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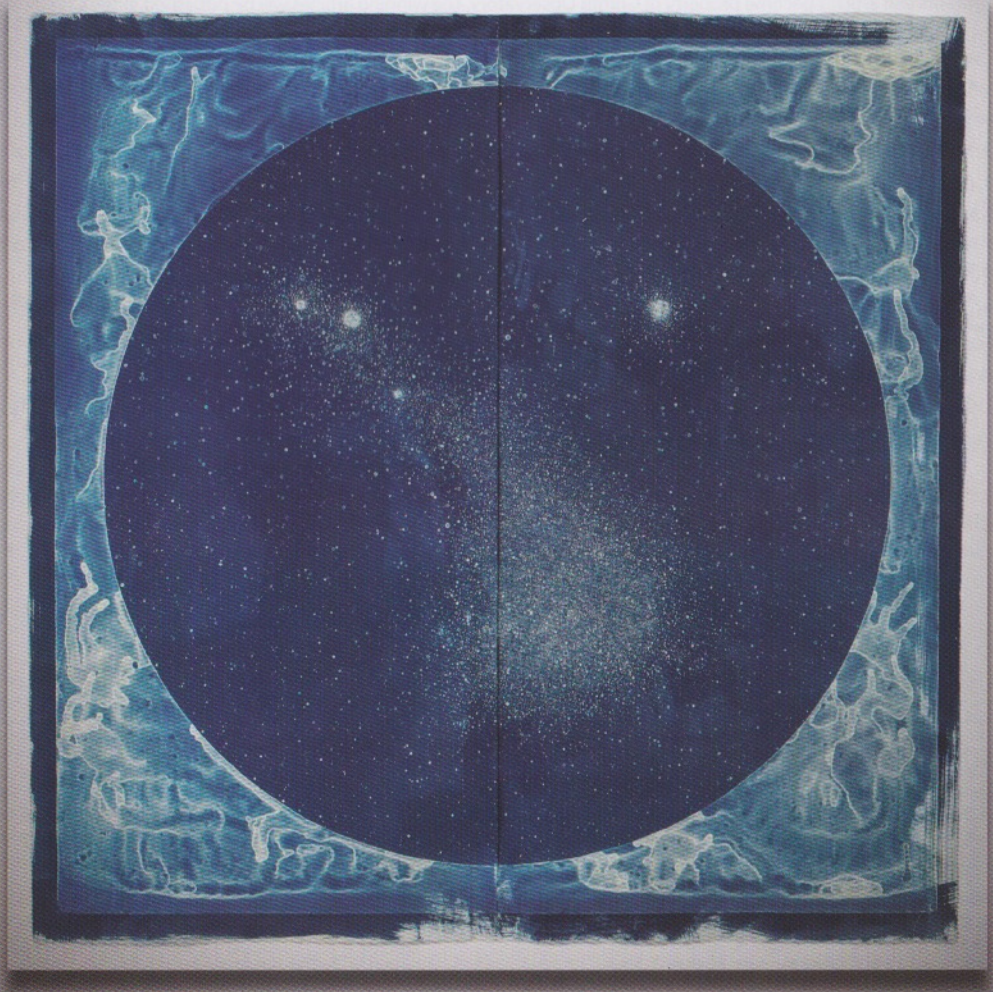

Sixth Annual Joan and Arnold Seidel *Griffith Observer* Science Writing Contest

Griffith Observatory, in the interest of stimulating the flow of information between scientists, science writers, and the public, proudly announces the annual offering of awards for the best articles in astronomy, astrophysics, and space science. For the sixth year, the contest is generously sponsored by Joan and Arnold Seidel.

Articles must be 3500-5000 words in length, typewritten, in English, double-spaced, and accompanied by a brief biographical sketch of the author. Text should be in Microsoft Word "doc" format, with normal paragraphing format (indent first sentence, don't skip a line between paragraphs). Images must not be embedded in the Word document. At least two (2), camera-ready illustrations must be included. Images must be in TIFF or JPG format at sufficient resolution. Print resolution is 300 pixels per inch, and an image intended to be printed at four inches should be at least 1200 pixels wide. Permissions, if necessary, must be supplied. The author's name should appear only on a cover sheet and not on the pages of the article itself.

Rules of Participation

All articles must be postmarked by **December 31, 2017**. The contest is open to all interested persons (Griffith Observatory employees excepted).

All winning articles become property of Griffith Observatory. The winning articles will be published in the *Griffith Observer*.

Previously published articles will not be accepted.

Any number of articles may be submitted to the contest by one person, but only one prize will be awarded to a winning author.

Judging will be done by Griffith Observatory, and the decision of the judges is final. Each entry is judged anonymously so that the author's identity is unknown to all of the judges.

Awards are made on the basis of clear and interesting style, accuracy, reade erest in the subject, correct grammar and syntax, originality in presentation and content, and neatness. Failure to meet e requirements on length, appearance, and illustrations may disqualify an entry from consideration.

Awards will be made on March 15, 2018, for the articles which best communicate to the average reader, material of current or historical interest in astronomy, astrophysics, and space science. The cash amounts of the awards are:

$1000.00	**First Prize**
$350.00	**Second Prize**
$200.00	**Third Prize**
$150.00	**Fourth Prize**
$50.00	**Honorable Mention**

Electronic mail submissions with the subject line "Seidel *Griffith Observer* Science Writing Contest Submission" are preferred. Postal mail submissions are also accepted, but a disk containing the articles and images must be provided. Address all articles to:

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Cosmic Blueprints

Dr. E.C. Krupp
Griffith Observatory

Most of the complex things we build require engineering drawings and architectural plans, usually more than one set because design documents need to be in more than one place at the same time. Blueprinting provides relatively simple and inexpensive copies. The original drawing—with dark lines on semi-transparent paper—is placed on top of photosensitive paper and exposed to light. The light prompts a chemical reaction that makes everything that was white on the original dark blue on the copy and leaves white the areas blocked by the original's dark lines.

