lecturer in mathematics at Amsterdam University. It was not his fault, Pannekoek added, if the government was willing to sacrifice science to politics. In any case, he concluded, he did not think his socialist writings merited all the fuss, since they were only of a purely theoretical nature. Pannekoek attributed all the public attention to the circumstance that he represented a socialist faction that had always been a minority, but was now gaining the upper hand. As a result, new revolutionary leaders regarded him as one of their forebears. He added: 'If I were in touch with these people, I would tell them to omit all these niceties that benefit no one.'³¹ De Sitter forwarded Pannekoek's letter to the Board of Trustees, adding that Troelstra's socialist allies had actually accused Pannekoek of not being an active revolutionary.³²

A few weeks later, two things happened in quick succession. On 29 April 1919, the government approved De Sitter's appointment as director of the observatory, and ministry officials approved the annual salary of Pannekoek (4500 Dutch guilders), starting from the moment he would become deputy director.³³ A few days later, on 3 May, however, Minister De Visser announced that he would 'under no circumstances' appoint Pannekoek, for reasons of state interest.³⁴ Apparently, something had happened between those two dates that changed the minister's mind.

Pannekoek himself pointed to an article in a local Groningen newspaper on 2 May. It mentioned the expected appointment in Leiden of Hertzprung,

28 Newspaper clipping without source information, sent by J.E. Boddaert, Secretary to the Trustees, to De Sitter, 16 April 1919, WdS inv. 224.1.

29 Pannekoek to De Sitter, 15 April 1919, WdS inv. 45.1.

30 Pannekoek 1982, 245.

31 Pannekoek to De Sitter, 18 April 1919, WdS inv. 45.1.

32 De Sitter to J.E. Boddaert, 19 April 1919, WdS inv. 45.1.

33 Staff file 'dr. A. Pannekoek', OKW file 52.

34 Minister to Board of Trustees of Leiden University, 3 May 1919, AC inv. no. 1840.

who was married to a Groningen local (Kapteyn's daughter Henriette). The piece also mentioned the other candidate, Pannekoek, 'whose communist political convictions have been written about these days'.³⁵ The article thus explicitly stated that a known communist was about to be appointed at a government institute. Pannekoek suspected that this had been the last straw for the government, more specifically for Prime Minister Ruijs de Beerenbrouck. The President of Leiden University's Board of Trustees, De Gijsselaar, who was usually well informed about intrigues in The Hague, confirmed this.³⁶ In this scenario, it would have been the second time that a prime minister concerned himself with Pannekoek. In 1903, Prime Minister Abraham Kuyper had already personally reprimanded him for supporting the great railway strike while working as a civil servant at a state university.³⁷

Leiden's Board now concluded that the minister's negative decision was final. They withdrew their own support for Pannekoek, referring to Troelstra's actions. De Gijsselaar now expressed the widely shared view that 'these red gentlemen never keep their word'. Personally, he could well believe that Pannekoek would not do anything stupid, but he did not see how he might convince the minister of that.³⁸

A few months later, the liberal newspaper *De Nieuwe Courant* looked back on the affair. Its editors approved of the government's decision, arguing that universities were teaching institutions, and while a bolshevist astronomer might be harmless, a bolshevist lecturer was not. The popular newspaper *Nieuws van de Dag* disagreed: if scientific appointments were subject to political considerations, this required more explanation from the government.³⁹ An explanation was also demanded by a communist member of parliament, W. van Ravesteijn, who spoke of a 'political inquisition' in higher education.⁴⁰ He was supported by several MPs from other political parties. J.H.A. Schaper, a social democrat, ridiculed the risks posed by a communist astronomer: 'he can hardly throw the stars into disarray'.⁴¹ Minister De Visser answered that political considerations should not play a role in academic appointments, but he argued that Pannekoek

35 *Provinciale Groninger Courant*, 2 May 1919. A newspaper clipping can be found in WdS inv. 224.1.

36 Pannekoek to De Sitter, 8 May 1919 WdS inv. 45.1; De Sitter, *dagboek reorganisatie*, WdS inv. 223.

37 Pannekoek 1982, 92-93.

38 De Gijsselaar to De Sitter, 16 May 1919, WdS inv. 224.1.

39 *Nieuwe Courant*, 6 September 1919; *Nieuws van den Dag*, 12 September 1919.

40 *Handelingen van de Tweede Kamer*, 25 November 1919.

