# ANCIENT LIGHT

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF
THE UNIVERSITY OF HAWAIʻI AT MĀNOA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

MASTER OF FINE ARTS

IN

ART

MAY 2018

By

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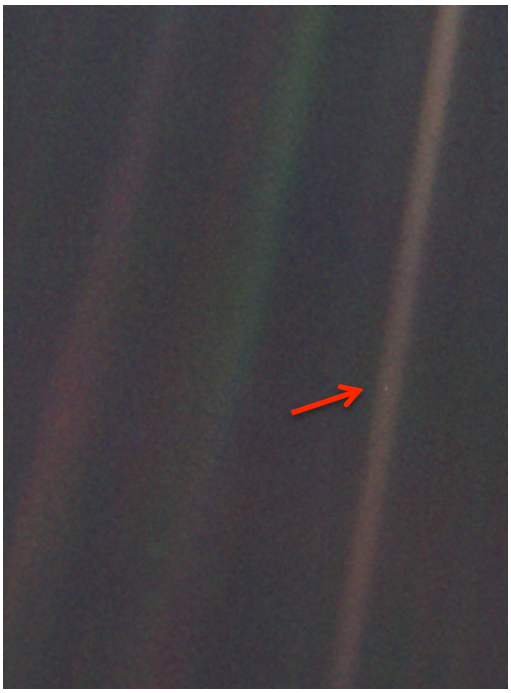
# Introduction

My exhibition is an exploration of different perspectives in visualizing time through the medium of photography and informed by NASA's discovery of the "Age of Sunlight" by R. Mitalas and K. R. Sills in 1992. This discovery posited that photons generated within the sun's core neither travel from its origin to the surface at the universal constant of 300,000 kilometers per second, nor in a straight line. Instead, light is constantly absorbed and transmitted between matter in the sun's interior, a process called "Photon Diffusion" (Mitalas, Sills 759). This process is wandering and virtually random as scientists are unable to predict the path of the photon within the dense interior of the sun, estimated taking between 10,000 to 100,000 years to break the surface of the sun. The light illuminating everything around us is consequently older than written human history, hence the title of my exhibition *Ancient Light.* Photography has always been a direct utilization of this ancient light and is the primary medium presented in three series. My project questions existence and reality through photographs of the sun rendered in different perspectives and effects of time.

An excerpt from Carl Sagan's book *Pale Blue Dot* expresses his concern of the relationship between the existence of humanity and the cosmos. In February 14, 1990, NASA probe Voyager-1 turned its camera back to earth after a six billion kilometer exploration of the outer solar system starting in 1977 (*nasa.gov).*



*(Voyager 1,* NASA 1990, nasa.gov)

Voyager-1's photograph depicts earth barely a pixel in size, composed within a beam of light against the void of deep space. Inspired by the sheer size of the cosmos in relation to the pixel representation of earth, Sagan wrote:

> *"Look again at that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there-on a moat of dust suspended in a sunbeam." (Sagan 8)*

As Sagan draws our attention between the human experience and the immense vastness of space, his quote inspired me to be concerned with the imperceptible passing of time. While Sagan's quote points to the infinitesimally small space of earth that encompasses all of humanity, my project draws attention to how the

sunlight we experience daily have undergone a journey that is longer than the entire existence of humanity.

My fascination with photography is its inherent ability to record the path of light in time and space. Astronomical photography is an example of this idea taken to the utmost limit; images of distant galaxies are depicted as they were millions of years ago.

(*Hubble Space Telescope,* NASA 1995, nasa.gov)

The Hubble Deep Field is an image made by NASA's Hubble Space Telescope in 1996 (*hubblesite.org).* Aiming towards a small patch of seemingly empty black space, the photograph depicts about 3000 early-forming galaxies one billion years after the birth of the universe, their light travelling thirteen billion years to our present moment.

