W. F. Denning - The Doyen of Amateur Astronomers.

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1. Introduction:
This year [1998] celebrates the 150th anniversary of the birth of William Frederik Denning. Although he was not a professional astronomer in the usual sense of the epithet, Denning made significant contributions to the development of meteor astronomy and was an avid 'sweeper' of comets and observer of the planets. In practice his field of interest was both wide and deep and his enthusiasm for observing inexhaustible.

We can not hope to review all of Denning's works in a study such as this. Likewise, we can not hope to present an in-depth review of his life. Indeed, the details concerning Denning's early life are still obscure and very little material relating to his personal thoughts has survived. There are threads, however, and a patchwork, rather than a tapestry of his life is emerging. It is my hope to piece together as much of this patchwork as is possible.

2. The Early years:
William Frederick Denning was born in the small Somerset village of Redpost on November 25th, 1848. At that time his father, Issac Poyntz Denning, was identified as an accountant. Interestingly just four years earlier, on the day of his second marriage Issac P. Denning had described himself as a schoolmaster. Denning's [we shall generally use Denning to refer to W. F. Denning] mother, Lydia Padfield, was the seamstress daughter of Richard Padfield, a wagon loader at Coal Barton Colliery. Issac Poyntz Denning's farther, Issac Denning, is identified in 1844 as a retired Sergeant Major. Indeed, Issac Denning served in the 53rd Shropshire Regiment of Foot (now the Kings Shropshire Light Infantry), and he saw action in the Peninsular wars which helped establish the 'Great Peace' between 1815 and 1914.

Virtually nothing is known of Denning's early childhood. When he was just eight years old, however, Denning and his family moved from the rural settings of Redpost to the City of Bristol. In the same year that the family moved to Bristol (1856) Issac P. Denning established the accountancy partnership of Denning, Smith and Co, and indeed, he was to work within this partnership until his death in 1884. Issac, and Lydia Denning were to raise a total of four children, and Denning, the eldest child, had a brother Frederick, and two sisters Emma and Margaret.

The Denning family seemingly had many relatives in the Bristol area, and Denning was to live within the City for the remainder of his life, indeed, he only rarely left its confines. The Denning family prospered in Bristol, but unfortunately no details of Denning's formative years have survived. It is reasonable to assume, however, that he received a sound education. Certainly it would appear that Denning had a healthy, and athletic adolescence. Amateur meteor observer J. P. M. Prentice commented [1] on Denning that, "in his younger days he [Denning] was somewhat of an athlete, delighting in running and playing hockey, and a keen and skillful cricketer." Denning's skill as a cricketer was described in several of his obituary accounts, and T. E. R. Phillips recounts [2] in particular that, "he once told the writer that W. G. had invited him to keep wicket for Gloustershire." W. G., of course, was none other than Dr. William Gilbert Grace who captained the renowned Gloustershire Cricket Club from 1871 to 1898. Then, as today, such an offer would have only been extended to players of distinction. For reasons that we can only guess at, Denning declined Grace's invitation. One suspects, however, that the offer was declined because the young Denning had already set his sights on a career in astronomy. At the time that the offer to play for Gloustershire was made Denning would have been in his early to mid-twenties.

Denning had a life-long interest in natural history, but began to specialize in astronomy at 17 years of age. In 1895 he wrote [3], for example, that he had, "been engaged, as an amateur astronomer, in observing celestial objects or in exploring the heavens, since 1865." It is probably significant that within a few years of his decision to pursue astronomy, Denning was fortunate enough to witness the spectacular meteor storm of 1866, and the flight of an awe inspiring fireball on the night of November 6th, 1869. It may be possible to speculate that it was the observation of these two impressive events that turned Denning's interests towards meteor astronomy. The 1869 fireball event was particularly significant since it initiated an important series of correspondence with Alexander Stewart Herschel. During the mid to late 1800's A. S. Herschel was one of the leading exponents of meteor astronomy in Britain, and he exchanged letters with

Denning [4] from 1869 to 1907 (the time of Herschel's death).

3. The amateur astronomer:
While meteor studies were to dominate Denning's later research interests, his early observational projects were many and varied. Denning purchased his first telescope, a 4.5-inch refractor, in 1866. As testament to his all-round enthusiasm and ability it can be observed that among Denning's first set of published notes there are several accounts pertaining to sunspot groupings, the timings of jovian satellite transits, and a record of a transit of Mercury [5].

Denning's first publications appeared in the Astronomical Register, and he began to submit material to this journal in 1868. The Astronomical Register had been founded by Sandford Gorton in 1863, and was the first British journal published with the amateur astronomer in mind [6]. Denning became a regular contributor to the Register, and he used its pages to describe, and initiate a series of observational campaigns. Details of the first campaign that Denning organized can be found in a letter to the Editor dated March 16th, 1869. Denning, along with sixteen other observers proposed to continually monitor the Sun between March 14th and April 14th (1869), "with the view of re-discovering the suspected intra-Mercurial planet Vulcan." [7] It is not clear how, or when, the members involved in this study were first assembled, but it is probably safe to assume that the Astronomical Register was their common focus, and that the organizing correspondence followed exterior to its pages. While the search for Vulcan was unsuccessful (we, of course, now know that any such search would have to be unsuccessful), Denning's enthusiasm for organized observing clearly remained high, and on July 1st, 1869 he became one of the founding members, as well the Treasurer and Secretary, of the Observational Astronomical Society (OAS). This unfortunately short-lived society was in many ways the forerunner of the present-day British Astronomical Association (founded 1890). The initial OAS membership was stated to be about fifty observers [8]. Denning compiled quarterly reports on the observations collected by the OAS members, and these were published in The Astronomical Register and the journal Nature. Denning was closely involved with several further campaigns intended to re-discover Vulcan, and (more fruitfully) in a series of studies of Venus.

