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CORRESPONDENCE

To the Editors of 'The Observatory'

Willem Henri Julius (1860–1925)

In her retrospective review[1] of Charles Abbot's 1911 book *The Sun*[2], Virginia Trimble notes that 'W. H. Julius' is mentioned and wonders who he was and what his contributions to solar physics were. Andrew Young has already briefly outlined Julius' contributions[3] but I have unearthed a few more details which I thought might also be of interest. As Prof. Trimble notes, Julius is not included in the *Biographical Encyclopedia of Astronomers*[4], at least in the edition to which I have access. However, Brüggenthies & Dick's *Biographical Index of Astronomy*[5] does have an entry for one 'Julius, Willem Henri' which gives further entries in the *Dictionary of Scientific Biography* (*DSB*; by Marcel Minnaert)[6] and the on-line *Finding List of Obituary Notes of Astronomers*[7] (*ONA*) compiled by Duerbeck, Ott & Dick. The *ONA*, in turn, gives three obituaries, of which I was able to locate two[8,9], including one in this *Magazine*. A further search of the NASA ADS Bibliographical Database for items about Julius published in the years shortly after his death found one by Einstein that appeared in *ApJ*[10]. It is not a conventional obituary but a recap of some of Julius' ideas and an appeal that they not be overlooked.

The two obituaries[8,9] are both anonymous, single, short paragraphs and do little more than note Julius' death. Most of what follows is based on the entry by Minnaert in the *DSB* and Einstein's paper in *ApJ*. Minnaert was Julius' research student[11] and later occupied the Chair that Julius had held (though Minnaert was not the immediate successor). Einstein was a long-standing friend.

Willem Henri Julius (his forenames were sometimes Anglicised to William Henry; Fig. 1) was born in Utrecht on 1860 August 4. He enrolled at the University of Utrecht in 1879, where he studied mathematics and physics, gaining a doctorate under the supervision of Buys Ballot. (Christophorus Buys Ballot, 1817–90, is primarily remembered as a meteorologist, but at the time he supervised Julius he held Chairs in Physics and Mathematics, having initially been appointed to teach Mineralogy and Geology and then holding a Chair