The fact light takes time to travel to inform our "present" experience suggests the human perception of "now" is a constant view of the past. An

example is the observation of one's own image in a mirror is a view billionth of seconds in the past as light travels from face to mirror, then into the eye. *Ancient Light* is a visual exploration of this persistent retrospective view. The exhibition utilizes our accumulated understanding of space and time in the form of photographing processes presented in three separate, yet interrelated image series: ***Earth at 970MPH, Waves,*** and ***A Distant Star. Earth at 970MPH*** is conceptually based on Nicolaus Copernicus's Heliocentrism through utilizing the spin of the earth to depict the motion of the planet paired with a still sun. ***Waves*** is a photographic recreation of the 1801 double slit experiment performed by Thomas Young. ***A Distant Star*** simplifies vast space into indivisible units to represent the Planck Length as a solution to Zeno's paradoxes of infinite steps of space in motion. The series also simulates a pixelated perspective of our sun as a star light-years away, representing our current technology and knowledge of our universe. As the three series are references to the history of our scientific understandings, the equipment and techniques I utilize to execute each series reference the early history of photography.

The images in the exhibition are arranged sequentially according to the progression of time or movement. ***A Distant Star*** is a thirty-image sequence recording the movement of the sun during a two-hour span. ***Earth at 970MPH*** records the effects of the rotation of the earth in five images, each of increasing exposure duration. ***Waves*** portrays the interaction of light waves in the same sequential manner as ***Earth at 970MPH***. Each image sequence describes

natural occurrences in a progression to unrecognizable abstractions informing the entropic qualities of time –a visualization of a path from order to disorder.

My project suggests the photographic description of time is one path towards disorder. This path is based on the limits of human comprehension to ever perceive the true form and shape of time, a concept based loosely on Edwin Abbott's *Flatland: A Romance of Many Dimensions*. Abbott's novel is an allegory for the limitations of the human perspective through the prism of a fictional two-dimensional world inhabited with beings of the same flatness. Just as the flat beings are unable to perceive the full shape of the third dimension in Abbott's novel, I argue that humans are unable to fully comprehend the fourth dimension of time. The various images in *Ancient Light* are arranged according to philosopher Rob Bryanton's method of interpreting the fourth dimension according to one line from his book *Imagining the Tenth Dimension*. The timeline, a directional representation of past to present, is visualized in the sequences which the photographs are displayed in the exhibition. The three homemade cameras used to produce the photographs are also displayed; their inclusion references the source of the photographs, as well as the early history of photography that influences my artistic practice.

The components of the exhibition simultaneously display the past and the "present" to provide a perspective of the natural world free from the constraints of our current position in time.

(Hiroshi Sugimoto. *Caribbean Sea, Jamaica, 1980.* sugimotohiroshi.com)

The *Seascapes* series by Hiroshi Sugimoto is an example of photographs that are not confined to a specific time and origin. Each photograph in his series depicts the ocean and sky with no trace of human existence. The absences of context, such as humans or man-made structures within Sugimoto's images, consequently provide a perspective that transcends the time and origin of which the photographs were made. With no represented position in time, *Seascapes* offer a view that can be simultaneously interpreted as the distant past and future.

Similar to Sugimoto's *Seascape*, I have also pared down my subject matter to the sun and light. ***Earth at 970MPH*** was made at a non-descript location on earth to remove context. Conversely, ***Waves*** was made at a highly specific location of Mauna Kea in Hawai'i. With a height of 13,7000 feet above sea level with an atmospheric pressure drop of 40%, the summit is well suited for

observing celestial objects with minimal air distortion, thus housing more than ten internationally owned telescopes. Photographing at this location simultaneously provides the presence and absence of humanity through the inclusion of the telescopes atop the summit and the exclusion of human presence through long exposures. The trace of the existence of humanity represented through telescopes without living humans suggest a view of the distant future.

All photographs in the exhibition are made from directly aiming the camera towards the sun; *Ancient Light* is a literal view of the past recorded during a "present". The project is a culmination of references to the histories of science, photography, and my artistic process, arranged in a space with the intent to comprehend the imperceptions of time. *Ancient Light* is the utilization of the past to provide a perspective beyond our current position in time and space.