The process is also called cyanotype, and it's commonly used in technical enterprises. Artists, for the most part, don't usually get involved with it, but artist Lia Halloran last spring papered the walls of Luis De Jesus gallery in Los Angeles with blueprints that transform technical astronomical imagery into fine art. The exhibition, *Your Body Is a Space That Sees*, kept the cosmos on display at 2685 South La Cienega Boulevard from 1 April through 20 May 2017.

When the show was reviewed in the 10 May 2017 edition of the *Los Angeles Times*, Lia Halloran's reliance on images related to the contributions of woman astronomers was spotlighted. The newspaper headlined her prints a "Female-centric salute written in the stars."

Lia Halloran's intent is clearly stated at her website:

> ***Your Body Is a Space That Sees* is a series of cyanotype prints that sources historical imagery and narratives to trace contributions of women in astronomy since antiquity.**

Although the scope of Ms. Halloran's project is the full range of woman astronomers from Hypatia to the present, the pieces in the exhibition emphasize the women who worked as "computers," or astronomer assistants, for Harvard College astronomer Edward Charles Pickering from about 1881 to 1918. Some of these women—particularly Williamina Fleming, Annie Jump Cannon, Henrietta Swan Leavitt, and Antonia Maury—pioneered the study of stellar spectra and fundamental properties of

FRONT COVER

Bluestocking the Cloud

The Small Magellanic Cloud is featured in Lia Halloran's cyanoprint *The Magellanic Cloud, after Henrietta Swan Leavitt*, 2016, one of the pieces featured in her gallery show, *Your Body Is a Space That Sees*, last spring at Luis De Jesus in Los Angeles. This small, relatively nearby galaxy, about 200,000 light-years away, is in the constellation Tucana the Toucan. In the southern half of the sky. It can't be seen from Harvard, but photographic plates of the Small Magellanic Cloud were obtained by the Harvard College Observatory at its station at Arequipa, Peru. Because the stars in the Cloud are essentially all at the same distance from us, Henrietta Swan Leavitt was able to use the Harvard plates to establish a relationship between the actual brightness (luminosity) of Cepheid pulsating variable stars and the duration of their cyclical change in brightness. Her work is foundational in astronomy and is the key link that extends the scale of cosmic distance to the extragalactic realm. Most of this issue showcases Lia Halloran's astronomically tempered art, which in this case also spotlights the astronomical contributions of the women of Harvard College Observatory. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

stars and made discoveries that changed the course of astronomical discovery.

Harvard College Observatory possesses and maintains the world's largest archive of telescopic glass negatives—more than a half-million—many of which were examined and analyzed by the women known in their time as "Pickering's Harem." Other trailblazing woman astronomers tagged in Halloran's cyanotypes—including Adelaide Ames, Cecilia Payne-Gaposhkin, and Helen Sawyer Hogg—were students of Harlow Shapley at Harvard College Observatory.

Attracted to the historical astronomical imagery on the Harvard plates and their connections with luminous woman astronomers, Lia Halloran selected plates for their content and for their affiliations with specific women, and her prints developed from them.

Media coverage of the Halloran work portrayed the women as "neglected by history." Although none of them qualify as celebrities and household names, most astronomers are equally unknown. While the public has little familiarity with these woman astronomers, they have not been neglected by astronomers, who know and understand the history of their calling. Williamina Fleming, Annie Jump Cannon, Henrietta Swan Leavitt, Antonia Maury, and Cecilia Payne-Gaposhkin all have respectable entries in *The Biographical Dictionary of Scientists: Astronomers* (1984) edited by David Abbott, and they and Adelaide Ames and Helen Sawyer