Denning compiled reports for the OAS throughout 1870, and became Honorary Secretary to the society in 1871. Also in 1871 Denning purchased a 10-inch With-Browning reflecting telescope. This telescope became Denning's main research instrument and he used it to good effect in his subsequent planetary work.

In late 1871 Denning published, through Wymann, and Sons of London, his first astronomy book. Titled *Astronomical Phenomena in 1872* this text was seemingly written with the amateur astronomer in mind, and it was probably intended as a handbook for OAS members. The book, however, was reviewed in the influential journal Nature with the anonymous reviewer giving it a decidedly poor evaluation [9]. The reviewer was to write that the, "general remarks on astronomical observing ... are addressed to the simplest tyro, and are so meager as to give the impression of a want of accurate knowledge." The review concluded, "altogether the book is a very weak production." One assumes that such a review would have disappointed Denning, and certainly no subsequent handbooks were produced.

It was presumably a disappointment to Denning that the OAS ceased activity in 1872. The last OAS report compiled by Denning [10] was published in May of 1872, and after that time, while individual notes by Denning, and other OAS members can be found in the literature, there are no more joint OAS projects reported. In December 1872 Denning published his first observational note [11] in the Monthly Notices of the Royal Astronomical Society (MNRAS). At about the same time that his first MNRAS note appeared Denning proffered his candidacy for fellowship to the RAS. He was, however, unsuccessful in his first attempt at Fellowship, and was not in fact to be elected a Fellow until 1877. The RAS does not keep records outlining the reasons for non-election of candidates [12], but one can speculate that the demise of the OAS, of which Denning was a prominent member, and the poor review of his first book were contributing factors.

Undaunted by the sour events of 1872 Denning continued to pursue his astronomical studies. Throughout the 1870's the majority of Denning's published notes were concerned with the observation of meteors, and the reduction of meteor radiants. His first radiant catalogue was published [13] in the MNRAS in 1876. This catalogue was based on observations collected between 1872 and 1876. An interesting point concerning Denning's 1876 radiant catalogue is that it was communicated to the Society by R. P. Greg. Along with A. S. Herschel, Greg was one of the foremost authorities on meteor astronomy in England at that time. Greg's endorsement of Denning's meteor work was no doubt an important factor in Denning's eventual election as a Fellow of the RAS.

Denning made his first truly significant contribution to meteor astronomy in 1877. It was in that year Denning, then 29 years old, was able to demonstrate a steady night by night movement in the Perseid meteor radiant. Denning's observations essentially confirmed, for the first time, a long postulated theoretical prediction. More significantly, however, in the following year (1878) Denning published his first paper suggesting that some meteor radiants were in fact stationary in the sky [14]. This important paper was controversial since it suggested something entirely new. The stationary radiant hypothesis, as Denning's claim came to be called, was problematic since it was clear from the outset that the origin of such meteoroid streams could not be explained through cometary decay [15]. The issue concerning the true existence of stationary radiants took many years to resolved and even at the time of his death, Denning still firmly believed in their existence.

With the close of the 1870s Denning began to publish an increasing number of notes on planetary observations (see figure 1). Using his 10-inch With-Browning reflector he embarked on a series of studies to determine planetary rotation rates. While he regularly observed Mercury, Venus, Mars and Saturn, the majority of his attention was directed towards Jupiter. Great interest had been excited towards Jupiter after what is now known as the Great Red Spot came into prominence in 1878. Denning made a detailed historical study of the Red Spot's appearance (published in 1899), and in his life time recorded many thousands of Jovian surface transits.

Parallel to his increased interest in planetary observing, Denning also began to search for comets in the 1870s. His efforts were rewarded in 1881, when on the morning of October 4th he discovered his first comet. This comet turned out to be a short period comet and the story of its discovery was often used by Denning as an example of why an "observer should never hesitate." [16] He noted, "on July 11, 1881, just before daylight, I stood contemplating Auriga, and the idea occurred to me to sweep the region with my comet eye-piece, but I hesitated, thinking the prospect not sufficiently inviting. Three nights later Schrabele at Ann Arbor, U. S. A., discovered a bright telescopic comet in Auriga! Before sunrise on October 4 the same year I had been observing Jupiter, and again hesitated as to the utility of comet-seeking, but, remembering the little episode in my past experience, I instantly set to work, and almost at the first sweep alighted upon a suspicious object which afterwards proved itself a comet of short period." From all accounts, Denning took this cometary episode to heart, and thereafter never hesitated at the thought of making any observation. Indeed, on the comet-seeking front Denning continued to have a measure of success, discovering three more comets in 1890, 1892, and 1894. For each of these discoveries he was awarded Bronze Medals by the Astronomical Society of the Pacific. Denning was also co-discoverer, with E. E. Barnard in America, of a comet in 1891.

By the mid- 1880s Denning's publication rate had risen to about 20 articles and observing notes per year, and his reputation as a dedicated and skilled observer was becoming widely known. His high standing in the amateur astronomical ranks was recognized in 1887 when he was elected President of the Liverpool Astronomical Society (LAS). This society, which still thrives today, had been founded in 1881, and at the time of Denning's election boasted some 440 members world-wide. In addition to his election as President, Denning was also elected to the Directorship of the meteor, and comet-seeking section, as well as the planetary (Jupiter) section.

Denning's return to organized amateur astronomy seems to have been largely successful. During his year long Presidency the LAS continued to prosper [17], and its membership increased to 641. The society held monthly meetings in several centres throughout England. Denning was a regular attendant at the divisional meetings held in London, and there he read a series of papers on meteors, comets, and planetary observing. He also wrote a collection of articles on telescopes, and telescopic work for the society's journal. These articles were later collected and expanded to form his second book. Denning's new work, entitled *Telescopic Work For Starlight Evenings* was published in 1891 and, just like his first book, was reviewed in Nature. This time, however, the text received whole hearted praise [18]. The anonymous reviewer wrote, "As might be expected from such an experienced and enthusiastic observer as Mr. Denning, this book is thoroughly practical. He is not content with describing the beauties of the skies, but gives invaluable information as to how to see them better." With similar praise, the reviewer concluded, "Everyone who uses a telescope, or who intends to use one, of whatever dimension, should read Mr. Denning's book."