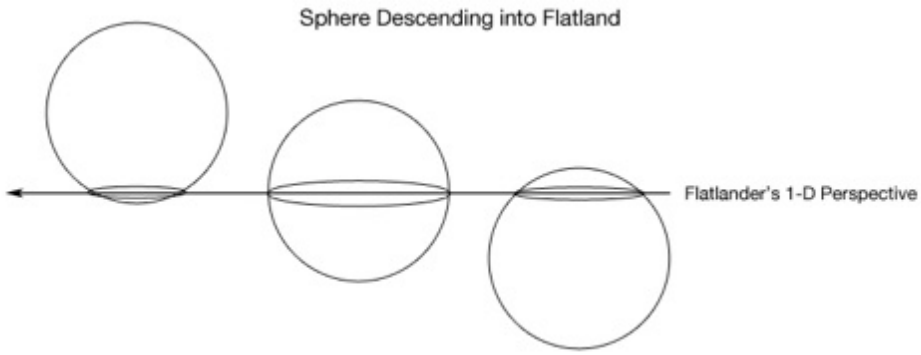
## I. Space and Time

### 1. Flatland

To understand the overarching concepts of my exhibition, it is necessary to first comprehend my logic of the limited human perception time and space, centered around Edwin Abbott's novel *Flatland: A Romance of Many Dimensions.* Abbott describes an imaginary two-dimensional world inhabited by beings of the same exceptional flatness shaped as "Lines, Triangles, Squares, Pentagons, Hexagons, and other figures[.]" (Abbott 3) As humans are three-

dimensional beings, our vision is simplified down to two dimensions; we utilize time to perceive three-dimensional space. Abbott translates the same pattern down another dimension for his flatlanders; their vision is one-dimensional, utilizing time to distinguish the varying shades and colors of their linear vision to navigate their space. (Abott 22-25)

In the story, a sphere-shaped three-dimensional being enters flatland and makes contact with a square flatlander. As the spherical being descends into flatland, the square witnesses a dot magically appearing in its room, progressively morphing into a growing line.

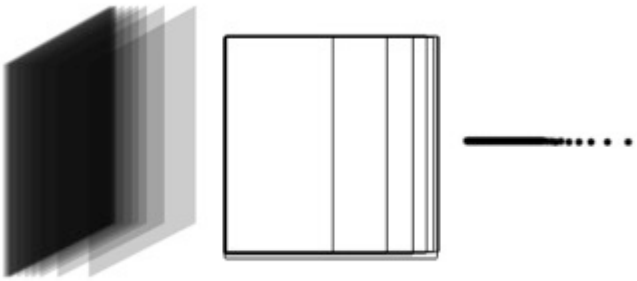



Unaware of the third dimension, the flatlander is unable to understand the concept of the sphere entering its world in cross-sectional representations of its entire form. The sphere then decides to lift the square out of flatland. Beyond comprehension, the square was given a new perspective of its world. (Abbott 79-85) The inability of the square to comprehend a view beyond his perspective is parallel to the unfamiliarity of subject matter abstracted from the effects of time represented in the photographs in *Ancient Light.*

## 2. The Fourth Dimension

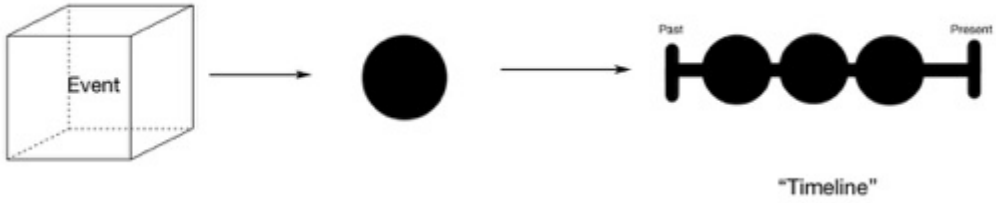
Like the flatlander in Abbott's novel, perhaps humans are unaware of the true size and scale of space. Rob Bryanton, who is also influenced by Abbott, suggests the fourth dimension is time, and our perception is only cross-sections of its entirety. (Bryanton 14) The cause-effect nature of time is a constant march towards the future, suggesting a linear and directional quality. The exhibition investigates this similar sectional nature of time through photographic representation and the geometric logic of space.

Einstein's theory of relativity suggests space and time are inseparable. This logic can be applied to basic geometry: A cube cannot exist without squares; a square cannot exist without lines; a line cannot exist without points. This logic also suggests a cube can be divided into infinite cross-sections of squares; a square contains an infinite number of cross-sectional lines; a line contains infinite points.