41 *Handelingen van de Tweede Kamer*, 25 November 1919: 'Hij kan toch moeilijk de sterren in de war schoppen'.

was a special case, since he publicly promoted the overthrow of the state. Interestingly, De Visser subsequently stated that the formal reason for his rejection was the fact that Pannekoek had been expelled from Germany for political reasons. A small majority of parliament accepted the minister's answer.⁴² In a later debate in the *Eerste Kamer* (senate), De Visser added that enemies of the state should not be involved in teaching students in these turbulent times.⁴³

Despite everything, De Sitter was taken by surprise by the rejection of Pannekoek. He was furious, both at the government and at Pannekoek, and he even considered stepping down.⁴⁴ Hertzsprung was angry too, particularly because he initially believed that Pannekoek himself had triggered the rejection with a political publication. 'It is possible that the world can still be improved, but let us not try to do it in a way that harms the working conditions of our science', he wrote.⁴⁵ He also threatened to withdraw himself for consideration if his appointment was not approved soon. Formal approval in his case was finally issued on 21 July.

In hindsight, Pannekoek's appointment in Leiden fell through because of bad timing. Troelstra's rash actions, combined with publications in the media about Pannekoek, led the government to take the rare step of rejecting an academic nomination. Soon after, things calmed down again and Pannekoek's appointment as professor in astronomy in Amsterdam in 1919 raised few eyebrows. Some years later, he was even admitted to the Royal Netherlands Academy of Sciences. Also, in 1924, the communist Dirk Coster was appointed as professor of physics in Groningen, a state university. Nevertheless, in 1920 Albert Einstein's position as visiting professor in Leiden was held up in government circles for close to a year because he had been confused with communist art critic Carl Einstein; Pannekoek's failed appointment a year before was cited by Paul Ehrenfest, Einstein's close friend and professor of physics in Leiden, as a reason why the government took an exceptionally close look at Einstein's credentials before he was finally approved.⁴⁶ The appointment of Marcel Minnaert as professor in Utrecht in

42 The vote was 37 against 35. *NRC*, 26 November 1919.

43 *Handelingen van de Eerste Kamer*, 12 February 1920.

44 Pannekoek to De Sitter, 8 May 1919, WdS inv. 45.1; Kapteyn to De Sitter, 8 May 1919; De Gijsselaar to De Sitter, 9 May 1919; De Sitter to the Board of Trustees, 2 June 1919; and personal notes, WdS inv. 224.1; see also De Sitter, *dagboek reorganisatie*, WdS inv. 223.

45 Hertzsprung to Pannekoek [draft, undated], EH C46/10: 'Best mogelijk dat de wereld nog te verbeteren is, maar laten ons [sic] het niet op een manier trachten te doen die de werkcondities van onzen wetenschap schaadt.'

46 van Dongen 2012.

1937 was equally controversial, probably because Minnaert, like Pannekoek, was not just a party member but a known activist.⁴⁷

According to his memoirs, Pannekoek's political life interfered with his scientific work on only one other occasion. In 1926, he wanted to join an expedition to the Dutch East Indies, to observe a solar eclipse and to draw the Southern Milky Way. The Governor General demanded that he promised to refrain from political agitation, as the authorities feared communist activism by the local population. Pannekoek was offended by the suggestion that he would use a scientific expedition for political aims, but in the end, he did make the promise.⁴⁸

Astronomy as a Discipline

Pannekoek could not work at the largest and best-equipped Dutch observatory, but this did not stop him from becoming a prominent researcher. Looking back in 1944, Pannekoek himself thought that the failed appointment in Leiden may even have been a blessing in disguise. No matter how much he respected De Sitter, he expected that conflict would have ensued sooner or later: 'He was like a Pope, who liked to make his authority felt'.⁴⁹ A conflict between Hertzprung and De Sitter did in fact occur for exactly this reason.⁵⁰ Pannekoek was fortunate enough to have an alternative, although this did not look like a very appealing option at first. When it was clear that he could not go to Leiden, he quickly accepted a position as lecturer at the University of Amsterdam. Unlike Leiden, it was not a state university: it was supervised by the city of Amsterdam. The municipal council had no qualms about appointing 'red professors'; in 1917 it had already welcomed the known communist Gerrit Mannoury as professor of mathematics.⁵¹

Pannekoek was the first scientist at the University of Amsterdam who was appointed to exclusively study astronomy: until then, astronomy had been one of the responsibilities of mathematician Diederik Korteweg. This gave Pannekoek the opportunity to start his own research programme – provided that it did not require any resources, since there weren't any, and that he

47 Molenaar 2003, 262-264.

48 Pannekoek 1982, 212.

49 Pannekoek 1982, 246-247 'Hij [De Sitter] was als een paus, die graag zijn meester-zijn naar voren bracht en deed voelen'.