Following his term as President to the LAS, Denning served as Vice President to the society through 1888. After this time he was only to continue his involvement with organized amateur astronomy through the newly formed British Astronomical Association (BAA). The announcement to establish what was to become the BAA appeared in the English Mechanic magazine on July 18th, 1890. Interestingly,

while Denning certainly read this magazine he made no attempt to become involved with the initial formation of the association. One wonders if memories of the short-lived OAS tempered his outlook on the prospects for this new amateur body. If this was the case, he had certainly changed his mind by June 1891, since on that date, having been described by the association's President as "an earnest and successful comet-seeker" Denning was elected a BAA member. He was also invited to be the first Director of the association's comet section [19]. The chief objectives of the BAA's Cometary Section were later outlined by Denning as, "comprising the discovery of new comets, nebulae, and recording telescopic meteors." [20] At its inception, next to Denning, there were three other observers in the comet section. This was to rise to seven observers by the time Denning retired his Directorship in 1893. Denning cited poor health as the reason for stepping down from office, and it would appear that the general state of his well being deteriorated from about 1890 onwards.

In addition to being elected Director of the BAA's cometary section, Denning was elected [21] a Corresponding Fellow of the Astronomical and Physical Society of Toronto, in Canada, in 1891. This society, later to become the Royal Astronomical Society of Canada (RASC) had approached Denning with reference to his work as an observer, and upon his being a prolific writer. Denning became a regular contributor to the Journal of the RASC, and within its pages was to publish several articles popularizing meteor astronomy [22].

Denning's high standing as an observer, both within the British Isles and around the globe, was recognized in the 1890's through the award of several prestigious medals. The French Academie des Science was to bestow their Valz prize on Denning in 1895 in recognition of his meteoric studies [23]. The RAS also honoured Denning [24] by the award of their highest medal, the Gold Medal, in 1898. This latter honour, bestowed in his fiftieth year, marked the zenith of Denning's career. His skill as a planetary observer, and recorder of meteors was now universally recognized. Not just in the scientific domain, however, Denning's authority extended even to the literary world. Writing in his new book, The War of the Worlds (published 1898), the renowned novelist H. G. Wells was to open chapter 2;

"Then came the night of the first falling star. It was seen early in the morning rushing over Winchester eastward, a line of flame, high in the atmosphere. Hundreds must have seen it, and described it as leaving a greenish streak behind it that glowed for some seconds. Denning, our greatest authority on meteorites, stated that the height of its first appearance was about ninety or one hundred miles. It seemed to him that it fell about one hundred miles east of him." [25]

During the last few years of the 1890s Denning was to publish several important studies on meteor astronomy. In 1897 his third book, *The Great Meteoric Shower of November* appeared [26]. This work was solely concerned with the Leonid meteor shower, and as with *Telescopic Work For Starlight Evenings* was based on a collection of articles previously published in the astronomical literature. This third book was a grand synthesis of virtually all that was known about the shower, and its text offered an historical survey along with the results of many collected observations.

In 1899 Denning published what was to become one of his most important works [27], the General Catalogue of the Radiant Points of Meteoric Showers and of Fireballs and Shooting Stars Observed at more that one Station. In brief, this catalogue was a general review of Denning's work on the determination of meteor radiants. The General Catalogue was appropriately published in the same year that Denning held the Directorship of the BAA's Meteor Section. Denning was to hold this office for just one year, and again was to cite poor health for retiring from the post. It is not entirely clear what form of ill health Denning was suffering from at this time, but it is noteworthy that he had also cited health problems as the reason for not attending the ceremony at which his RAS Gold Medal was awarded [24].

In 1904, at the age of 56 years, Denning was awarded a Civil List Pension by the British Government [28]. This pension which amounted to £150 per annum was presented "in consideration of his services to the Sciences of Astronomy, whereby his health has become seriously impaired, and of his straitened circumstances." In 1906 Denning's health took a sufficiently bad turn that he elected to abandon planetary observing altogether, and he thereafter concentrated his efforts towards naked-eye astronomy, and the reduction of meteor radiants.

The first decade of the 20th century delineates a clear transitional period in Denning's life. Not only was his health deteriorating, but he became an increasingly reclusive figure. From circa 1900 onward he saw few people, and only rarely left his home. Certainly, it would seem that he did not travel beyond the confines of Bristol. During the last thirty years of his life Denning's only contact with the astronomical community was by extensive correspondence. It is a

sad misfortune that only a small fraction of this correspondence seems to have survived to the present day. One of the largest surviving fragments of correspondence, however, is that with A. S. Herschel. And, even this collection of letters is unfortunately one sided with only the letters from Herschel to Denning being extant [4]. The Herschel-Denning correspondence that has survived to the present day dates from the period August 31st, 1871 to September 12th, 1900. The letters cover all aspects of meteor astronomy, and offer a few tit-bits of personal information, and activities. Most of the correspondence, however, deals with the exchange of observational data.

Alexander Herschel died in 1907, and Denning was to write his obituary [29] for the journal Nature. In his account Denning explained, "it is not too much to say that without the deep interest incited by Prof. Herschel's letters the meteoric observations obtained at Bristol during the past thirty-five years may never have been made." Indeed, Denning lost an important friend and confidant when Herschel died. Not only had Herschel openly encouraged Denning in his meteoric work, but he was also a strong supporter of the stationary radiant concept. The stationary radiant issue had by circa 1910 become very controversial, and Herschel's death left Denning with virtually no supporters from within the ranks of the 'professional' astronomers.