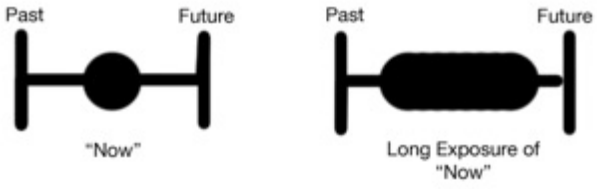


From this supposition, we can imagine simplifying the fourth dimension as a one-dimensional line. Within the line, our three-dimensional experiences are simplified to points. As time passes, our point of experience travels in one-

direction within the imagined timeline. (Bryanton 13-14)

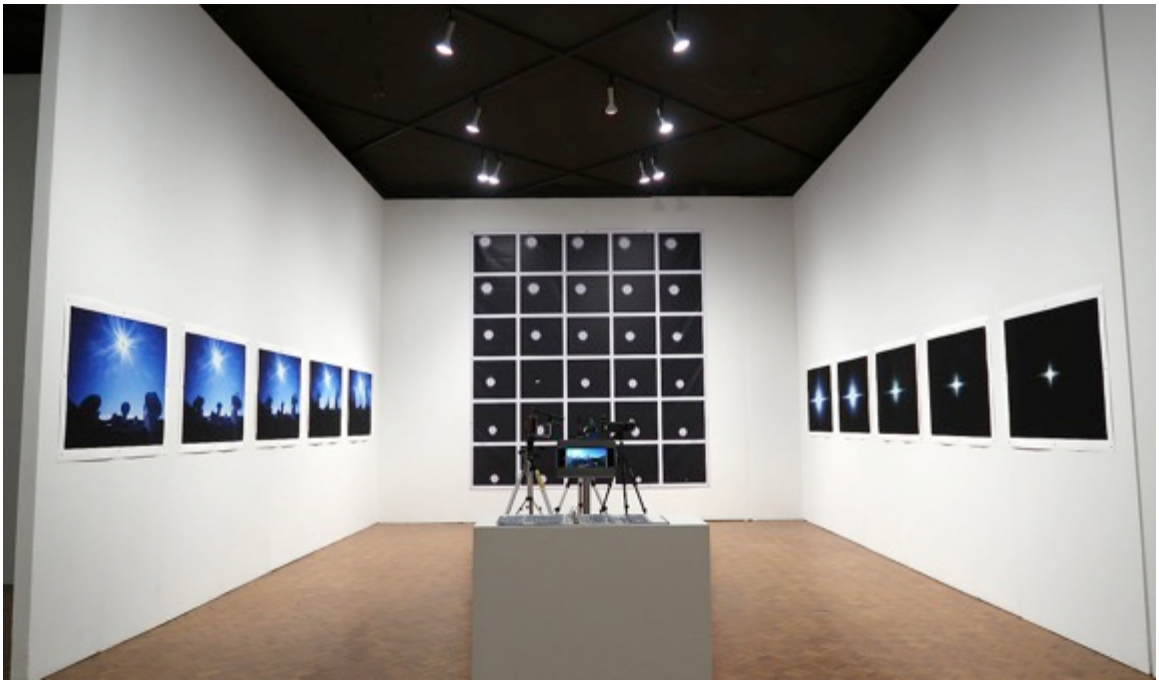



Photography inherently documents points within the line of time and allows the ability to refer backwards to its one-way direction. With the ability of long exposures, my photographs extend the point of our perspective –consequently elongating the dot within the timeline.



