

Denning on Comets, nebulae and novae

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Reprint from WGN, The Journal of IMO 26(6), 1998, 268-272

In this article we continue our celebration of the life and works of William Frederick Denning. As a tireless investigator of the heavens, Denning turned his attention toward many diverse astronomical subjects, and here we discuss aspects of his observation and discovery of comets, nebulae and novae.

1. Comet-sweeping:

Denning's personal journals and published works clearly indicate that he dedicated a considerable amount of telescope time towards searching for comets. And indeed, history tells us that in the gentle art of comet sweeping he was highly successful, with four cometary discoveries being accredited to his name. The faint, nebulous glimmerings of the comets now designated 72P/1881 T1, C/1890 O2, C/1892 F1, and D/1894 F1, were first swept-up by Denning and his telescope, and he was pre-empted by just a matter of hours in the discovery of comet C/1891 F1.

Denning's first official office within the British Astronomical Association was as the Director of the Comet Section. He held this post from 1891 and 1893, and only later, from 1899 to 1900, did he take-on the role of Director of the Association's Meteor Section. Denning's views on comet-seeking afford a good example of his general belief that systematic and applied work inevitably provide successful results. As early as 1882, he was to write [1] "success in this, as in other departments of research, depends, in a very large measure, upon the energy with which it is pursued. To an observer who devotes himself closely to it, and avails himself of every chance presented, there is an encouraging prospect of success." It is interesting to note, however, that in his first book, published in 1872, Denning had commented "comets are not interesting objects in telescopes" [2].

Some measure of how much time Denning dedicated to cometary work can be gained from a calculation he presented [3] in 1894. At that time he commented that in 596 hours of comet-sweeping he had discovered five comets. This averages to some 119 hours of searching per comet. Although he continually tried to promote cometary studies among English amateur astronomers Denning found that they did not easily turn to the subject. As late as 1922, Denning can be found complaining in the journal *Nature* "it is remarkable that English astronomers appear hitherto to have taken little interest in cometary work, and that very few comets have been discovered from this country. ... there are a great number of telescopic observers in the United Kingdom who have the means and the time at their disposal to accomplish valuable work in this department if they would only engage in it in an earnest manner." [4].

Only two of the comets discovered by Denning are short-period comets, the others have parabolic orbital elements. Denning's first comet was discovered on the morning of October 4th 1881, in the constellation of Leo, and it was subsequently found to have an orbital period of about 8.7 years. Comet 1894 I was discovered on March 26th, in the constellation of Leo minor, and has an orbital period of about 7.4 years. Denning's comet of 1881 was 'lost' for 97 years after its discovery (11 perihelion passages) before being re-discovered by Fujikawa in 1978. Denning's comet of 1894 has only been seen the once, and has now been 'lost' for 104 years (or 14 perihelion passages). The nodal points of comet 72P/Denning-Fujikawa fall close to the orbits of both the Earth and Venus. While there is no conspicuous annual meteor shower that can be linked to 72P/Denning-Fujikawa, Olsson-Steel [5] has found a weak shower association with a radiant in the constellation of Sagittarius. Beech [6] has further speculated upon the possibility of a venusian meteor shower from the comet. The nodal points of D/1894 F1 fall at 0.78 and 2.22 AU, and consequently no shower association would be expected at the Earth's orbit.

2. Nebulae – “the bane of the comet-seeker”

When Denning outlined the role of the BAA's Cometary Section in the June 1891 issue of the *Journal of the British Astronomical Association*, he commented that besides searching for comets its main aims were to discover new nebulae and record telescopic meteors [7]. While a working knowledge of the positions of diffuse nebulae is of value to the would-be comet-searcher, since as Charles Messier had long before pointed out they can be confused with a new comet, Denning did refer to nebulae on one occasion [2] as "the bane of the comet-seeker."

Denning discovered several new and 'unmarked' nebulae during his cometary searches and he described their position and visual characteristics in detail. The term 'nebular' was not well defined in Denning's day, and objects such as galaxies, globular clusters, galactic clusters and diffuse interstellar clouds were all included under the nebular umbrella. One contentious point concerning nebulae that Denning commented upon was the issue relating to their apparent variability. In particular, Denning made a number of comments on the supposed variability of the brightness of the nucleus of M31, the Andromeda galaxy [8]. While the variability that had been ascribed to M31 had been based upon photographic observations, Denning showed typical disregard for such 'hi-tech' results, and commented that from his experiences the supposed variability was probably due to "atmospheric disturbances." In this case Denning was correct, but instrumental techniques would soon, thereafter, begin to outstrip the human observer in both sensitivity and versatility.

