

Galactic Gazette

a blog from the staff of the Wolbach Library



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EXHIBITS HISTORY NEWS

The First Computer: Williamina Fleming and the Horsehead Nebula

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• 2 Comments



Williamina Paton Stevens Fleming

Working by day with glass-plate photographs of the night sky, the Harvard Computers of the late 1800s studied the stars in search of cosmic secrets. First among them was Williamina Fleming, an immigrant maid from Scotland. Her career in astronomy is highlighted by discoveries, stellar classification, and a work ethic that kept the Observatory running.

Our new exhibit shows the process of her work, from plate and workbook to the public reveal in the *Annals of the Harvard College Observatory*. In the 'star' of our exhibit, Plate B2312, she discovered a "large nebulosity, with a semi-circular indentation, intense and well-marked." These are the words of a skilled professional: it's a small white object under belt of Orion, engulfed in light grey clouds. You might recognize this as the Horsehead Nebula.

Williamina did not sacrifice her personal life for this profession. On the contrary, she kept a rich and rewarding home life with her son Edward and numerous friendly colleagues. In her diary, she noted how her life was "necessarily different" from her male colleagues, who did not have "all these housekeeping cares" on top of their scientific work. Yet still she managed a life full of friends, family, and professional dedication.

Read here to learn more about Williamina and her work!



Plate B2312 with the Horsehead Nebula labeled.

Plate B2312 was taken February 6th, 1888 with the 8-inch Bache Doublet in Cambridge. It covers a familiar region of the sky: Orion's Belt with Orion's Nebula defined in the center. Williamina describes an object under the first star of Orion's Belt:



"A large nebulosity extending nearly south from Zeta Orionis for about 60 minutes. More intense and well marked on the following side, with a semicircular indentation 5 minutes in diameter 30 minutes from Zeta." (

[*Annals of the Harvard College Observatory, Vol 18 \(1890\), 116*](#)

)

The “semicircular indentation” refers to the Horsehead Nebula, recognizable by the ‘notch’ that seems to fall over itself. Of course, it’s more helpful (but somewhat redundant) to say it looks like a horse’s head. Visit the plate [information page](#) on the DASCH website to learn more about this plate.



The 8-inch Bache Telescope used to take the Horsehead Nebula Plate. The telescope was also used in Willows, California; at Solon I. Bailey’s temporary station on Mount Harvard near Chosica, Peru; Arequipa, Peru; and Bloemfontein, South Africa.

Williamina worked everyday with plates like these. Usually she spent her time classifying the spectra of stars, but she occasionally had the opportunity to light upon new undiscovered objects. Edward Pickering, director of the HCO at the time, first published (with credit to Williamina) about the discovery of this nebula and others in 1890, [in the 18th volume of the Observatory Annals](#) (quoted above). At this point, the “semicircular indentation” was treated as part of the same “large nebulosity,” and the two were catalogued together. This publication was picked up by John Louis Emil Dreyer in his effort to update Herschel’s *General Catalogue of Nebulae and Star Clusters (NGC)*. Unfortunately, Dreyer did not have as liberal of a spirit as Pickering to allow and credit women for their work in astronomy. Dreyer’s Index, published as an addition to his *NGC* in 1895, credited this large nebula to “Pickering,” under No. 434 ([Index Catalogue of Nebulae found in the years 1888 to 1894, 198](#)). To add to the insult, in his introduction to the Index Catalogue, Dreyer presented the additions as faint, inconsequential, and far less beautiful than the already-known nebulae.



The ‘notch’ of the Horsehead Nebula. Photo courtesy of NASA.

Fortunately for Williamina, her colleagues at Harvard recognized the mistake. In a later edition of the [HCO Annals, Vol. 60 \(1908\), 149, entry 62](#) Williamina's name is directly and unambiguously attached to this nebula as "Discoverer." By this time, almost 20 years after the first identification, astronomers at Harvard had begun to differentiate the wispy larger nebula from the darker and firmer "indentation." Already in 1895, William Henry Pickering (Director Edward's brother) questioned the mysteries behind "this well-defined and rather striking notch" ([HCO Annals, Vol. 32 \(1895\), 66](#)). He and many others were just beginning to reveal the countless 'dark nebula' in the sky, invisible unless serendipitously backlit. It would take more observation with better technology to fully understand this object and recognize it as a 'horsehead,' but it was Williamina's eye that first spotted the notch.



Harvard University, Harvard University Archives, W289693_1

Williamina at work. Photo courtesy of Harvard University Archives.

Here is Williamina at work at the Observatory, wearing black, sitting over a lightbox, classifying stellar spectra. Behind her, another computer performs similar work ([this might be Mabel C. Stevens](#)). As head of the computers, Williamina had many hands at her disposal to assist in observations and calculations. But, as said in [her obituary published by the Royal Astronomical Society](#), "to work through computers is rather a change of method than a relief from labour" (266).