It is probably safe to suggest that some of Denning's growing reclusiveness was due to the increasing number of attacks on the stationary radiant concept. Some hint of Denning's bitterness towards this controversy can be found as early as 1891 when he wrote, "as a rule, amateurs should avoid controversy, because it very rarely clears up a contested point ... it wastes time, and often destroys that good feeling which should subsist amongst astronomers of every class and nationality ... competition and rivalry in good spirit increases enthusiasm, but there is little occasion for the bitterness and spleen sometimes exhibited in scientific journals." [30] For the moment we simply observe that the existence of stationary radiants was an issue that dominated the last thirty years of Denning's life. It is also worth noting that Denning's continued belief in the existence of stationary radiants saw him become increasingly alienated from the main-stream of astronomical thought.

Denning quietly continued his work on the reduction of meteor radiants throughout the second decade of the 20th century. He was to return to the astronomical lime-light, however, in 1920 when on the night of August 20th he discovered a nova in the constellation of Cygnus [31]. This discovery offers clear testament to Denning's tenacity as an observer and to the great acuity of his septuagenarian eyes.

In 1922 Denning's standing as a respected meteor observer was further acknowledged by an invitation to become the first President of the Commission des e'toiles Filantes in the newly formed International Astronomical Union (IAU). Denning had in fact been approached with the offer in 1919, and some measure of his dire situation at that time can be found in one of the few surviving letters that he wrote to his niece (Christine Gravely) [32]. In a letter dated 1919, November 25th Denning commented,

"[I have] been placed at the head of a committee of the International Astronomical Union appointed to study and advance our knowledge of meteors and meteoric phenomena. I hope to manage it all by correspondence. The first meeting does not take place until 1922 in Belgium, and it is quite a strain that someone will have to be chairman in my absence."

Denning continued in the same letter to his niece,

"my night-watchings have been few lately - I find it rather trying to be sitting out in the garden for hours on these damp cold nights. If I could take solid food and use a hamper all could be easy but things are different with me now to what they were 40 or 50 years ago when I found it quite pleasant to be out in the frost all night long!"

Understandably, advancing age and ill health were having their effect on Denning's ability to observe and participate in astronomical research. It would also appear that his spirits were at a low ebb. Writing again to his niece on September 4th, 1923 Denning explained,

"I am sorry not to have answered your letter before, but I have done very little writing indeed for some weeks having been suffering more that usual. Your bright and interesting letter was very entertaining and was read by me with great pleasure at a dull time.

I am glad you still find enjoyment in natural history subjects. If I could only get into the fields I should watch the birds more and make notes of what I saw and heard, but I am not often out in my own garden now and I have made hardly any observations during the last two years.

This has been detrimental to me in various ways. I used to have the expectation of a night's successful observation and after that the discussion of my results

and comparison with details obtained before proved engrossing. It passed the time agreeable and occupied my thoughts - whereas now I have no new work to think about or fresh discoveries to look forward to. Day and night succeed each other with dull monotony.

You were kind enough to inquire about the articles I had been writing lately for a serial now being issued entitled The Splendour of the Heavens. It is a grandly illustrated work. I have written rather long chapters in part 6 and 9 and another chapter on shooting stars will be printed in part 11 or 12. The work is full of most attractive pictures, and I believe they will be appreciated by everyone fond of astronomy."

The book that Denning refers to in this letter, The Splendour of the Heavens, was edited by W. H. Steavenson, and was destined to become a popular, and widely read astronomy text. Steavenson was to later recall [33] a visit to Denning's home at this time (circa 1922). He remembered being greeted by a subdued figure draped in an old overcoat warming himself by a fire in surroundings of dank poverty. It is also at this time, the story is recounted, that the young boys of Denning's street (Egerton Road) used to taunt and shout at him whenever he left the house [33]. It would seem that Denning's reclusive, poverty-stricken life-style, along with his 'strange' interest in the stars had become the cruel butt of school boy humour.

In 1927 Denning was awarded the degree of Master of Science, honoris causa, by the University of Bristol. Denning's health at that time was sufficiently poor that he was unable to attend the award giving ceremony. Indeed, he was even unable to receive a deputation from the University. His degree was eventually conferred in absentia [34]. It is fitting that Denning's final academic award for services to astronomy was bestowed by his 'home-town university', and the degree represents a well deserved crown on a life dedicated to the furtherance of meteor science. Right up to the very last Denning was recording, and collating meteor data, and his final observing note, published in the Observatory magazine, appeared just a few weeks before he passed away [35]. At the age of 83 years Denning died on 1931, June 9th. The cause of his death being determined as arricular fibrillation.

Denning's death was announced in the Times newspaper on June 10th, and a brief biographical account was published the following day. The June 11th "special article" was written by Sir Henry Maddocks K.C., who heralded Denning as the, "doyen of amateur astronomers." In unison with the astronomical community, the City of Bristol also honoured Denning's achievements by erecting a memorial tablet at his home (of the previous 26 years) in Egerton Road. At this ceremony Dr. Knox Shaw, President of the RAS, remarked that, "Mr. Denning was an amateur in the true sense of the word. He studied the heavens not in the hope of gaining fame or renown, but because he could not help it." [36]

4. The Other Side of the Man:

We have now accomplished the main chronological description of Denning's life. There are, however, a few points that should be addressed before we close our review. One issue that has proved difficult to fully determine, is how Denning made a living - that is, how did Denning acquired money for his every day expenses? Several of his obituary accounts [1,2] suggest that Denning was a trained accountant, but there is in fact no evidence to support this claim. Certainly Denning's father (Issac Poyntz Denning) was the leading partner in the accountancy firm Denning, Smith and Co., but Denning himself was apparently never on the official payroll. The partnership of Denning, Smith and Co., is described in the 1868 Trade Directory for Bristol as being a, "public and private accountants, auctioneers, bankruptcy, insolvency, and general agents, valuers, etc." Later directories indicate that Denning's brother, Frederick Denning, became a partner in the company, and that circa 1890 the partnership was to become just Denning, and Co. While Denning, and other family members are listed in the various name directories for Bristol throughout the 1880s and 1890s at no time is Denning ever described as an accountant. It would seem that the obituary accounts are somehow confused. Confused, that is, in the sense that Denning was never a fully trained, registered and practicing accountant. Further confusion is also evident from the observation that Denning's father, Issac Poyntz Denning, was referred to in several obituary accounts as having been "Borough Accountant of Bristol". This was never the case. Certainly, it is possible that he may have undertaken occasional work for the City, but not through the auspices of an official civic office.