50 Baneke 2010.

51 Knegtmans 1998, 29.

spent a significant portion of his time teaching mathematics and physics to undergraduates.

Just like Kapteyn, Pannekoek was thus dependent on observations from elsewhere. To collect data, Pannekoek spent time at the Dominion Observatory in Canada and the Bosscha Observatory in Lembang (Java) – founded by Joan Voûte, his one-time colleague who had also fled Leiden Observatory in the early 1900s. Pannekoek also joined several eclipse expeditions, including one to Lapland (where he was joined by the students Bart Bok and Gerard Kuiper, who travelled to Lapland by bike).

Aside from collecting observations from elsewhere, Pannekoek also did theoretical work, with great success. Others in this volume have written about Pannekoek's remarkable switch to theoretical astrophysics, in which he built on Meghnad Saha's work.⁵² The main point to observe here is that he began research in a subject that was completely new to the Netherlands. But did he also start a research tradition? As has been stated before, he had few students and the University of Amsterdam did not have the facilities to offer a graduate programme in astronomy; students who had ambitions in this direction had to go to Leiden or Utrecht. Nevertheless, Pannekoek still influenced the organization and research of the Dutch astronomical community, because precisely around this time, a national disciplinary infrastructure was being established.

With Pannekoek as a new lecturer in astronomy in Amsterdam, and with an almost entirely reconstituted staff in Leiden, a new generation of astronomers had stepped forward in Dutch astronomy. Around the same time, in 1921, Kapteyn retired from Groningen. He was succeeded by his student Pieter J. van Rhijn. This generational transition had far-reaching consequences for Dutch astronomy. The new generation introduced new research topics and methods, new teaching programmes, and new institutions, such as a professional society and a journal. They also collaborated and coordinated much more closely than their predecessors. This meant that Pannekoek could interact with students and staff members of other research institutes on a regular basis.

Leiden started a graduate programme for astronomy students in the 1920s, which involved both theory (taught by De Sitter, Woltjer, and Oort) and a thorough training in observational practice (Hertzprung's specialty).

52 See Edward P.J. van den Heuvel, 'Anton Pannekoek's Astronomy in Relation to his Political Activities, and the Founding of the Astronomical Institute of the University of Amsterdam', in this volume, 25-50; and Robert W. Smith, 'Astronomy in the Time of Pannekoek and Pannekoek as Astronomer of his Times', in this volume, 109-136.

This was a new development, since in earlier days future astronomers typically finished a degree in physics or mathematics before starting hands-on astronomical training at an observatory. From 1923 onwards, students could also benefit from an agreement between Leiden and the Union Observatory in Johannesburg, South Africa – in this way, De Sitter had sought to give Hertzsprung access to the Southern sky, building on Kapteyn's South African contacts.⁵³ The Leiden school of the 1920s and 1930s produced many well-known astronomers, including for example Gerard Kuiper and Adriaan Blaauw.

Pannekoek was not directly involved in the Leiden programme. He did, however, play a role in the introduction of another new member to the astronomical community who would become extraordinarily influential: Marcel Minnaert. If Pannekoek's career was unusual, Minnaert's was even stranger. After a turbulent life, he ended up as the other great pioneer of astrophysics in the Netherlands, founding a renowned research school in Utrecht and inspiring many generations of students.⁵⁴ Minnaert was radical in everything he did. He was strictly vegetarian, a teetotaller, and he had strong political convictions. During World War I, he joined the Flemish nationalist movement that founded a Dutch-language university in Ghent, supported by the German occupation. Although trained as a biologist, Minnaert would teach physics. To prepare himself, he spent a year with Paul Ehrenfest in Leiden. After the war, he was convicted in Belgium for collaborating with the Germans. He fled to the Netherlands and ended up in Utrecht, where W.H. Julius was founding a solar physics laboratory.⁵⁵ Minnaert had the right combination of theoretical and technical skills to help in building its instruments. Even his background in biology turned out to be relevant: for his original PhD thesis, he had tried to measure the intensity of sunlight to study its influence on plant development. Now, measuring the solar spectrum became his life's work. He initially followed Julius's rather unorthodox theory of solar physics, worshiping him with characteristic intensity. Pannekoek, together with the physicist L.S. Ornstein, advised him to establish his own research projects. In 1926, Minnaert obtained a second PhD, in physics.