The computers were very important to Williamina, and she believed that such a task was well suited for women who wanted to earn wage. Especially in the environment that Pickering provided, Williamina saw how capable all workers could be, with only a passion for their subject. In her [1893 publication "A Field for Women's Work in Astronomy."](#) Fleming argued that for all who "labor honestly, conscientiously, and steadily, recognition and success must crown your efforts in the end" (684). She presents this position by summarizing the work that she and her colleagues had been completing at the Observatory. She concludes:



"While I may be thought to have strayed far afield from the subject on which I was supposed to address you here, the investigations and researches described above are those in which the women in this departments are engaged, in which they are thoroughly interested, and in which they are becoming trained and competent assistants." (688)

However, working as a woman at the observatory was not as easy as Williamina made it look. Pickering published works of the women computers under their names, but they were still referred to as the *women* computers, often as 'Pickering's Harem,' attached and subordinate to the senior astronomers. As Williamina's language suggests, they are still "assistants" to the formally educated male scientists.

The women were also not paid as much as the men. In her diary, [fully digitized by the Harvard University Archives](#), Williamina recounts a discussion she had with Pickering about the matter of wages. Noting that her male colleagues were paid \$2500 yearly, while she received only \$1500, she questioned how Pickering would manage if she left, in order for him "to find out what he is getting" for that price. She exclaims, "Does he ever think that I have a home to keep and a family to take care of as well as the men?" As resonant as these statements seem with 100 years retrospect, Williamina was not serious with the threats, and even appreciated the fact that Pickering supported the interests of her and her colleagues. Shortly after her conversation with Pickering, she fell seriously ill with a cold that she admits she had been suppressing for sometime underneath the stresses of life. After she recovered, she wrote a private apology to Pickering where she clarified that she meant no offense to his judgement, but rather meant only to enlighten him about the salaries received by other women in respectable positions elsewhere. Despite all the work of computing, managing the computers, and serving as curator of the astronomical photographs, at her paltry wage, she "felt that [her] work cannot be of much account."

And still, Williamina added to her responsibilities at the Observatory, taking work at the head of the Observatory's publications. After she and the other computers had compiled the numbers, Williamina would check their accuracy, edit, and revise her colleagues remarks. She did not enjoy this work, but still gave it her all. In her diary she writes:



“

If one could only go on and on with original work, looking for new stars, variables, classifying spectra and studying their peculiarities and changes, life would be a most beautiful dream; but you come down to its realities when you have to put all that is most interesting to you aside, in order to use most of your available time preparing the work of others for publication. However, "Whatsoever thou putttest thy hand to, do it well". I am more than contented to have such excellent opportunities for work in so many directions, and proud to be considered of any assistance to such a thoroughly capable Scientific man as our Director (Edward Pickering)."

Yet throughout all of this hard work, Williamina lived a flourishing personal life. Her diary is filled with small stories and personal narratives of her life in Cambridge. [But in the words of her pupil and friend, Annie Jump Cannon:](#)



“Mrs. Fleming was possessed of an extremely magnetic personality and an attractive countenance, enlivened by remarkably bright eyes. Although most of her life was spent in the routine of science, yet her human interests were numerous. Fond of people and excitement there was no more enthusiastic spectator in the stadium for the football games, no more ardent champion of the Harvard eleven. Industrious by nature, she was seldom idle, and long years of observatory work never unfitted her for the domestic side of life. As much at home with the needle as with the magnifying eyepiece, she could make a dainty bag, exquisitely sewed, or dress a doll in complete Scotch Highland costume. She was never too tired to welcome her friends at her home or at the observatory, with that quality of human sympathy which is sometimes lacking among women engaged in scientific pursuits. Her bright face, her attractive manner, and her cheery greeting with its charming Scotch accent, will long be remembered by even the most casual visitors to the Harvard College Observatory.” (316-17)

Without Williamina, the Harvard College Observatory could never have made as big of a name for itself within the astronomical community. Stop by our new display case in Wolbach Library, and join us to celebrate her work and artifacts!

Explore these websites to learn more about Williamina at the Harvard College Observatory:

[Harvard Open Collections: Working Women, 1800-1930](#)

[Project Continua: Williamina Fleming](#)

Also on the Gazette

McEachern, Maria. 2013. [“Every Star Speaks for Itself: Williamina Fleming and the Work of the Harvard College Observatory”](#) *Galactic Gazette*, blog of the Wolbach Library.

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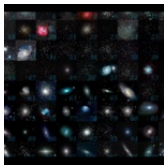
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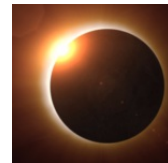
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Alex is the Archival Assistant at Wolbach.



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Mujeres Astrónomas – Laboratorio de Astronomía

March 8, 2018 at 10:58 am

[...] The First Computer: Williamina Fleming and the Horsehead Nebula [...]

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Ruthie

February 25, 2019 at 3:22 pm

My ancestor!

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