Writing in 1905, H. Macpherson noted [37] that Denning followed a journalistic line of work. This would make more sense when one considers Denning's life style. It would not have been easy to hold down a full time day-job, and spend as much time observing as Denning evidently did. Certainly journalism, and popular writing were two ways that Denning would have made some money. Many newspaper articles, and popular accounts by Denning are in existence, and one can find general astronomy articles by him in, for example, the *Boys Own Magazine*, and *Encyclopedia Britannica*. It has been suggested that Denning received occasional monies from Queen Victoria to

carry on his work [38]. Again, it has not been possible to confirm this, although such gifts were indeed conferred on occasion [39]. Maddocks [40] also notes that Denning's income had, "been argumented in recent years [circa 1920? - 1930] by subscription among his brother astronomers who have thereby shown their appreciation of his quality".

The only regular source of income that can be attributed to Denning is that of his Civil List Pension, which was awarded in 1904. He was, however, 56 years old when this was first paid out. It would seem from the available information that Denning followed no full-time accountancy career. He did generate, however, a small income from both writing and journalism, and possibly by some part-time accountancy work. On a few occasions Denning's income was complemented by prize money. The Valz Prize (awarded by the French Academie des Sciences), for example, came complete with a cash award of fr. 460. The suggestions that Denning led a reserved and frugal life would certainly appear to be true. Some further indication that Denning was unable to fully support himself financially is offered by the fact that he was listed as living at the same address as his parents in the 1880 and 1890 Bristol Name Directories. He would have been respectively 32 and 42 years of age in those years. Denning moved to his last, and probably best known address, 44 Egerton Road, in 1906. That he was able to support himself there in the long term was, no doubt, due to the financial security afforded by his Civil List Pension.

As testament to his all round character it is worth pointing out that not all of Denning's writings were concerned with astronomical research. Indeed, Denning would on occasion express his thoughts and feelings through prose and poetry. There is no direct evidence to support the notion that Denning was a deeply religious man, but it is clear that he rejoiced in the study of nature, and in the observation of the heavenly cycles. Being self taught, and with no formal scientific training, Denning relied purely on what he saw with his eyes when formulating ideas, making no speculative suggestions above or beyond what he observed. In this sense Denning was a true Baconian scientist. Certainly, for so it would seem, Denning was driven to make his observations by a quest for truth. Not only the truth, however, Denning also believed in a sense of scientific continuity. He was to write, for example, "the work of observations must go on continuously. It is like a river which runs endlessly along the shores of time connecting the past with the present and the present with the past." [41] For Denning the act of observing was part and parcel a quest for understanding, and a contribution to the 'river' of knowledge. Denning's feelings towards observing are further expressed in his comments concerning the supposed observation (in 1900) of markings on Saturn's disk, "it resolves itself into a question of ethics. There are men who will report nothing but what they are absolutely certain is presented to their eyes, and are unbending in their regard for the truth." [42] Denning's outlook on life was guided by high principles, and it would seem that truth, continuity and personal integrity were the underlying ethics that Denning employed in his studies.

There is no great evidence to support the idea that Denning was a 'serious' poet. Rather it would seem that he occasionally used poetic language to express his enjoyment at participating in the scientific process. What poetic verse Denning did write may have been fanciful and romantic, but it was not romantic in the poetic sense. The romantic poetry of Wordsworth and Keats, after all, was essentially a reactionary backlash against the critical rationalism of science. In this manner Denning's few surviving poems have more in common with the works of Mark Akenside and James Thomson, poets who rejoiced at the wealth of knowledge that scientific study brought forth, than with those of his contemporaries such as Tennyson and Hardy, who were more inclined to see nature and its study in a darker and more ominous light [43]. One example where Denning used both prosaic language and poetry to express his feelings can be found in an article written circa 1895. In this account Denning rejoices at the imminent arrival of spring [44], and he expounds,

"Oh, Spring! Dear Spring! Thou more dost bring
Than birds, or bees, or flowers -
The good old times, the holy prime
Of Easter's solemn hours;
Prayer's offer'd up and anthems sung
Beneath the old church towers."

Following this triumphant outpouring Denning continues, "The opening of the snowdrop and crocus tells us that spring is near, the bloom of the primrose and violet brings us the realization. March, though it has its keen winds and sometimes wears a wintry frown, yet proves that the dark days are past, and towards the end of the month gently introduces us to the summer's advent in the person of her younger and sweeter sister spring." There is a clear sensitivity in Denning's writing and indeed, one can sense that he has a deep respect for nature. Clearly Denning experienced a heart-felt joy in observing the seasonal change.

Smatterings of other poetic verse can be found in Denning's Telescopic Work For Starlight Evenings. Concerning the observation of Mercury, Denning was to write,

"Come, let us view the glowing west,
Not far from the fallen Sun;
For Mercury is sparkling there,
And his race will soon be run.
With aspect pale, and wav'ring beam,
He is quick to steal away,
And veils his face in curling mists, -
Let us watch him while we may."

And in similar lyrical tones Denning was to write of the planet Saturn,

"Muse, raise thy voice, mysterious truth to sing,
How o'er the copious orb a lucid ring,
Opaque and broad, is seen its arch to spread
Round the big globe, at stated periods led."