In the course of the 1920s, Pannekoek introduced Minnaert to the Dutch and international astronomical community. After being a biologist and physicist, Minnaert became an astronomer. He joined several eclipse

53 Feast 2000.

54 Molenaar 2003.

55 Heijmans 1994; Verbunt and Bleeker 2010.

expeditions, including the one of 1926 to Sumatra, and in 1933 he made a lecture tour of astronomical institutes in the US and Canada. Finally, in 1937, he succeeded A.A. Nijland as professor of astronomy in Utrecht – not without controversy, because the former Flemish nationalist had in the meantime become a radical communist with strong internationalist convictions.

Minnaert turned Utrecht Observatory into a centre for solar physics. He also turned it into a major research school for new generations of astronomers. He was famous as an inspiring teacher and populariser of astronomy. One of his main innovations was the creation of an 'astronomical practicum', in which all first-year students of physics, mathematics, and astronomy learned how to do astronomical observations. It inspired more than one prospective physicist to change course and become an astronomer instead.⁵⁶ The expansion of teaching and new research in Utrecht and Amsterdam led to the establishment by Minnaert and Pannekoek of a tradition of astrophysics in the Netherlands.

The generation of De Sitter, Pannekoek, and Minnaert did things differently than their predecessors, not only in their research and teaching, but also in the way in which they cooperated and organized their discipline. Since the turn of the century, Dutch astronomy professors regularly met in the 'Eclipse Commission' of the Royal Academy of Sciences, an initiative of A.A. Nijland of Utrecht.⁵⁷ There were no other national astronomical institutions, apart from the amateur society for astronomy and meteorology that had been founded in 1901.⁵⁸ That changed in 1918 with the founding of the *Nederlandse Astronomenclub* (Dutch Club of Astronomers, NAC), a professional organization. It is not entirely clear whose initiative this was, but in 1918 Pannekoek had suggested to establish a new astronomical society, comparable to the Royal Astronomical Society in Britain. One of his arguments for increased communication between Dutch astronomers was the difficulty of communicating with colleagues abroad because of World War I. It was to be a *professional* society that explicitly excluded amateurs. Similar plans were also proposed by others around that time.⁵⁹

Before World War I, many Dutch astronomers had been members of the German *Astronomische Gesellschaft*, which had now become politically problematic. It is also possible that talks about joining the new International

56 de Jager, van Bueren, and Kuperus 1993; Baneke 2015.

57 van Berkel 2004.

58 de Boer and van der Brugge 2001.

59 Pannekoek to De Sitter, 29 September 1918, WdS inv. 45.1. I thank Chaokang Tai for this reference. See also Stein 1928; Baneke 2015, 121-125.

Astronomical Union played a role.⁶⁰ This required a national organization to represent the Netherlands. Finally, the initiative was likely closely related to the reorganization of Leiden observatory and the momentum this created.

It turned out to be difficult to define the target group of the new society. The combined tenured astronomical research staff at the four universities in 1920 consisted of eleven men (six in Leiden, two in Utrecht, two in Groningen and one in Amsterdam), but there were also research assistants, advanced students, and active astronomers who worked at other institutions – like Pannekoek when he was teaching at a 'HBS' high school between 1915 and 1919. Suggested descriptions included 'professional astronomers or people who can be regarded as their equivalent', or astronomers 'who are actively pursuing research'.⁶¹ Interestingly, NAC president J. Stein SJ (himself a teacher at a gymnasium, although he would later become director of the Vatican Observatory) later, after the NAC's creation, spoke of 'doctoral candidates and their equivalents', making academic training the decisive criterion. By speaking of 'doctoral candidates' (*doctorandi*) instead of PhDs (*doctors*), he explicitly included graduate students. In practice, new members had to be approved by the club, which actually rarely caused controversy. The NAC started with about twenty members in 1918, growing to more than 40 in 1940.

The *Astronomenclub* was a relatively informal society, which gathered two or three times per year to discuss ongoing research and organizational issues, for example the status of Voûte's new observatory in the Dutch East Indies or its relation with amateur astronomers. Pannekoek frequently contributed as a lecturer. Many students were introduced into the professional research community through these meetings – arguably their most important function.

At least as important as the *Astronomenclub* was the creation of the *Bulletin of the Astronomical Institutes of the Netherlands (BAN)* in 1921. Until then, the astronomical institutes of Leiden, Utrecht, and Groningen each had their own publication series (in German, French, and English, respectively).⁶² Dutch astronomers also published in the proceedings of the Royal Academy of Sciences, and occasionally in the *Monthly Notices* of the (British) Royal Astronomical Society or the (German) *Astronomische Nachrichten*.

60 Blaauw 1994.

61 The notebooks with the proceedings of the *Astronomenclub* are preserved in Leiden Observatory; see also Stein 1928.

62 *Annalen der Sternwarte in Leiden*; *Recherches astronomiques de l'Observatoire d'Utrecht*; *Publications of the Astronomical Laboratory at Groningen*.