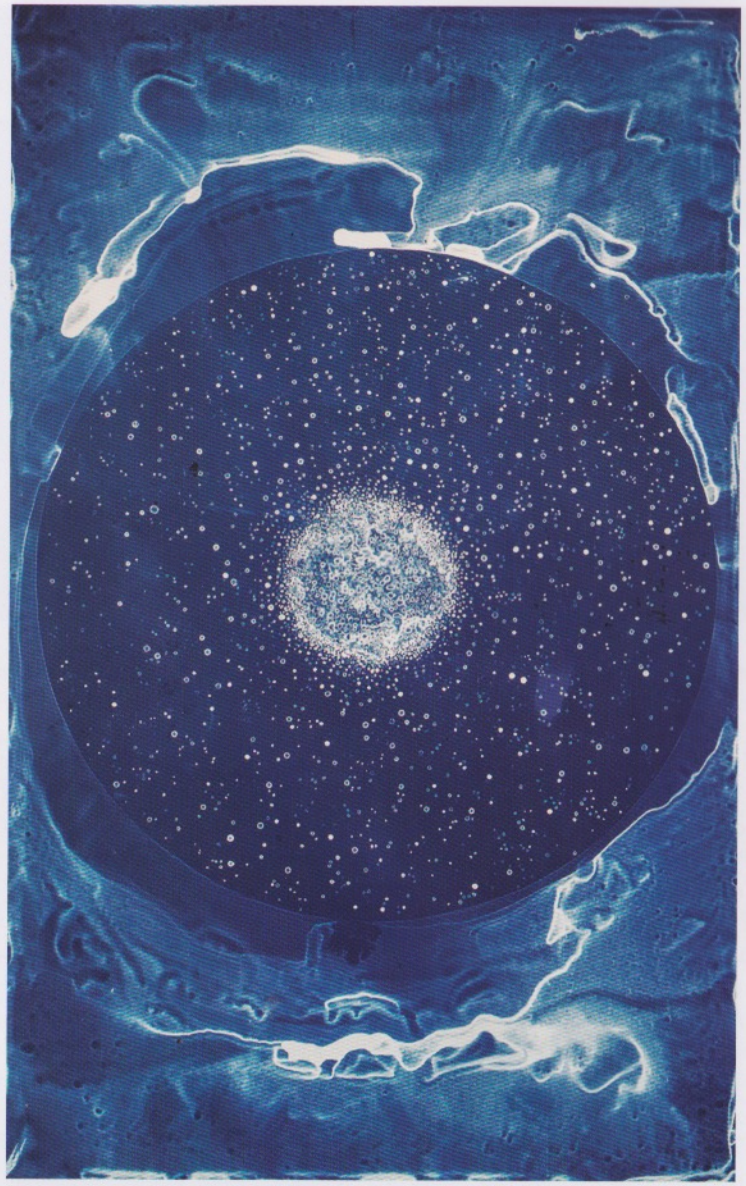
Astronomy went into the blue at Luis De Jesus gallery (2685 South La Cienega Boulevard, Los Angeles, California 90034) with Lia Halloran's installation of astronomical cyanotypes. The walls of the gallery's front room include an image of a luminous gaseous nebula in blueprint and a blueprint and black-on-white original painting of the Small Magellanic Cloud, one of the Milky Way Galaxy's satellite galaxies. Another cyanotype—a globular cluster—is caught through the corridor to the next room of Halloran art. Neither the nebula nor the globular cluster is specifically identified. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

The remaining wall in the first room at Luis De Jesus is consumed by Lia Halloran's *Triangulum, after Adelaide Ames,* 2017. It is seven feet high and fourteen feet long. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

Hogg are fully documented in the *Biographical Encyclopedia of Astronomers* (2007) edited by Thomas Hockey. Fleming, Cannon, Maury, Leavitt, and Payne-Gaposhkin are all mentioned in Heather Couper's and Nigel Henbest's popularly oriented *The History of Astronomy* (2007). In the last third of the twentieth century and well into the twenty-first, an extraordinary number of college students read about Cannon and Leavitt in George O. Abell's elementary astronomy textbook, *Exploration of the Universe.* In 1961, Antonie Pannekoek's *A History of Astronomy* documented the work of Cannon, Maury, Leavitt, and Payne-Gaposhkin. Adelaide Ames's name is attached to the *Shapley-Ames Catalog of Bright Galaxies*, a fundamental reference known to everyone involved in extragalactic research. All of these women and many other prominent woman astronomers have appeared at one time or another in the pages of the *Griffith Observer.*

Those outside a discipline are often surprised to discover what is actually well known and appreciated by members of that community and superficially imagine they have recovered something that was lost. A few, however, like Lia Halloran, explore more artfully the surprises of unknown territory and adaptively reuse the past to turn the stories into something new and mobilizing. Each of her cyanotype prints is rooted in a real astronomical image acquired at the telescope around a century ago and related to one of the woman astronomers.

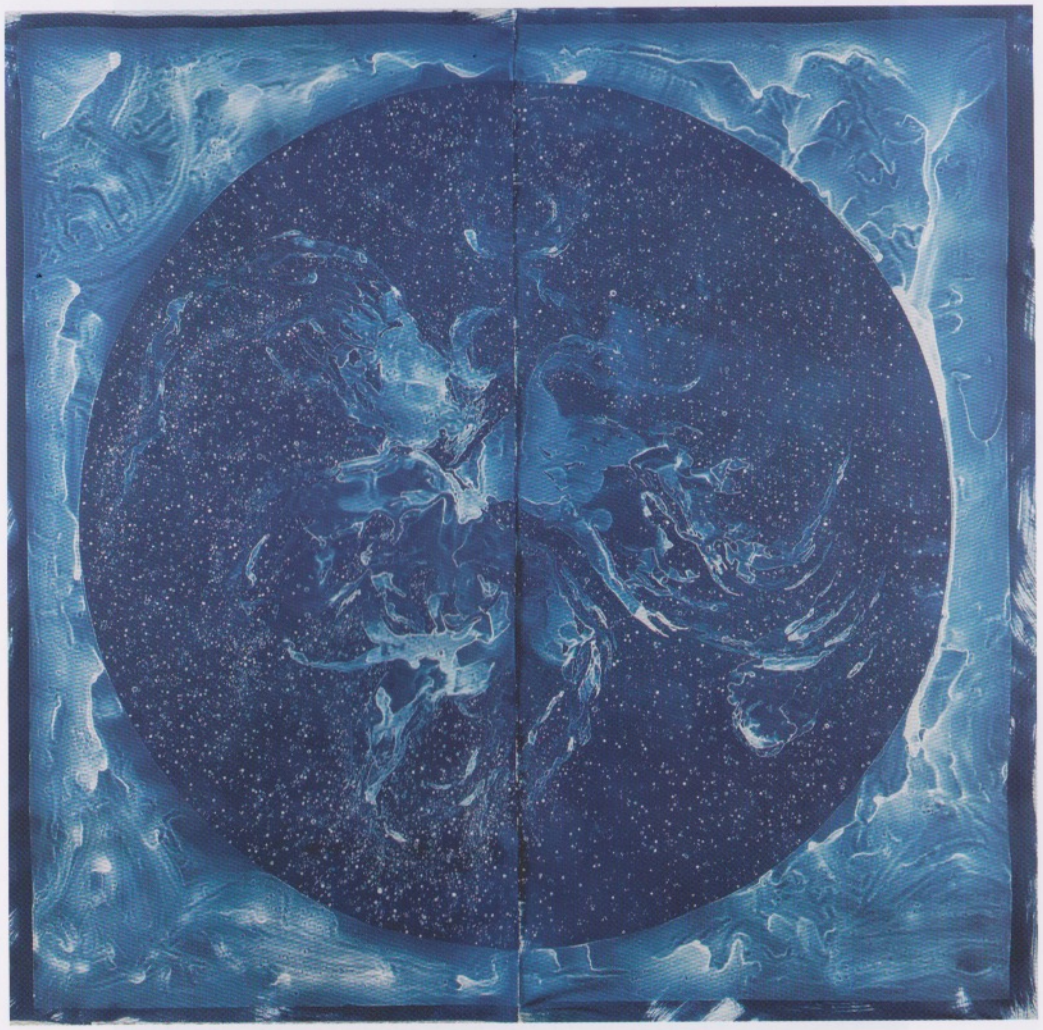
The original telescopic plates are relatively small, typically about the size of a piece of letterhead. The blueprints are large, big enough to take over a wall. Halloran paints the astronomical object from the selected plate, star field and all, oversize on a large piece of transparent film, paints a frame of nebulosity, tendrils, and whirls around it, places this original on an equally heroic sheet of paper prepared with a chemically