Interestingly, while the study of meteors was one of Denning's major pre-occupations only one poem on this topic seems to have seen print. This poem, simply called Falling Stars, appeared in the Journal of the Royal Astronomical Society of Canada in 1915, and was written just two days after his 66th birthday [45]. The poem is worth re-producing in full since its verse does offer some insight into Denning's personal thoughts and feelings:

Bright falling stars I greet you with a smile,
While you beguile,
My loneliness, with pleasure pure and sweet
In moments fleet.
In coloured beauty and in lustre dressed,
Never at rest,
You span the sky and guild the heav'nly way
With sparkling ray.
I only know the moments of your birth,
Above the earth;
As she performs her yearly round in space
You run your race
And pierce the blue just as a flashing blade
Too quick to fade.
Along your flight the burning embers sow
An after-glow,
To mark your path amid the stars of night,
With guiding light.
I never know the instant when you will
Disturb the still
Of Heaven's stars and speed athwart the sky
All silently.
Nor can I tell in Nature's open book,
Just where to look,
To watch your coruscations wax and fade
Amid night's shade.
Adown the east or west your fiery ball
May headlong fall,
Or, slowly, stream along the starry height
In graceful flight.
Whene'er you come you bring a joyous thrill
My soul to fill.
Oh messengers from distant worlds! I yearn
Your tale to learn,
And I await, amid earth's frosted dews,
Celestial news.

This poem is one of pure celebration. It celebrates the phenomena of shooting stars, and it celebrates the joy inherent to their study. It is also a personal poem that hints at loneliness, and pain.

Denning's reclusiveness was a well known characteristic, and he seems to have had few close and personal friends. Denning mostly made contact with the outside world through an extensive correspondence, and within this correspondence he only occasionally offered some personal thoughts. In a letter to Grace Cook [46], however, Denning wrote of the fatigue that he experienced after a long observing session, "I fancy it does me good intellectually and physically to be at work exercising my patience in this way. Anyone who really loves the stars for their own sake need never despair of finding, sooner or later and whatever troubles may oppress him, not only a solace but a supreme happiness in contemplating them". He also wrote to Cook on another occasion commenting that once the 'spirit of the night' appeared to him after a long night's observing session. Upon being asked if he [Denning] would see her again, the 'spirit' replied, "at some hour when you feel weary with your labours and the night is far spent I will come to cheer you."

We have now to conclude our brief look into the life and times of William Frederick Denning. The patchwork that constitutes the legacy of this great amateur observer is by no means finished, but at least some structure and colour has been added to its form.

I do not think that Denning had any delusions of greatness, although I do believe that he was a great amateur astronomer. In this manner our parting image of him should be one of a passionate and dedicated astronomer, a man enthralled by the heavens and a man who was dedicated to the act of observing. Denning's image is not one of a great and revered genius of science, rather it is one of a gentleman who found his peace amongst the stars. He found joy under the dark Bristolian skies while those around him slept

snugly in their beds. It is a shadowy image that we see moving at the telescope, an earnest observer silhouetted against the crisp dark sky, and it is with Denning's contented words that we conclude our imagery: "I have supped and imbibed moderately, and even had my 'weed' at the telescope. When I discovered the periodical comet of 1894, on March 26 of that year, I was enjoying my pipe, and it is fortunate for me that the little stranger was not blotted out amid the wreaths of smoke."

5: Acknowledgments:

Many people have helped me during my researches on Denning's life and works. I am deeply grateful to George Spalding, formally Director of the BAA Meteor Section, who supplied many insightful comments about Denning's work. Maurice Brain of the Bristol Astronomical Society kindly supplied me with photocopies of two letters that Denning wrote to his niece. James Muirden was also kind enough to supply some details from his own researches. Peter Hingley, Librarian to the Royal Astronomical Society helped me with obscure references on numerous occasions. Mr. E, C. Wright, Registrar and Secretary, University of Bristol kindly supplied me with information concerning Denning's honary degree, and Mr. A, Derrett, Assistant Registrar to the Royal Archives, Windsor Castle helped me with details concerning Denning's supposed Royal patronage payments.