At the end of World War I, however, the *Astronomische Nachrichten* had to fight paper shortages and an international scientific boycott against Germany and its allies. Its dire situation led Hertzsprung to propose to establish a Dutch journal. Hertzsprung added that publishing in the proceedings of the Royal Netherlands Academy of Sciences was not a suitable alternative: he described them as a 'graceful tomb', in which astronomical publications disappeared, never to be read.⁶³ De Sitter agreed, adding that a new journal should be published in English and have British and American support – an indication of their reoriented international outlook. Pannekoek suggested that it should have the format of a 'bulletin': submissions should have a quick turnover time and issues should appear as soon as there was enough material. His ideas followed the model of the *Lick Observatory Bulletin* and were in fact realized. The Bulletin's fast and cheap production made it an efficient medium to quickly disseminate Dutch astronomical research. The *BAN* became the main journal for Dutch astronomers, including, for example, many of Jan Oort's groundbreaking publications. In 1927, Hertzsprung reported from Harvard that it was well read there.⁶⁴

The Dutch astronomers agreed that Visibility in the English-speaking world had become of great importance. Around this time, the first decades of the twentieth century, America was emerging as the leading country in astronomy, while World War I caused great material and political difficulties for German astronomy.⁶⁵ At the same time, George Ellery Hale and others founded an impressive series of large new observatories in the United States. Hale also founded several new journals and astronomical organizations, and pioneered the integration of modern astrophysics into mainstream astronomy.⁶⁶ Thanks especially to Kapteyn's friendship with Hale, Dutch astronomers developed close connections to the American astronomical community. Kapteyn introduced many Dutch astronomers at Mount Wilson, for example.⁶⁷

De Sitter's international network was also important. As President of the International Astronomical Union, he hosted its 1928 General Assembly in Leiden, which was attended by Harlow Shapley, Frank Schlesinger, and Henry

63 Hertzsprung to De Sitter, 16 February 1921, WdS inv. 23.2: 'een sierlijk graf'. Correspondence about the founding of the *BAN* can be found in the WdS inv. 23.2, 23.9, and 45.1.

64 Hertzsprung to De Sitter, [?] January 1927, WdS inv. 23.5.

65 Lankford has also pointed at the *Carte du Ciel* project as a cause of stagnation in European astronomy. See: Lankford 1997.

66 Wright 1994; Sandage 2004.

67 DeVorkin 2000b.

Norris Russell, three of the leading American astronomers (also known as 'the generals').⁶⁸ It was the first astronomical conference since World War I to which German astronomers were invited.⁶⁹

American observatories and universities were eager to import European scholarship to help establish professional American research programmes. Kapteyn, Hertzsprung, De Sitter, and Pannekoek all embarked on extensive lecture tours in the 1910s and 1920s. Pannekoek remarked that Americans tried to squeeze all usable knowledge out of European astronomers.⁷⁰ His own itinerary in 1929 was typical: Victoria (Canada), Berkeley, Lick, Mount Wilson, Yerkes, Washington, New York, Cambridge, MA. He was also invited to teach at a summer school in Harvard in 1935 and 1936 (Bart Bok reported in a letter that 'Papa Pannekoek nicely did his best'⁷¹). Harvard even awarded him an honorary doctorate in 1936, communist or not.

Dutch astronomers not only promoted their own research while in the US. They also used their connections to recommend their students for fellowships and research positions. The number of Dutch astronomy graduates increased sharply in the 1920s and 1930s, but there were few career opportunities in the Netherlands. All permanent staff positions had been filled around 1920, so opportunities to succeed retiring professors were not to be expected for some time. As Bart Bok recalled, De Sitter's advice to astronomy students was: 'Boys, when you get your PhD, you can either become a secondary school teacher, or you go to the United States'.⁷² Especially Hertzsprung was actively promoting his students. For instance, he met with representatives of the Rockefeller Foundation's International Education Board to suggest their names for fellowships.