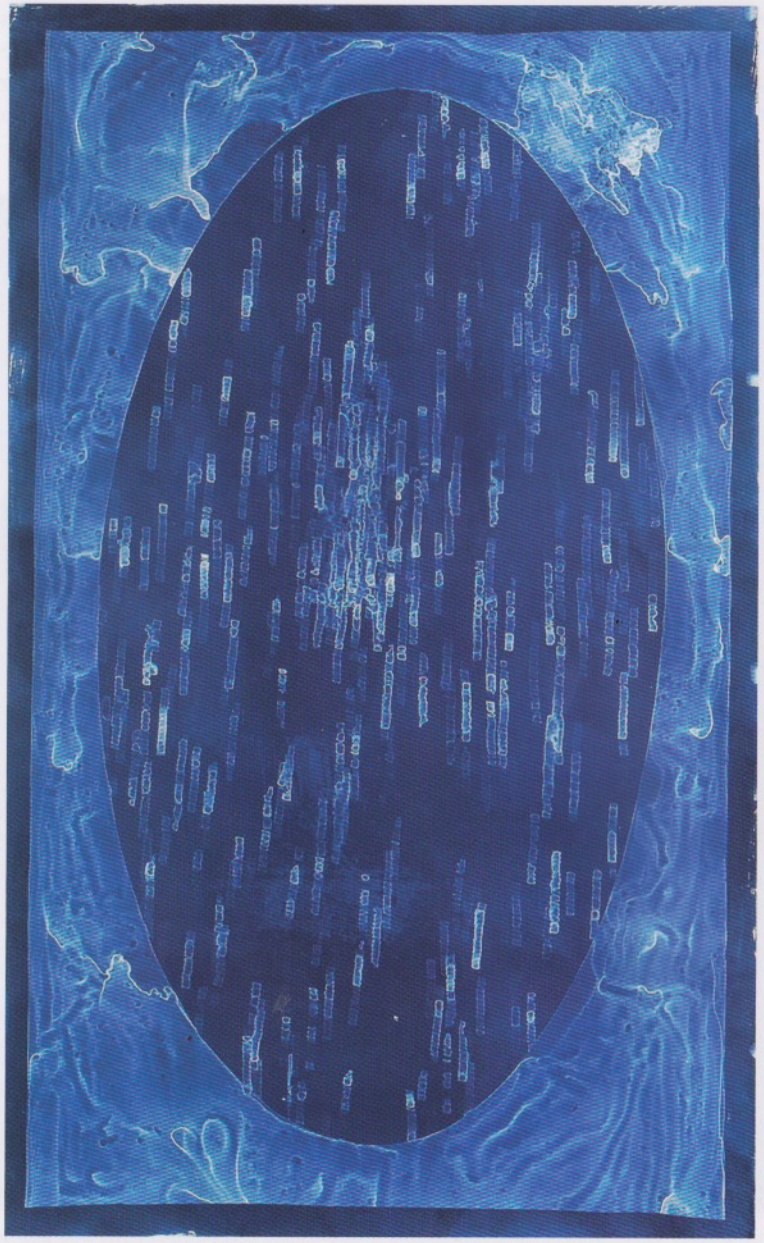
Lia Halloran painted and then blueprinted this globular star cluster with Cecilia Payne-Gaposhkin in mind. The cyanotype is titled *Globular Cluster, after Cecilia Payne*, 2016, but it's hard to tell which globular cluster this is. After Cecilia Payne completed her undergraduate studies at Cambridge University in England, she left for the U.S. and Harvard College Observatory, where she became Harlow Shapley's graduate student. Through that work she was awarded a Ph.D. in astronomy from neighboring Radcliffe College. Her astrophysically significant thesis was monumental. She demonstrated the spectral classes of stars are directly related to surface temperature and realized that the chemical composition of stars is quite unlike the earth. Stars, in fact, are primarily hydrogen and helium, a revolutionary insight. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles

photosensitive emulsion, and exposes it to the sun. The sun's ultraviolet light activates the potassium ferricyanide and creates a negative with Prussian blue dye where the original was clear.