6. Notes and References:

1] Prentice, J. P. M. 1931. Journal of the British Astronomical Association. 42, 36 - 40.
2] Phillips, T. E. R. 1931. Observatory magazine, 54, 276 - 282. Many obituaries were written for Denning, and in addition to those by Prentice (Ref. 1) and Phillips further accounts can be found in the Monthly Notices of the Royal Astronomical Society, 92, 1932, 248 - 250., and Nature, 128, 1931, 12 - 13. Denning in fact used his knowledge of cricket on at least one occasion (Nature, 51, 1895, 320 - 321) to illustrate his frustration at the manner in which some observatories set about making meteoric observations. He noted "it seems to be the fashion at certain observatories to set a number of observers (some of whom have perhaps never registered a meteor path before) watching and recording meteors, and then to investigate their results as though they could be thoroughly depended upon. It is similar to placing a man, who has never played in a cricket match before, as wicket-keeper to fast bowlers like Mold, Richardson and Woods, and expect his performance to be creditable." The analogy is in fact a good one, and Denning was often critical of the many poor observational accounts that found there way into the astronomical literature.
3] These comments were found in an article entitled "A self-made English Astronomer", published in the North British and Ladies Journal, April 4th, 1904.
4] Beech, M. 1992. The Herschel - Denning Correspondence. Vistas in Astronomy, 34, 425 - 447.
5] See the Astronomical Register, 6, 1868, 92., for Denning's very first publication. This article was concerned with Observations of Jupiter's Satellites. Further notes by Denning are found in the same volume of the Register on pages 137, 256, and 266.
6] Johnson, P. 1990, The Astronomical Register, Journal of the British Astronomical Assoc., 100, 62 - 66.
7] Denning, W. F. 1869, The Supposed New Planet Vulcan, The Astronomical Register, 7, 89. The first supposed sighting of Vulcan was made on March 29th, 1859 by the French country doctor Edmond Lescarbault. Denning seems to have been very interested in re-discovering this planet, and he even alluded to having seen it himself. Writing in 1871 (Astronomical Register, 9, 287) Denning commented "some years ago, I saw, what I supposed must have been, a planetary body in transit across the Sun." Denning's memory was not too clear on when his observation was made, but he noted "it must have been between June, 1860, and June 1863, and I imagine the season was either spring or autumn." In the years stated Denning would have been between 12 and 15 years old. Denning was later to write of Lescarbault (see Ref. 16. p. 350.) that he "obviously lacks the experience and caution necessary to command credit." These comments followed in the wake of Lescarbault's announcement that he had discovered a "new star" in Leo on the night of January 11th, 1891. Incredibly, this "new star" was not a nova but the planet Saturn, and indeed, Denning's comments seem apt.
8] Newall, H. F. 1987, in History of the Royal Astronomical Society: 1820 - 1920. p. 135. Blackwell Scientific Publications, Oxford.
9] Anonymous review in Nature, 4, 1872, 261 - 262.
10] Denning, W. F. 1972, Nature, 6, 94.
11] Denning, W. F. 1872, Observations of Luminous Meteors, Monthly Notices of the Royal Astronomical Society, 33, 93 - 95.
12] Hingley, P. (Royal Astronomical Society Librarian) 1990, personal communication.
13] Denning, W. F. 1876, Radiant - Points of Shooting Stars, Monthly Notices of the Royal Astronomical Society, 37, 282 - 284.
14] Denning, W. F. 1878, Suspected Repetition, or Secondary Outbursts from Radiant Points; and the Long Duration of Meteor Showers, Monthly Notices of the Royal Astronomical Society, 38, 111 - 114.
15] That meteoroid streams could be produced through cometary decay was realized in the mid 1860s. The Italian astronomer Giovanni Schiaparelli first

demonstrated this in 1866 when he found that the Perseid meteoroid stream had orbital parameters similar to those of periodic comet Swift - Tuttle. I discuss the history of meteoroid stream formation in Beech, M. 1997, WGN 25 (4), 157 - 160. A more detailed understanding of the cometary - meteoroid stream formation process did not become available until well into this century. This work was initiated by Fred Whipple during the 1950s. A general introduction to cometary physics is given by Brandt, J. C., and Chapman, R. D. C. 1981, in Introduction to Comets, Cambridge University Press, Cambridge.

16] Denning, W. F. 1891, in Telescopic Work for Starlight Evenings, Taylor and Francis, London., p. 79.

17] Report from the Seventh Annual Meeting, 1888, July 9. The Observatory magazine, 11, 309 - 311.

18] Anonymous review in Nature, 44, 1891, 467.

19] The first President of the BAA was Captain William Noble, and his comments concerning Denning can be found in the Memoirs of the British Astronomical Association, 36, (2), 1948, p. 10.

20] Denning, W. F. 1891, Journal of the British Astronomical Association, 1, 490.

21] Denning's fellowship was announced in the Trans. Physical Society of Toronto, 1891, 2, 45.

22] Beech, M. 1990. William Frederick Denning: in quest of meteors, Journal of the Royal Astronomical Society of Canada, 64, (6), 383 - 396.

23] Denning's award of the Valz Prize was announced in Nature, 53, 1896, 215.

24] The Presidents address at the presentation of Denning's Gold Medal is reproduced in the Monthly Notices of the Royal Astronomical Society, 63, 1898, 242 - 253. Denning did not attend the presentation due to poor health. Denning's Gold Medal is presently on display in the Royal Astronomical Society's Fellows Room at Burlington House in London.

25] Wells, H. G. The War of the Worlds, Pan Classics, Pan Books Ltd, London, 1975.

26] This book was based on a collection of articles previously published in the Observatory magazine. A favourable review was given to the volume in Nature, 57, 1897, 7. Denning was to later produce another book that was based on collected Observatory magazine articles. This book, The Planets Mercury and Venus, appeared in 1916, and was reviewed in the Observatory, 39, 1916, 469.

27] Memoirs of the Royal Astronomical Society, 53, 1899, 203 - 292.

28] House of Commons paper 201, 1905. The British Government Archives.

29] Denning, W. F. 1907, Nature, 76, 202.

30] Ref. 16. p. 56.

31] Denning, W. F. 1920, Nature, 105, 838. A review of observations collected at the Greenwich Observatory, London concerning this nova is given by Luyten, W. J. 1920, Monthly Notices of the Royal Astronomical Society, 81, 61 - 65. See also Beech, M., 1993. Denning on Novae, Journal of the British Astronomical Association, 103, 130.

32] I am indebted to Maurice Brain for making copies of several letters by Denning available to me.

33] Muirden, J. 1989, personal communication.

34] Wright, E. C., Registrar and Secretary, University of Bristol, 1987, personal communication. Although the award given by Bristol University was to be the last Denning received while alive, he was posthumously honoured by having craters on the far side of the Moon, and the surface of Mars named after him.

35] Denning, W. F. 1931, Autumnal Meteors, Observatory , 54, 271 - 272

36] Memorial speech by H. Knox Shaw reproduced in the Western Daily Press, December 19, 1931.

37] Macpherson, H. 1905, in Astronomers of Today, Gall and Inglis, London, p, 172 - 178.

38] Brain, M., 1989, personal communication.

39] Derrett, A., Assistant Registrar to the Royal Archives, Windsor Castle. 1989, personal communication.

40] Maddocks, H. 1931, Mr. W. F. Denning: Doyen of Amateur Astronomy, in the Times newspaper, Thursday, June 11th, page 16, column b.

41] This reference is based on a newspaper cutting among the Denning archives of the British Astronomical Association's Meteor Section. The article was clearly published in a newspaper, but it is not clear whether it was a national or provincial paper. The article was seemingly written circa 1900.