Dutch graduates were particularly welcome in the US due to the new teaching programmes in Leiden and Utrecht that combined theoretical studies with observing skills.⁷³ The list of young Dutch astronomers who departed for the US in the 1920s and 1930s includes Jan Oort, Jan Schilt, Dirk Brouwer, Bart Bok, Gerrit (Gerard) Kuiper, Pieter Oosterhoff, and Adriaan Blaauw. Hertzsprung also introduced Kaj Strand there, a Danish student who had worked with him in Leiden for several years. Most remained in the US for the rest of their career; only Jan Oort and Adriaan Blaauw returned to the

68 Peter van de Kamp, interview with David DeVorkin, Session II, 18 March 1977, AIP; see also DeVorkin 2000a.

69 Blaauw 1994.

70 Pannekoek 1982, 270. He also described his lecture tour in Pannekoek 1930.

71 Bok to Van de Kamp 12 October 193[?], PvdK: Papa Pannekoek heeft fijn zijn best gedaan.

72 Bart Bok, interview with David DeVorkin, Session I, 15 May 1978, AIP.

73 Herrmann 1994, 50; van der Kruit and van Berkel 2000.

Netherlands. According to historian John Lankford, the Dutch were second on the list of foreign-born astronomers in the US in 1940, after Canadians.⁷⁴

Legacy

In the decade after 1918, the Dutch astronomical community changed dramatically, and Pannekoek played an active role in initiating these changes. Not, as first envisioned, as a member of De Sitter's all-star cast in Leiden, but as the sole astronomer of Amsterdam University, with few resources and students. Returning to astronomy after his political adventures initially turned out to be more difficult than he had expected, mostly because of unfortunate timing. It probably was the prime minister himself who, in 1919, had vetoed his appointment in Leiden. Soon after, however, Pannekoek was appointed professor in Amsterdam and started working with others towards building a new national disciplinary structure that made it possible for him to contribute significantly to the renaissance of Dutch astronomy. His most important contribution was the introduction of modern theoretical astrophysics to the Netherlands. Indirectly, he also inspired colleagues and students, most notably helping Marcel Minnaert to become an astronomer.

Pannekoek's generation of astronomers was remarkable. In the first place because of their research, but also because of the students that they produced and because of the way they cooperated with each other. A good example of the latter was the 1923 statement on the state of the field that the institute directors submitted to the government. They wanted to ensure that astronomy was represented at all Dutch universities. Interestingly, they added that Leiden Observatory, by far the largest institute, should not become too dominant. Apparently, De Sitter's ambitions were not entirely uncontroversial. The directors agreed that all institutes, including smaller ones like Pannekoek's, should have at least one observer, several (human) computers and a decent budget for instruments.⁷⁵

The statement also listed the research specializations of each institute, demonstrating that there was no overlap between them. Pannekoek's research

74 Lankford 1997, 361; overviews of Dutch astronomers in the US are provided by Oort 1941; van Berkel 2000. The quip that 'Leiden is the place where they grow tulips and astronomers for export' is usually ascribed to Harlow Shapley, for example in van Herk, Kleibrink, and Bijleveld 1983, 85. The oldest version of this remark that I could find was by the South African Minister of Science J.H. Viljoen, in his opening address for the new telescope in Hartbeespoort on 9 September 1957, see Viljoen 1957, 214. He added 'jenever' (gin) to the list of notable Dutch exports.

75 WdS inv. 229.

topic was listed as 'stellar astronomy' and the measuring of photographic plates that had been made elsewhere – much like Kapteyn's programme, even though theoretical astrophysics would soon become his main focus. The principle of dividing research subjects over the institutes through mutual agreement would remain an important feature of the Dutch astronomical community.⁷⁶ Other elements of the new disciplinary structure also proved durable. The *Bulletin of the Astronomical Institutes of the Netherlands* remained the main publication medium for Dutch astronomers until it merged with other European journals to create *Astronomy and Astrophysics*, still one of the leading journals in the field. The *Astronomenclub* had its most famous meeting on 15 April 1944, when Henk van de Hulst presented his prediction of a 21 cm hydrogen spectral line. Later, its function was largely taken over by the *Nationale Astronomenconferenties*, informal annual conferences initiated by Minnaert. Close relations with America also remained, as the US emerged as the uncontested leading astronomical nation after World War II. Ambitious Dutch students still found their way to American institutions.

Pannekoek's legacy has remained tangible in the two major research traditions of Dutch astronomy in the twentieth century. One was the collaboration between Groningen and Leiden, which was dominated by Kapteyn's research programme into stellar astronomy and galactic structure. It was the result of careful planning by Kapteyn and De Sitter, and continued by Hertzsprung and Oort. The other was the Amsterdam-Utrecht collaboration in astrophysics, which was not planned at all: it resulted from the unpredictable careers of Pannekoek and Minnaert, in which politics had played such an important role. However dependent on the unpredictable turns of history, its legacy remains visible today. In the 1970s, the Amsterdam astronomical institute was greatly expanded by Edward van den Heuvel, Minnaert's last PhD student, and therefore a direct descendant of this research school. Van den Heuvel was instrumental in continuing the astrophysical research tradition, extending its life for many decades, even after the Utrecht astronomical institute was closed in 2011.