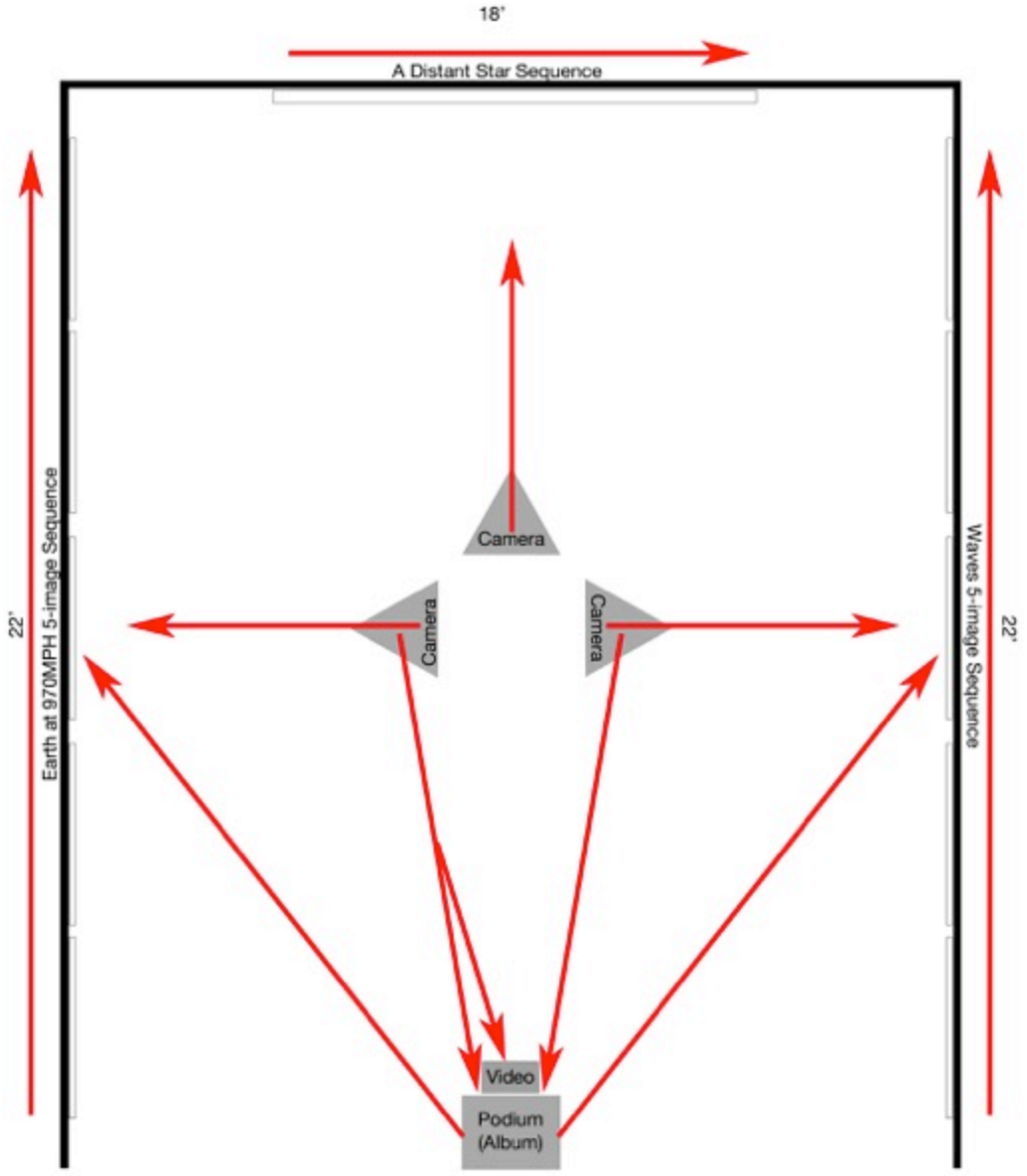

Long exposure photographs in the exhibition portray a reality beyond our experience by compressing time and space within a two-dimensional image.

## 3. Timelines and the Exhibition



Front view of exhibition.

The exhibition is installed in a 22’ x 18’ gallery. Near the gallery entrance center is an album of photographs made with instant film and a tablet displaying a video from ***Earth at 970MPH***. ***Earth at 970MPH*** and ***Waves*** are shown on the left and right walls facing each other, each contains a five image sequence of print measuring 30”x40”. The wall facing the entrance holds ***A Distant Star***, a 30-image sequence measuring 10’x11’. The center of the exhibition space contains three cameras; each facing towards the series of photographs that it was used to produce. The exhibition layout is to further visualize the concept of timelines discussed in the previous section.