3. Novae:

By their very nature the appearance of novae and supernovae cannot be predicted, and consequently their discovery must rely upon serendipitous circumstances. When Denning wrote his *Telescopic Work for Starlight Evenings* the mechanisms responsible for nova-like eruptions were completely unknown. Denning did know, however, that these 'new' or 'temporary' stars required an "exceptional explanation" and he even questioned their

classification as simple variable stars. He further commented in *Telescopic Work* that he had “frequently, while watching for meteors, reviewed the different constellations in the hope of picking up a new object, but had never succeeded in doing so.” Some thirty years after writing his comments in *Telescopic Work*, Denning finally succeeded in his wishes. It is interesting to note that in 1895 [9] Denning commented that one of the most wonderful sights that he had ever seen was the temporary star of August 1885 in M31.

Between 1918 and 1920, Denning was party to the discovery of two novae [10]. While his priority on the discovery of the first of these novae, Nova Aquila (V603 Aql) was not to be established [11], he is accredited with the August 20th, 1920 discovery of the nova in Cygnus (V476 Cyg). With respect to the discovery of the nova in Cygnus, Denning wrote that he had set out to begin a meteor watch but had immediately noticed a new star of magnitude +3.5 in Cygnus [12]. To “immediately” recognize such an interloper in the crowded star fields of Cygnus is no mean feat and offers impressive testament to Denning’s detailed knowledge of the sky [see also note 11].

When he discovered Nova Cygni Denning was 72 years old. While still an influential astronomer within England during the first two decades of the 20th century, Denning had long since established himself as a staunch recluse. Indeed, from the early 1900s onwards he communicated with his astronomical colleagues through an extensive postal correspondence only. Some insight as to the personal impact that the discovery of Nova Cygni had made on Denning’s life can be gained from a letter he wrote to his niece (Christine Gravely) on September 26th, 1920 [13]. He noted in particular that “the new star brought me about 100 letters extra and the event seems to be regarded as a very important one in the astronomical world.” In this latter respect, Denning was certainly correct and an extensive visual and photographic study of the nova was at the Greenwich Observatory, and the results were summarized by W. J. Luyten [14]. Denning also followed the brightness variations of the nova and between August 20th and October 13th he observed the ‘star’ on 47 nights, finding that the average rate of fading was 1/10th of a magnitude per day [15].

References

- [1] Denning, W. F. 1882, Comet-Seeking, *Observatory*, **5**, 285 - 289.
- [2] Denning, W. F. *Astronomical Phenomena in 1872*, Wyman and Sons, London. This book was not well received by the reviewer in *Nature*, **4**, 1872, 261 - 262. Denning was to completely change his opinions of comets, and comet-seeking shortly after the publication of this book. He was later to remark, for instance, that "comet-seeking is the most exciting work of any in which I have indulged." (*Tit Bits*, August 31st, 1895, 386)
- [3] Denning, W. F. 1894, The Discovery of comets, *Monthly Notices of the Royal Astronomical Society*, **54**, 544 -546.
- [4] Denning, W. F. 1922, Observation of Comets, *Nature*, **109**, 613.
- [5] Olsson-Steel, D. 1987, Theoretical Meteor radiants of Earth-approaching asteroids and comets, *Australian Journal of Astronomy*, **2**, 21 – 35.
- [6] Beech, M. 1998, Venus-intercepting meteoroid streams, *Monthly Notices of the Royal Astronomical Society*, **294**, 259 -264.

- [7] Denning did comment in his *Telescopic Work for Starlight Evenings* that "the discovery of new nebulae offers an inviting field to amateurs." Denning would on occasion publish detailed observations of the nebulae that he came across while comet searching. In his first list (*Monthly Notices of the Royal Astronomical Society*, **51**, 1890, 96 - 97) of ten new nebulae he gives detailed positions and descriptions. Interestingly he has enlisted the help of several professional astronomers to determine accurate coordinates. M. Charlois of the Nice Observatory, France even made observations at Denning's request. Further descriptions are given in *Transactions of the Astronomical and Physical Society of Toronto*, **2**, 1891, 69 -70, and *Observatory*, **15**, 1892, 104 - 106.
- [8] Denning, W. F. Variations in Nebulae, *Observatory*, **14**, 196 - 197.
- [9] *Tit Bits Magazine*, August 31st, 1895, p.386.
- [10] Beech, M., 1993, Denning on Novae, *JBAA*, 103 (3), 130 – 131.
- [11] Denning, W. F. 1918, Observations of Nova Aquilae, *Monthly Notices of the Royal Astronomical Society*, **78**, 570. Denning commented in this paper, "on commencing a watch for meteors on June 8, I immediately observed that a new star of considerable brilliancy had made its appearance in the western border of Aquila."
- [12] Denning's discovery was announced in *Nature*, **105**, 1920, 838.
- [13] I am very grateful to Maurice Brain of the Bristol Astronomical Society for access to his collection of letters written by Denning.
- [14] Luyten, W. J. 1920, Visual and Photographic Observations of Nova Cygni-3, made at the Royal Observatory, Greenwich. *Monthly Notices of the Royal Astronomical Society*, **81**, 61 - 65.
- [15] Denning, W. F., 1920, The Nova in Cygnus, *Nature*, 106, 254.