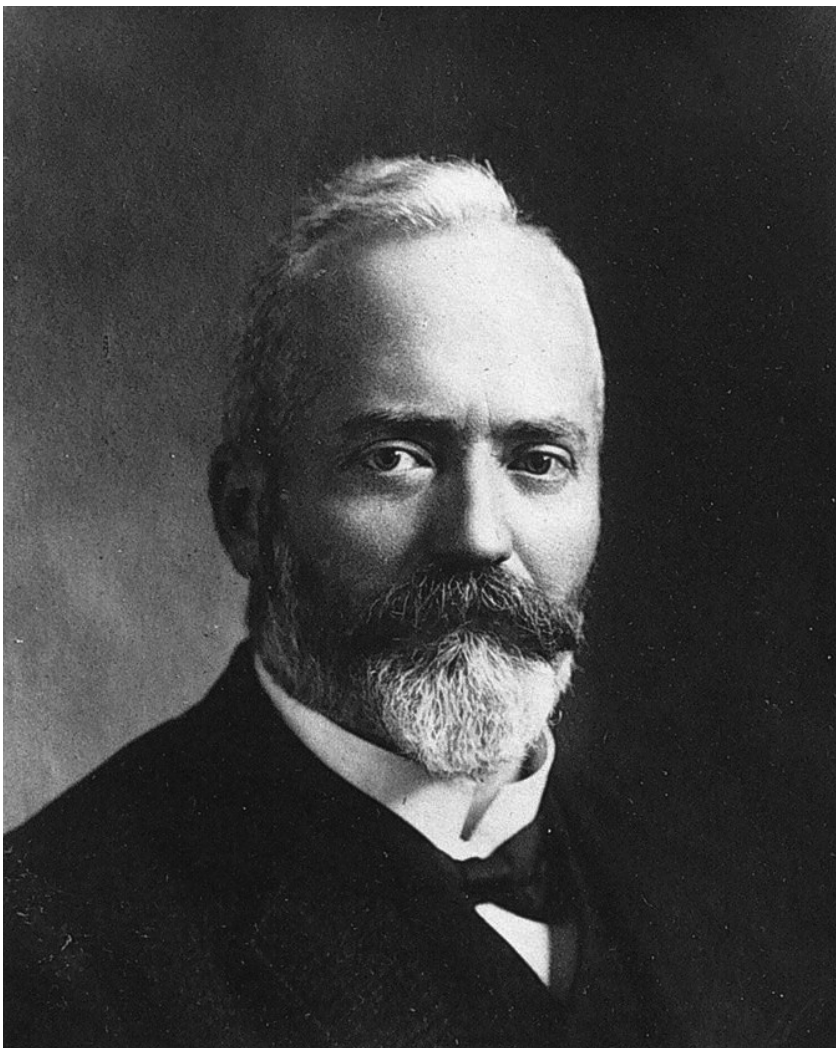

Fig. 1

William Henry Julius (1860–1925). Photograph extracted from the on-line genealogical database geni.com where it is included in an album compiled by Ms. Marije Walbeek, a descendent. It is reproduced courtesy of Ms. Walbeek.

in Chemistry[12].) In 1890 Julius was appointed a Professor at the University of Amsterdam but in 1896 moved back to Utrecht to take up a Chair there. He remained at Utrecht for the rest of his career and later became Director of the University's Physical Laboratory, within which he subsequently established a Heliophysical Observatory[13]. Julius died on 1925 April 15 at the age of 64.

Julius' career divides into two parts. In the first he worked primarily on laboratory physics, specifically using radiometers to study the infrared emission and absorption spectra of gases. In order to improve the stability of his radiometers he developed the 'Julius suspension' in which the radiometer is supported directly below its centre of mass in order to reduce vibration.

Around 1890–1900 Julius' work underwent a change of direction. Einstein places this change in 1891 and attributes it to Julius reading August von Schmidt's study of refraction in the solar atmosphere[14]. Conversely Minnaert places it in 1901 when Julius was involved in observing the eclipse of that year. These assertions can be reconciled, at least to some extent, if Julius read Schmidt's book some years after its publication in 1891 and in preparation for the eclipse. The earliest astronomical publication by Julius recorded in the NASA ADS is from 1899[15] and concerns what became his principal astrophysical interest: extending Schmidt's ideas about refraction in the solar atmosphere.

Julius was heavily involved in the Dutch expedition to observe the 1901 total solar eclipse from Karang Sago, then in Dutch Sumatra, now in Indonesia. He was a member of the organizing committee for the expedition, wrote (with J. C. Kapteyn, J. P. van den Stok and A. A. Nijland) a pamphlet offering advice to amateur astronomers about observing the eclipse, and participated in the expedition itself[16,17]. He also observed the 1905 and 1912 eclipses[18].

However, most of Julius' solar work was concerned with extending Schmidt's ideas on refraction due to density inhomogeneities in the solar atmosphere and anomalous refraction close to the central wavelength of absorption lines. He used these ideas to explain aspects of the appearance of sunspots and prominences and the broadening of Fraunhofer lines. Starting in 1899 he published many papers on this topic.

Julius' ideas initially received a mixed reception, for example, being criticised by St. John[19–22] and Royds[23] but treated more favourably by Albrecht[24] and Croze[25]. Anomalous dispersion is an established phenomenon, demonstrated in laboratory experiments (see the discussion of theories of optical dispersion between the 1870s and 1920s by Taltavull[26] and references therein). At the time of Julius' work the pressure in the solar atmosphere had not been measured but was assumed to be much higher than turned out to be the case. In 1923 Fowler & Milne[27] measured the electron pressure in the solar atmosphere to be 10^{-4} atm, far too tenuous for anomalous dispersion to play a significant role in solar phenomena. From this point Julius' theories were untenable. Forbes[28] gives a succinct summary of these developments. In his *DSB* entry Minnaert judiciously describes the importance that Julius attached to anomalous dispersion as 'vastly exaggerated' (Minnaert's thesis under Julius had been on 'Irregular ray curvature'). In his paper Einstein merely suggests that Julius' ideas are worth considering and discusses them in the context of the radial velocities observed in the photosphere; he does not endorse them. More recently Julius' ideas are briefly discussed by Taltavull[29] and at greater length (and in German) by Hentschel[30].