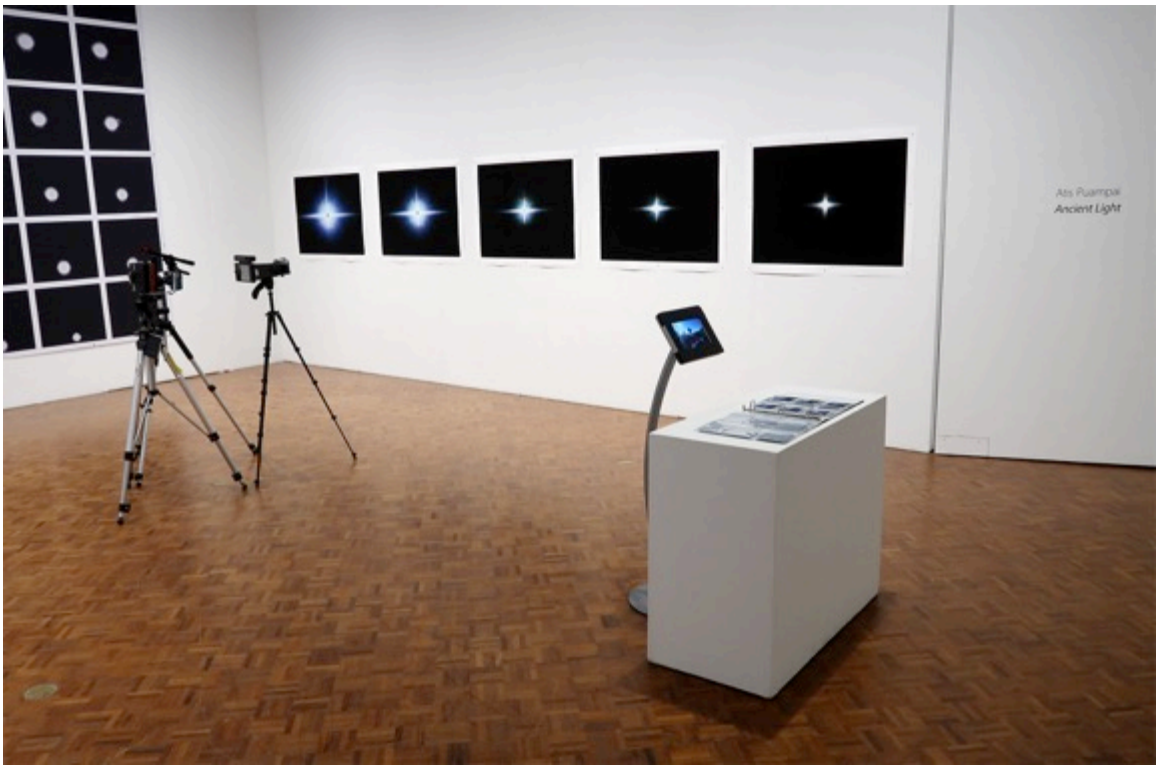

Top-down exhibition floor plan. Arrows indicate timelines

The first object encountered in the exhibition is the album of instant prints. Comprised of 25 Fujifilm FP-100C photographs, ten were used to produce the digital enlargements for ***Earth at 970MPH*** and ***Waves***. Each instant photograph contains written notes of their titles, dates, locations, and exposure data.

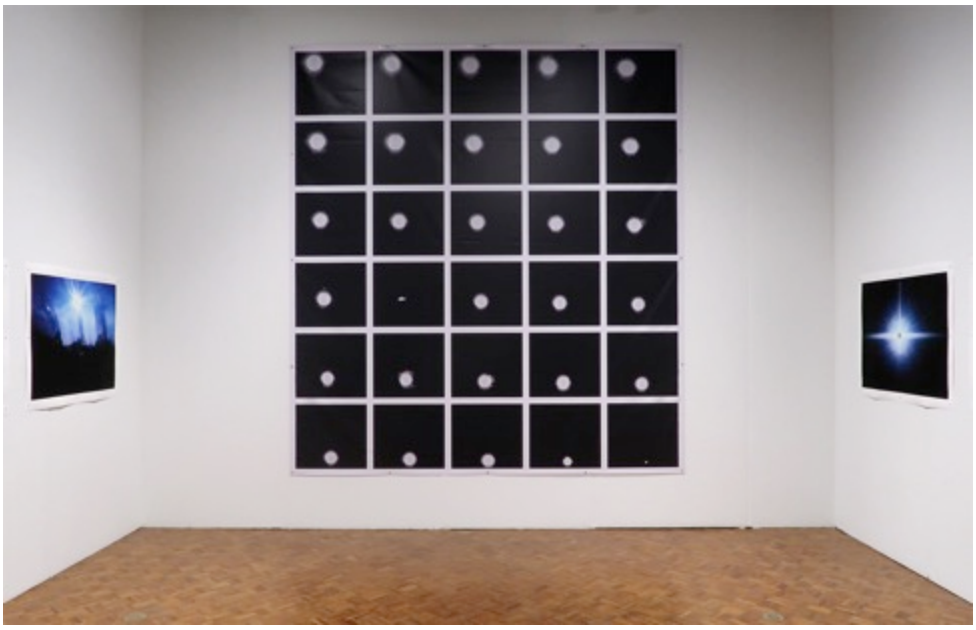
Instant prints and video.