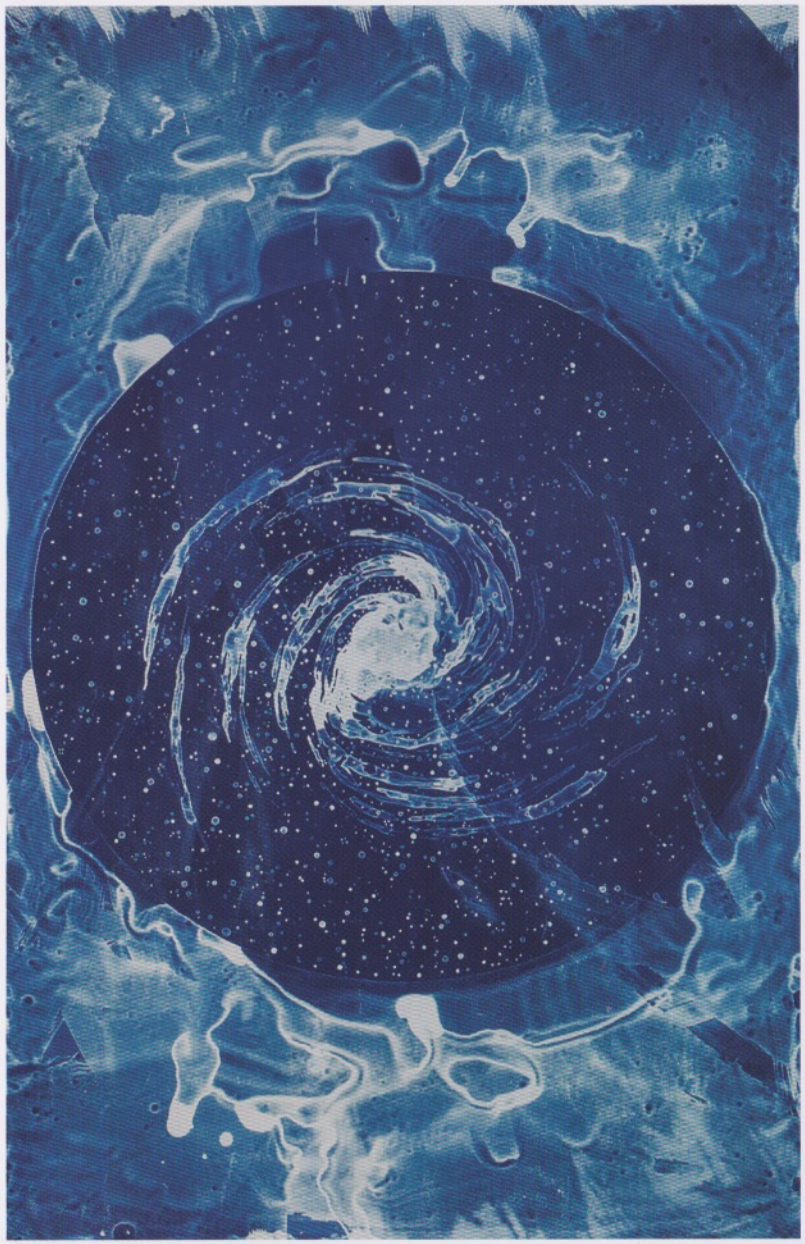
Astronomer John Herschel first discovered the blueprint process, in 1842. He was the son of William Herschel, who discovered the planet Uranus and attempted to tease out of the



Nebula, after Williamina Fleming, 2016, acknowledges Williamina Paton Stevens Fleming, who first worked as a maid for Harvard College Observatory Director Edward Charles Pickering. He then hired her to classify stellar spectra, and she became a primary contributor to the *Henry Draper Catalogue*, which classified stars by brightness and spectrum and was a fundamental resource for astronomers through the twentieth century. During Fleming's career, she discovered 59 gaseous nebulae on Harvard plates. This unidentified nebula may be M8, the Lagoon nebula in Sagittarius. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)