By the mid-19th Century astronomy was well-established at Utrecht, the University Observatory having been founded in 1642, just six years after the University was founded in 1636[31]. However, there had been no solar work before

Julius[32]. His own work, founding the Heliophysical Laboratory and the several doctoral students that he supervised[33], were the start of the Utrecht solar physics group, which became well-known and well-respected later in the 20th Century. Julius also supervised doctoral students in mathematics[34] and meteorology[35].

Some correspondence by Julius is extant. George Ellery Hale (1868–1938)[36] is mostly remembered as the founder of the Yerkes, Mount Wilson, and Palomar Observatories, for his rôle in the establishment of scientific organizations, including the International Union for Co-operation in Solar Research (a precursor of the IAU), and for co-founding *ApJ*. His own research was primarily in solar astronomy and, of course, the Mount Wilson Observatory included extensive, indeed preeminent, instrumentation for solar work. An extensive correspondence between Hale and Julius during the years 1903–25 has survived[37]. The greater part of it concerns anomalous dispersion, though other topics include the submission and discussion of papers (in Hale's editorial rôle for *ApJ*), instrumentation for Julius' Heliophysical Observatory, and a visit by Julius to Mount Wilson. While the Director at Mount Wilson, Hale encouraged a number of eminent European astronomers to visit the Observatory, use its facilities and collaborate (Kapteyn is a well-known example), and Julius duly visited in the summer of 1907. The correspondence shows Hale as initially open-minded about the importance of anomalous dispersion and he collaborated with Julius in the design of instruments and experiments to test these ideas at Mount Wilson. He largely maintains this open mind throughout the correspondence, though his attitude seems to cool somewhat as convincing evidence proves elusive. The final item in the correspondence is a printed announcement of Julius' death sent by his wife and children.

In the autumn of 1911 there was a complicated correspondence between Julius, Henderick Lorentz (Professor at Leiden), and Einstein, offering the latter a chair at Utrecht, which had become vacant following the death of Cornelis Wind (1867–1911) earlier in the year. Julius made an informal approach on August 20 and on November 15 Einstein sent his final refusal, declining in favour of the offer of a chair at Zurich, for which he had also been in negotiation and had probably preferred all along. During this period Einstein visited Julius in Utrecht on his way home from the First Solvay Congress, held in Brussels during October. This episode is briefly described by Fösling[38], in more detail by Clark[39], and at greater length (and in Dutch) by van Herwaarden[40]. A few years later Julius joined Lorentz, Pieter Zeeman, and Heike Kamerlingh Onnes in sending a letter of support for Emil Warburg's fourth (and unsuccessful) nomination of Einstein for a Nobel Prize[41].

The extant correspondence between Julius and Einstein is included in the Einstein *Collected Papers*[42]. In addition to letters about the proposed appointment at Utrecht there is various other correspondence from the turn of the century to a few months before Julius' death. Some additional material pertaining to Julius is held in the Archives of the University of Utrecht.

A search of the NASA ADS bibliographic database[43] finds 53 publications by Julius, of which it considers 24 to be refereed. Julius published primarily in the *Proceedings* of the Royal Netherlands Academy of Arts and Sciences (*KNAB; Koninklijke Nederlandse Akademie van Wetenschappen*, Proceedings Series B, Physical Sciences; 24 papers) and *ApJ* (16 papers), together with a few publications in other journals, including one in this *Magazine*[44]. He mostly published in Dutch or English, but also wrote a few papers in German or French. Following normal practice at the time all but two of his papers are single-author. However, these numbers should be regarded with a certain