Archives

AC Archief van Curatoren, 1878-1953 (Archives of the Board of Trustees).
Leiden University Library.

⁷⁶ Baneke 2015.

- AIP Oral History Interviews. Niels Bohr Library & Archives. American Institute of Physics, College Park, MD. <http://www.aip.org/history/ohilist/transcripts.html>
- EH Ejnar Hertzsprung papers. Center for Videnskabsstudier. Aarhus University.
- OKW Archief van het Ministerie van Onderwijs, Kunsten en Wetenschappen: Persoondossiers Rijkspersoneel, c. 1870-c. 1974 (Archives of the Ministry of Education, Culture and Science: Personal files government personnel), catalog no. 2.14.17. National Archives of the Netherlands, The Hague.
- PvdK Peter van de Kamp papers. Anton Pannekoek Institute for Astronomy. University of Amsterdam.
- WdS Willem de Sitter papers, Leiden Observatory Archives. Leiden University Library.

Bibliography

- Baneke, David. 2004. "Hij kan toch moeilijk de sterren in de war schoppen". De afwijzing van Anton Pannekoek als adjunct-directeur van de Leidse Sterrewacht in 1919'. *Gewina* 27(1): 1-13.
- . 2005. "Als bij toverslag". De renovatie en nieuwe bloei van de Leidse Sterrewacht 1918-1924'. *BMGN – Low Countries Historical Review* 120(2): 207-225.
- . 2010. 'Teach and Travel: Leiden Observatory and the Renaissance of Dutch Astronomy in the Interwar Years'. *Journal for the History of Astronomy* 41(2): 167-198.
- . 2015. *De ontdekkers van de hemel. De Nederlandse sterrenkunde in de twintigste eeuw*. Amsterdam: Prometheus Bert Bakker.
- Berkel, Klaas van. 2000. 'Growing Astronomers for Export: Dutch Astronomers in the United States before World War II'. In *The Legacy of J.C. Kapteyn: Studies on Kapteyn and the Development of Modern Astronomy*, ed. by Pieter C. van der Kruit and Klaas van Berkel. Dordrecht: Kluwer, 151-174.
- . 2004. 'De Akademie, Indië en de bloei van de sterrenkunde in Nederland. De Eclipscommissie van 1899'. In *De Akademie en de Tweede Gouden Eeuw*, ed. by Klaas van Berkel. Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 107-138.
- Blaauw, Adriaan. 1994. *History of the IAU: The Birth and First Half-Century of the International Astronomical Union*. Dordrecht: Kluwer.
- Boer, Jan A. de, and Aad H. van der Brugge. 2001. 'Honderd jaar NVWS'. In *Evolutie in weer- en sterrenkunde: 100 jaar Nederlands onderzoek*, ed. by Mat Drummen, Cornelis de Jager, and Hugo van Woerden. Utrecht: Stichting De Koepel.
- DeVorkin, David H. 1984. 'Stellar Evolution and the Origin of the Hertzsprung-Russell Diagram'. In *Astrophysics and Twentieth-Century Astronomy to 1950*, ed. by