42] Denning, W. F. 1900, Notes on Saturn and His Markings, Nature, 67, 237.

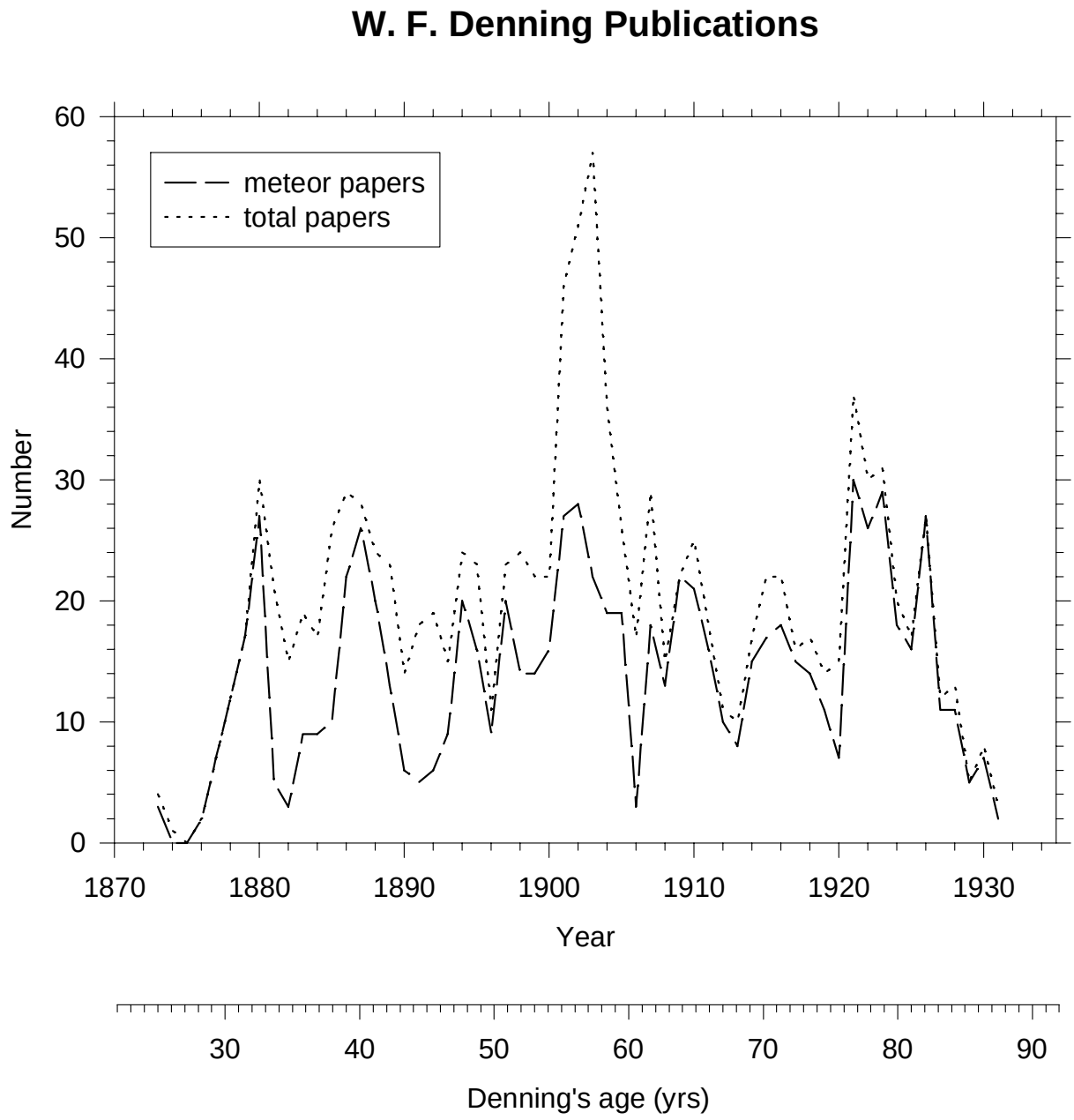
43] Beech, M. 1989. Meteor Imagery in English Poetry. New Comparison, 7, (2), 99 - 112.

44] As with Ref. 41 this quotation is taken from a cutting in the Denning archive. This article was written circa 1895.

45] Denning, W. F. 1915, The Claims of Meteoric Astronomy, Journal of the Royal Astronomical Society of Canada, 9, 57 - 60.

46] Cook, A. G. 1931, Journal of the British Astronomical Association, 42, 1931.

Figure 1: Denning's annual publication rate. The dashed line corresponds to the number of meteor related papers, while the dotted line indicates the total number of papers published. The data used in the construction of figure 1 represent a lower bound on Denning's actual output. He wrote widely and the data represents his contributions to the main journals of his time (e.g., The Observatory, Monthly Notices RAS, JBAA, Astr. Nachr, Nature, Knowledge and Science News, etc...). In total, Denning published 1179 papers in the major astronomical/science journals between 1873 and 1931. Of these 825 (70 percent) relate to meteor studies, 153 relate to jovian studies and 88 relate to cometary observations. The remainder of the total relate to many diverse topics. Denning achieved a remarkable average publication rate of 23 papers per year for 58 years. The yearly rate shows a marked peak circa 1905. This corresponds to time at which Denning was award of a Civil List pension, and presumable represents a time in which his financial situation was significantly improved and in which he had more time to dedicate to his observations. The vast majority of the 'extra' papers between 1902 and 1908 were concerned with observations of the planet Jupiter. There is an interesting ~10 year cycle in the publication rate for which I can offer no explanation.


W. F. Denning Publications
meteor papers
total papers
Number
Year
Denning's age (yrs)
0
10
20
30
40
50
60
1870
1880
1890
1900
1910
1920
1930
30
40
50
60
70
80
90