degree of circumspection. Andrew Young's *Annotated Bibliography of Atmospheric Refraction*[45] lists two papers on anomalous dispersion that Julius published in the *Physikalische Zeitschrift* (a German physics journal that ran during the first half of the 20th Century) which do not appear in the ADS list. Also, many of the papers listed by the ADS are duplicates, with the same paper published in *ApJ*, *KNAB*, and in some cases other publications (such duplication, to give papers a wider international readership, was another practice more common then than now). Finally, the figures do not include Julius' non-astronomical publications on laboratory studies of infrared emission and absorption. A search of the *WORLDCAT* global on-line union catalogue of library holdings lists 28 books by Julius, but inspection reveals that some of the entries are bound copies of reports or reprints of papers (again, the circulation of reprints was common at the time). Removing these entries whittles the list down to five titles, all of which are in Dutch. They are summarized in Table I.

A simple on-line search (unsurprisingly) found entries for Julius in the on-line *Biographical Dictionary of the Netherlands*[46] maintained by the Huygens Institute, and in the Dutch Wikipedia[47]. The latter includes a scan of a portrait of Julius by Mrs Antonie Lewin dating from 1916. He would have been 56 when it was painted but looks older. The search also found an entry in the *Lucerna* on-line database of magic-lantern images hosted by the University of Exeter[48]. It refers to three sets of magic-lantern slides of Dutch eclipse expeditions of 1901, 1905, and 1912, with low-resolution images available, some of which clearly show Julius.

Finally, Julius' posthumous *Leerboek der zonnephysica*[49] (which was brought to publication by Minnaert) includes a summary biography of Julius and a complete list of his publications. Minnaert's *DSB* entry locates this biography and bibliography in a book entitled *De Natuurkunde van de Zon*, of which I can

Table I

Books published by W. H. Julius. In all cases they are in Dutch and Julius is the sole author.

Date	*Title*	*Title (English)*	*Publisher*	*Location*	*Notes*
1888	*Het warmtespectrum en de trillingsperioden der moleculen van eenige gassen*	The heat spectrum and the vibration periods of the molecules of some gases	J. van Boekhoven	Utrecht	Doctoral Thesis.
1891	*De methoden van onderzoek in de natuurkunde*	The methods of research in physics	Clausen	Amsterdam	Inaugural lecture at the University of Amsterdam.
1896	*Kritiek in de natuurkunde*	Criticism in physics	Kemink	Utrecht	
1908	*Energievervoer in de electronenwereld*	Energy transport in the electronics world	J. van Druten	Utrecht	Speech delivered on the 272nd anniversary of the Utrecht high school, 26 March 1908.
1928	*Leerboek der zonnephysica*	Textbook of solar physics	Noordhoff	Groningen	Posthumous. Published in the series *Natuurkundige Bibliotheek.*

find no trace; if it exists it has left a remarkably light bibliographic footprint. Minnaert had published a paper[50] and a book[51] with very similar titles at around the same time and it seems plausible that he was simply mis-remembering the title when he wrote the *DSB* entry.

In summary, Willem Henri Julius was a physicist who later turned to solar physics and was active in that field in the early decades of the 20th Century, so his being mentioned in Abbot's 1911 book about the Sun is not surprising. He started solar work at Utrecht and founded the solar physics group there, but his own ideas about refraction in the solar atmosphere did not survive measurement of the pressure in the solar atmosphere.

Acknowledgements

I am grateful to Dr. Paul Lambers of the University Museum, Utrecht, for information about material pertaining to Julius held by the University of Utrecht and to Professor V. Trimble for comments on an earlier version of the manuscript. This investigation has made extensive use of the NASA ADS on-line bibliographic database and, in practice, would have been impossible without it. It has also made substantial use of the *WORLDCAT* global on-line union catalogue of library holdings and the *JSTOR* on-line digital academic library. I was able to access *JSTOR* courtesy of the National Library of Scotland. Other on-line resources used are listed in the references. As ever, I remain grateful for the use of the Library at the Royal Observatory Edinburgh. Translations from Dutch and German were made using the on-line translation service Translate.com; I do not read either language. Any mistakes, of course, are my own.

Yours faithfully,
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2023 October 6

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