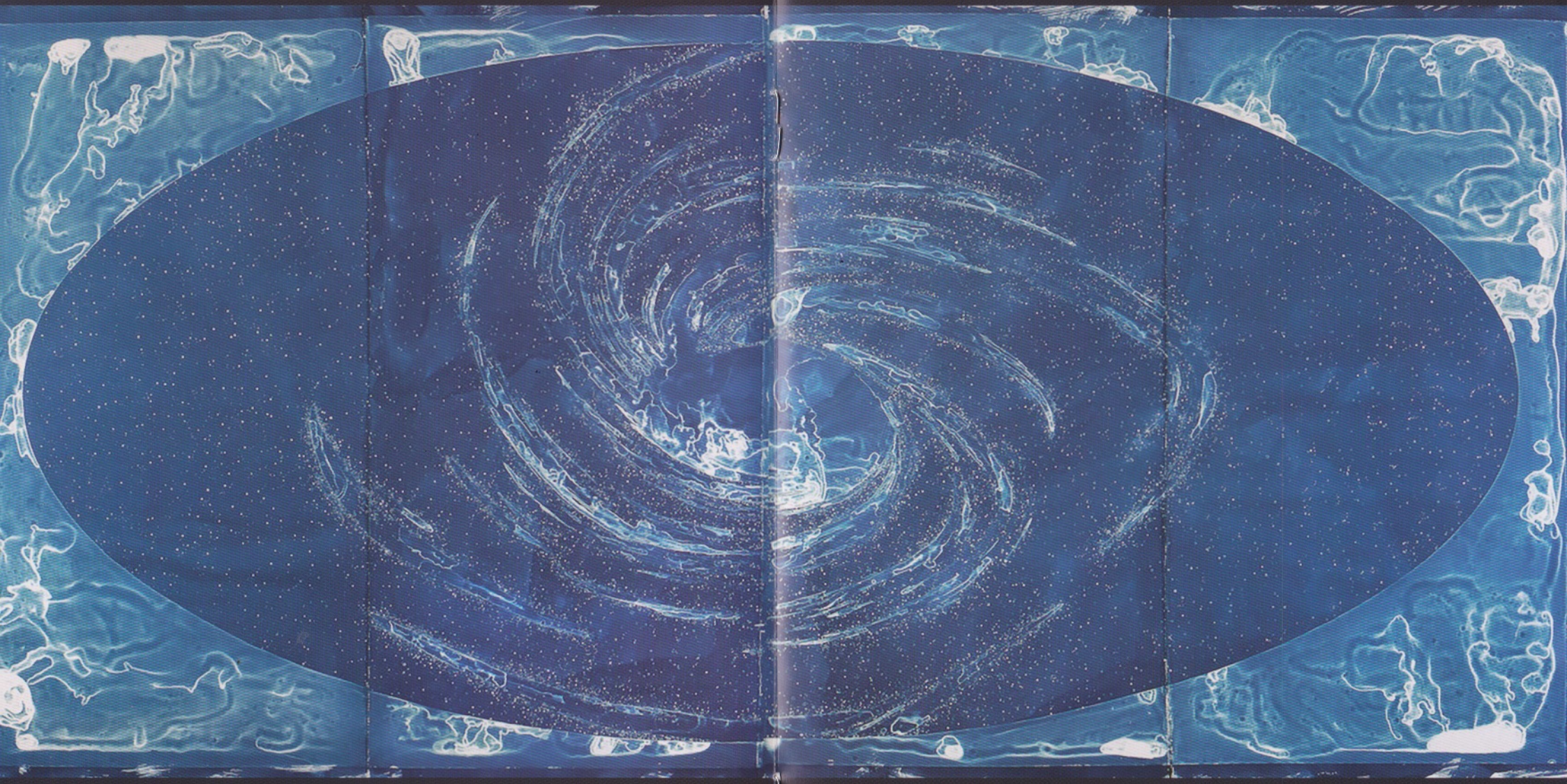
Annie Jump Cannon developed the modern system of spectral classification at Harvard College Observatory. The scheme organizes spectra according to temperature. Cannon could tell at glance the class of a spectrum, and during her life, she identified more than 350,000 spectra. Lia Halloran's cyanotype, *Spectra, after Annie Jump Cannon*, 2016, appears to represent an objective prism plate, on which a spectrum is recorded for each star in the field of view through the placement of a prism in front of the primary optics of the telescope. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)



Spiral, after Adelaide Ames, 2016, collects a galaxy from out of the blue. This looks like M83 (NGC 5236), a blue and patchy barred spiral galaxy in Hydra the Water Serpent. It is near enough and bright enough to be in the top 40 in the *Shapley-Ames Catalog of Bright Galaxies* (1932), which was co-authored by Harvard astronomer Adelaide Ames. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

