

# THE WOMEN OF HARVARD AND THE HORSEHEAD NEBULA

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The November 2019 Sidereal Times “Image of the Month” was Dawn Davies’s beautiful and inspirational image of the Horsehead Nebula (Barnard 33), a feature of the greater Orion Molecular Cloud Complex, that she made with a 25-inch reflector, a night vision eyepiece, and an iPhone 11.

The Horsehead Nebula was first identified by Williamina Fleming in 1888. A new immigrant to Boston from Scotland, Fleming was either pregnant or with a newborn when her husband abandoned her. She had worked briefly as a teacher before meeting her husband. So, she clearly had some “social capital” when she was left to her own resources. Fleming’s good fortune was to be hired as a housekeeper in the home of Edward Charles Pickering of the Harvard Observatory. The story is variously told and sometimes it is Mrs. Pickering who gets the credit. The detail that biographers agree on is that Pickering often ranted at his staff that their work was sloppy and his Scottish maid could do better. And, indeed, she did.

Fleming was the first of a group of women known as the Harvard Computers. Among them were Annie Jump Cannon, Henrietta Leavitt, Antonia Maury, Florence Cushman, and, eventually, Cecilia Payne-Goswold. Typically educated at Eastern women’s



*Caption: “Harvard Computers (1925)”*

*Margaret Harwood sat on the floor for this posed tableau on May 19, 1925. Harvia Wilson is at far left, sharing a table with Annie Cannon (too busy to look up) and Antonia Maury (left foreground). The woman at the drafting table is Cecilia Payne.” Glass Photo 29-605, Harvard University Archives.*

colleges, they did the hard analytical classification and detailed cataloguing of data. Those who were paid at all received salaries closer to day laborers than to business clerks and nowhere near the pay of male academics. In 1900, Fleming was paid \$1500 per year compared to \$2500 for a male assistant. More to the point, Fleming worked a double shift and ran her own household. (She put her son, Edward, through MIT.)

Fleming’s primary work in identifying and categorizing stellar spectra with the new tool of dry plate photography was among many contributions, few of which were published under her own name. One aspect of that work was that the photographic

plates could be studied anywhere. It was no longer necessary to actually be in an observatory. That work was left to men. The gendered narratives of that time also included the supposition that all men are hale and hearty hunters who love winter nights in unheated observatories in the mountains.

Here and now—where arctic gear comes in all shapes and sizes, and everyone has electronic computers—Viviana Guzmán and Karin Öberg of the Harvard Center for Astrophysics joined Maryvonne Gerin, Evelyne Roue, and other astronomers at the IRAM 30-meter diameter millimeter wavelength radio telescope, situated at 2850 meters at Pico Veleta in Andalusia, Spain, to map the Orion Nebula. (See “The Anatomy of the Orion B

Giant Molecular Cloud: A Local Template for Studies of Nearby Galaxies," Jérôme Pety, et al., *Astronomy & Astrophysics* 599, 98, 2017.)

The Horsehead Nebula is a feature of the giant molecular cloud (GMC) designated Orion-B. GMC Orion-A includes M43, the eponymous "Orion" Nebula in the Sword. Orion-B has been measured at over one degree in angular size, twice that of Earth's moon as we see it. Its true diameter is 25 light years. It is considered an ideal laboratory for "observing a wide range of conditions ... to obtain a statistically significant breakdown" of the processes involved in the formation of new stars. Guzmán, Öberg, Gerin, Roue, and the team sought to establish baselines that can be used to validate the claims made by others who observed similar structures in galaxies.

In addition to the mechanics of gravity, the Horsehead Nebula contains clues about the origins of life. Many papers have been published about the hydrocarbon molecules detected there including propynyl (C<sub>3</sub>H<sub>2</sub>), ethynyl (C<sub>2</sub>H), and butadynyl (C<sub>4</sub>H). Even more interesting is the evidence that these short hydrocarbons are the result of ultraviolet radiation breaking down more complex polyaromatic hydrocarbons (PAHs) such as naphthalene (C<sub>10</sub>H<sub>8</sub>) and anthracene (C<sub>14</sub>H<sub>10</sub>), which we now know to be abundant in the universe.



Caption: "Pickering's Harem"

Photograph of the Harvard Computers (unflatteringly known as "Pickering's Harem"), a group of women who worked under Edward Charles Pickering at the Harvard College Observatory. The photograph was taken on 13 May 1913 in front of Building C, which was then the newest building at the Observatory. The image was discovered in an album which had once belonged to Annie Jump Cannon. Image courtesy of the Harvard-Smithsonian Center for Astrophysics. Back row (L to R): Margaret Harwood (far left), Mollie O'Reilly, Edward C. Pickering, Edith Gill, Annie Jump Cannon, Evelyn Leland (behind Cannon), Florence Cushman, Marion Whyte (behind Cushman), Grace Brooks. Front row: Arville Walker, unknown (possibly Johanna Mackie), Alta Carpenter, Mabel Gill, Ida Woods. [www.wikimedia.com](http://www.wikimedia.com)

### Further reading

"The Horsehead Nebula: A beautiful case," Emilie Habart, et al., *ESO Messenger*, No. 120, June 2005.  
 "Simulating star formation in molecular cloud cores: IV. The role of turbulence and thermodynamics," Rhianne Elizabeth Attwood, et al., *Astronomy & Astrophysics*, Volume 495, Number 1, February III, 2009.

"SCUBA observations of the Horsehead nebula – what did the horse swallow?" D. Ward-Thompson, D. Nutter, S. Bontemps, A. Whitworth, R. Attwood, *Monthly Notices of the Royal Astronomical Society*, Volume 369, Issue 3, July 2006, Pages 1201–1210.

*The Madam Curie Complex: The Hidden History of Women in Science*, Julie Des Jardins. New York: Feminist Press, 2010.

"The Women Who Mapped the Universe and Still Couldn't Get Any Respect," Natasha Geiling, *Smithsonian.com*, September 18, 2013.