- Owen Gingerich. *The General History of Astronomy* 4. Cambridge: Cambridge University Press, 90-108.
- . 2000a. *Henry Norris Russell: Dean of American Astronomers*. Princeton: Princeton University Press.
- . 2000b. 'Internationalism, Kapteyn and the Dutch Pipeline'. In *The Legacy of J.C. Kapteyn: Studies on Kapteyn and the Development of Modern Astronomy*, ed. by Pieter C. van der Kruit and Klaas van Berkel. Dordrecht: Kluwer, 129-150.
- Dongen, Jeroen van. 2012. 'Mistaken Identity and Mirror Images: Albert and Carl Einstein, Leiden and Berlin, Relativity and Revolution'. *Physics in Perspective* 14(2): 126-177.
- Feast, Michael. 2000. 'Kapteyn and South Africa'. In *The Legacy of J.C. Kapteyn: Studies on Kapteyn and the Development of Modern Astronomy*, ed. by Pieter C. van der Kruit and Klaas van Berkel. Dordrecht: Kluwer.
- Guichelaar, Jan. 2009. *De Sitter. Een alternatief voor Einsteins heelalmodel*. Amsterdam: Veen.
- Heijmans, Henri G. 1994. *Wetenschap tussen universiteit en industrie: de experimentele natuurkunde in Utrecht onder W.H. Julius en L.S. Ornstein 1896-1940*. Rotterdam: Erasmus.
- Herk, Gijsbert van, Herman Kleibrink, and Willem Bijleveld. 1983. *De Leidse Sterrewacht: vier eeuwen wacht bij dag en bij nacht*. Zwolle: Waanders/DeKler.
- Herrmann, Dieter B. 1994. *Ejnar Hertzsprung: Pionier der Sternforschung*. Berlin: Springer.
- Jager, Cornelis de, Henk G. van Bueren, and Max Kuperus. 1993. *Bolwerk van de Sterren*. Amersfoort: Bekking.
- Kerszberg, Pierre. 1989. *The Invented Universe: The Einstein-De Sitter Controversy (1916-17) and the Rise of Relativistic Cosmology*. Oxford: Oxford University Press.
- Knegtmans, Peter Jan. 1998. *Een kwetsbaar centrum van de geest. de Universiteit van Amsterdam tussen 1935 en 1950*. Amsterdam: Amsterdam University Press.
- Kruit, Pieter C. van der. 2015. *Jacobus Cornelius Kapteyn: Born Investigator of the Heavens*. Cham: Springer.
- Kruit, Pieter C. van der, and Klaas van Berkel, eds. 2000. *The Legacy of J.C. Kapteyn: Studies on Kapteyn and the Development of Modern Astronomy*. Dordrecht: Kluwer.
- Lankford, John. 1997. *American Astronomy: Community, Careers, and Power, 1859-1940*. Chicago: University of Chicago Press.
- Molenaar, Leo. 2003. *Marcel Minnaert, astrofysicus 1893-1970. De rok van het universum*. Amsterdam: Balans.
- Oort, Jan H. 1941. 'Jongere Nederlandsche sterrekundigen op belangrijke posten in het buitenland'. *Hemel en Dampkring* 39: 355-363.
- Pannekoek, Anton. 1930. 'Een vluchtig bezoek aan eenige Amerikaansche sterrewachten'. *Hemel en Dampkring* 28 (1-3): 1-7, 33-45, 81-91.

- . 1982. *Herinneringen: herinneringen uit de arbeidersbeweging; sterrenkundige herinneringen*. Ed. by Ben A. Sijes, Johanna M. Welcker, and J.R. van der Leeuw. Amsterdam: Van Gennep.
- Pyenson, Lewis. 1989. *Empire of Reason: Exact Sciences in Indonesia, 1840-1940*. Leiden: Brill.
- Sandage, Allan. 2004. *The Mount Wilson Observatory: Breaking the Code of Cosmic Evolution*. Cambridge: Cambridge University Press.
- Sande Bakhuyzen, H.G. van de. 1872. 'De methode welke thans bij de beoefening der sterrenkunde moet gevolgd worden'. Inaugural lecture, Leiden: Leiden University.
- Stein, Johan W.J.A. 1928. 'De Nederlandsche Astronomenclub 5 oct. 1918 – 5 oct. 1928'. *Hemelen Dampkring* 26(11): 335-347.
- Verbunt, Frank, and Johan Bleeker. 2010. 'Spectroscopy in Utrecht: A Brief History'. *Space Science Reviews* 157(1-4): 3-13.
- Viljoen, J.H. 1957. 'Rede deur sy Edele die Minister van Onderwys, Kuns en Wetenskap, mnr. J.H. Viljoen by geleentheid van die opening van die Leidse Sterrewag te Hartbeespoort op 9 September 1957 om 15 uur.' *Hemelen Dampkring* 55: 213-215.
- Wright, Helen. 1994. *Explorer of the Universe: A Biography of George Ellery Hale*. Woodbury, NY: American Institute of Physics.
- Zuidervaat, Huib J. 2008. 'Joan Voûte 1879-1963. Een reuzentelescoop op de Bosscha-sterrenwacht te Lembang'. In *De telescoop: erfenis van een Nederlandse uitvinding*, ed. by Dirk van Delft, Albert van Helden, Hans Hooijmaijers, and Huib J. Zuidervaat. Amsterdam: Bert Bakker, 45-51.
- , ed. 2011. *Frederik Kaiser (1808-1872), schepper van de 'nieuwe' Leidse sterrewacht*. Amsterdam: Gewina.

About the Author

David Baneke is Assistant Professor at Utrecht University, where he coordinates the master's programme History and Philosophy of Science. He studied history in Groningen, and obtained his PhD in 2008 in Utrecht. His research addresses the role of science in twentieth-century culture and politics, and the history of modern astronomy. In 2015, he published *De ontdekkers van de hemel*, about the history of modern astronomy in the Netherlands; an English translation is forthcoming. In 2019, he co-authored *The International Astronomical Union: Uniting the Community for 100 Years* about the history of the International Astronomical Union.