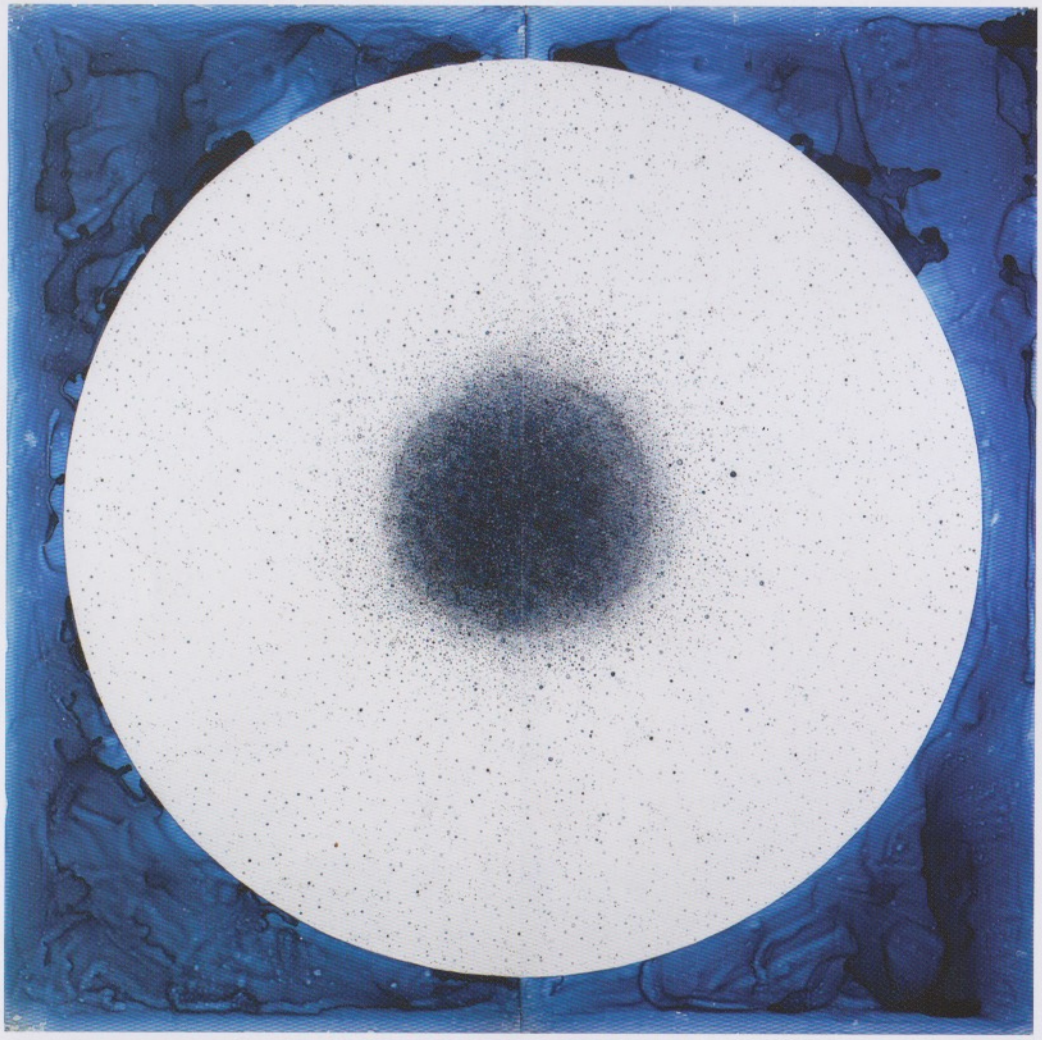
The identity of the "Great Comet" in *The Great Comet, after Annie Jump Cannon,* 2016, remains uncertain. The Great Comet of 1858 was the first to be photographed. Although Harvard College Observatory obtained a telescopic image of the comet, it did not look like this. This may be the Great Comet of 1882 or the Great Comet of 1910, which upstaged Halley's Comet that year. Although Annie Jump Cannon did not study comets, she followed Williamina Fleming as Harvard's Curator of Astronomical Photographs. The theme of Lia Halloran's cyanotypes not only sheds light on women in astronomy but relies as well on historic astronomical photographs. In the digital era, long-term preservation of astronomical data is challenging, and Halloran's work recognizes the value of archived imagery. The "great comet" is long gone, but the record of its passage survives. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

The Orion nebula is seasonally recaptured by Griffith Observatory's telescopes. It is a picture-perfect delivery room for newborn stars. Although Henrietta Leavitt is best known for her revelatory work on Cepheid variable stars, Lia Halloran also included her name in the title of *Orion Nebula, after Henrietta Leavitt*, 2016, which is based on a Harvard College Observatory plate of the nebula. An asteroid and a crater on the moon are both named for Leavitt. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)



M33, a spiral galaxy in the constellation Triangulum the Triangle, is a member of the Local Group, to which the Milky Way Galaxy also belongs. Sometimes called the Pinwheel galaxy (a name that really belongs to M101), M33 is about 2.87 million light-years away, a little farther than M31, the Andromeda galaxy, and has about one-tenth the mass of the Milky Way Galaxy. It is one of 1249 galaxies tablulated in the *Shapley-Ames Catalog of Bright Galaxies* (1932) by Harvard astronomer Harlow Shapley and Adelaide Ames, Shapley's first graduate student. Their catalog was the primary reference catalog for galaxies through most of the twentieth century. Lia Halloran relied on a Harvard plate of M33 for the imagery of *Triangulum*, after *Adelaide Ames*, 2017. Fourteen feet long and seven feet high, the pieced cyanotype requires an entire wall of Luis De Jesus. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

stars the structure of the Milky Way Galaxy. Cyanotype and the contributions of women to astronomy converged first in John Herschel, for his aunt was astronomer Caroline Herschel, who not only assisted her brother William Herschel at the telescope but was recognized internationally for her independent astronomical discoveries.



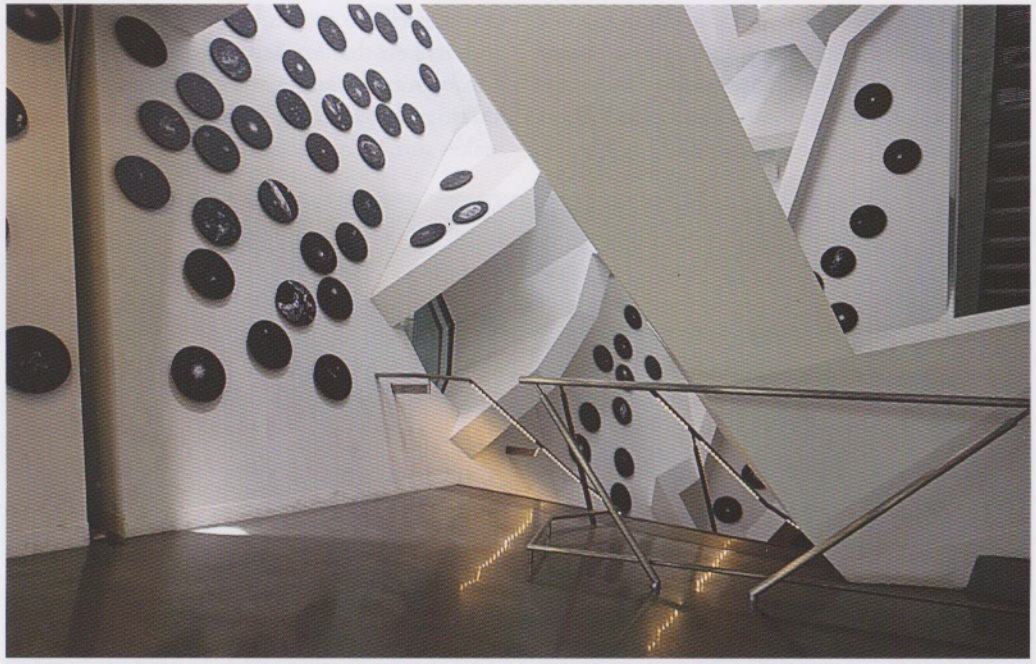
To make the celestial blueprints Lia Halloran first paints the image in ink on white, semi-transparent drafting film, which is the "negative" for the cyanotype "positive." This negative is *The Globular Cluster, after Helen Sawyer*, 2017. As an undergraduate at Mount Holyoke College, Helen Sawyer was in part inspired by Annie Jump Cannon's visit to the school. Helen Sawyer Hogg subsequently attended graduate school in astronomy at Harvard College Observatory, and her Ph.D. thesis made her an expert on globular star clusters. Her contributions to astronomical research throughout the twentieth century were immense, particularly in the study of variable stars, but she was also an energetic popularizer of astronomy. (artwork Lia Halloran, photograph Luis De Jesus Los Angeles)

Lia Halloran's cyanotype prints are intended to catch and please the eye, but they are based on real data with historic resonance. They capture a form from an esoteric source and direct the viewer to an aesthetic response.

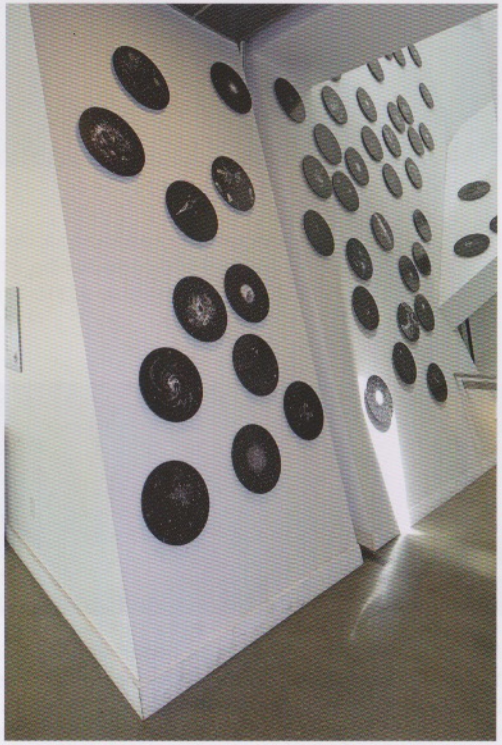
Astronomers routinely recognize the innate beauty of these cosmic scenes but submerge that experience within the effort to understand and explain the detailed physical nature of the astronomical target. Astronomers know they are looking at something wonderful. Lia Halloran makes sure no one misses it.

Five Lia Halloran cyanotypes bring those old cosmic blues to one of the walls of Luis De Jesus. The blueprint on the far right is *Horsehead Nebula, after Williamina Fleming*, 2016. Fleming discovered the Horsehead nebula, in Orion the Hunter, on Harvard College Observatory plate B2312. (artwork Lia Halloran at Luis De Jesus, photograph E.C. Krupp, 18 May 2017)

The cyanotypes for *Nebulae, after Williamina Fleming*, 2016 and *The Magellanic Cloud, after Henrietta Swan Leavitt*, 2016 are paired with their inked and painted "negatives" at Luis De Jesus. (artwork Lia Halloran at Luis De Jesus, photograph E.C. Krupp, 18 May 2017)



Lia Halloran's astronomical art is not confined to the Harvard plates and woman astronomers who made use of them. Another installation, *Deep Sky Companion* (2016) is a permanent feature of the primary stairway of the Cahill Center for Astronomy and Astrophysics at the California Institute of Technology in Pasadena, California. One hundred and ten black disks polka dot stairwell walls that seem to share the anomalous geometry of the German Expressionist sets in the 1920 film *The Cabinet of Dr. Caligari*. Each disk bears the image Halloran has painted and then printed of each of the objects in Charles Messier's list of "nebulous" features easily mistaken for comets. Comets were what really interested Messier, and his catalog was intended to help him avoid the annoying astronomical mimics. In fact, the Messier objects include galaxies, luminous interstellar clouds, gas shells ejected from stars, open star clusters, and globular star clusters. They are actually all telescopic charmers and important targets of astrophysical study. (photograph E.C. Krupp, 29 June 2017)



Like the cyanotypes in *Your Body Is a Space That Sees*, the images in *Deep Sky Companion* were contact printed on photosensitive paper from ink paintings on transparent film. (photograph E.C. Krupp, 29 June 2017) →

The images of Messier objects in *Deep Sky Companion* do not necessarily replicate what is captured at the telescope in the eye or on a drawing, plate, film, or chip but are interpretations based on telescopic imagery. This disk, the first encountered at ground level may be M5, a globular star cluster in Serpens the Serpent. (photograph E.C. Krupp, 29 June 2017)

M45, the Pleaides, is unmistakable on a disk above the stairs that descend from ground level. It is an open star cluster in Taurus the Bull, and there is nothing seen by the unaided eye in the sky quite like it. Its relatively bright stars, distinctive appearance, and location near the ecliptic made it a primary signal of seasonal change for nearly every ancient and traditional culture on the planet. (photograph E.C. Krupp, 29 June 2017)

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