With the absence of title or description panels, the album provides information of the exhibited images for the viewer and represents timelines from the original photographs to the digital enlargements on the sidewalls.

The three displayed image sequences represent timelines of their process of capture. ***Earth at 970MPH*** and ***Waves*** are arranged to face each other from opposite ends contrasting a macro and microscopic perspective of sunlight that the project investigates. Both series represent a direction of time that starts from the entrance to the interior of the exhibition. The wall facing the entrance holds the 30-image sequence of ***A Distant Star***. The represented timeline of the two-hour motion of the sun is read from left to right, top to bottom.




Right and left walls displaying ten 30”x40” digital enlargements from ***Waves*** and ***Earth at 970MPH***.



Rear wall displaying ***A Distant Star,*** approximately 11'x10'.

Homemade cameras used to produce the three series. (Left, right, bottom: ***Earth at 970MPH, Waves, A Distant Star)***

The center of the exhibition is an installation of the three homemade cameras used to produce the photographs of *Ancient Light.* The cameras point towards the photographs of which each is responsible producing, representing timelines of the cameras as the origins to the resulting images. The arrangement of the exhibition space represents eleven timelines describing three variations of the passage of time. ***A Distant Star*** portrays a timeline of two hours in four-minute increments. ***Earth at 970MPH*** is a timeline of about two hours in five images of exponentially increasing durations. ***Waves*** spans 17 seconds with the same sequential pattern of ***Earth at 970MPH***. The inclusion of the equipment and instant prints encompass my own timeline – my artistic process from camera creation to their production of instant photographs and digital enlargements. My equipment and methods of capture in turn reference the history of photography and scientific theories.

## II. Connecting History

### 1. Scientific Reference

In the 16th century, Nicolaus Copernicus published *On the Revolutions of the Heavenly Spheres.* The preface of the book is a letter to Pope Paul III, summarizing his studies of the motion of earth and its position not being the center of the universe. (Duncan 23-27) The photographic technique in ***Earth at 970MPH*** visualizes the studies of Copernicus through utilizing the spin of the

earth and the movement of the sun in still photographs. The technique fixes the position of the sun during a set of multi-exposures to a single sheet of film. As the sun moves through the sky, the captured landscape in each exposure shifts position on the film, resulting in a blur effect. This juxtaposition communicates the physical movement of the earth and the fixed position of the sun.

***Earth at 970MPH*** provides the view of landscapes altered from Copernicus's study of the motion of the earth and its position in relation to the sun. The contrasting perspective from ***Waves*** displays the microscopic behavior of sunlight filtered through the experiment from Thomas Young. In 1801, Young devised an experiment to observe the behavior of light rays. Guiding sunlight through two narrow slits, Young observed an interference pattern of light in his darkened room; a pattern identical to water waves interacting with each other from two stones thrown in a pond. Light is strengthened and destroyed as the peak and troughs of the two waves meet at different angles. The interference pattern is the result of this destruction and strengthening of light and proves its wave-like behavior. (Young 457-471) My series ***Waves*** is a recreation of Young's original room-sized experiment into a portable camera. The use of photographic film records the interference pattern of light over time, an effect not available during Young's era. ***Waves*** provides a view of the effect of time towards the fundamental force humans utilize to perceive their natural surroundings.

***A Distant Star*** incorporates the contrast of the infinitesimally small and large to visualize the paradox of infinity proposed in *Achilles and the Tortoise* by Greek philosopher Zeno:

> *"1. Suppose Achilles runs ten times as fast as the tortoise and gives him a hundred yards start. In order to win the race Achilles must first make up for his initial handicap by running a hundred yards; but when he has done this and has reached the point where the tortoise started, the animal has had time to advance ten yards. While Achilles runs these ten yards, the tortoise gets one yard ahead; when Achilles has run this yard, the tortoise is a tenth of a yard ahead; and so on, without end. Achilles never catches the tortoise, because the tortoise always holds a lead, however small." (Black, Salmon 67)*

Zeno's logic entails space can be infinitely divided. From this notion, any movement is the paradox of the ability to traverse infinite steps of space. For the sake of intuition, the fact is Achilles will definitely overcome the tortoise. The work of Max Planck suggests nature contains an indivisible unit, the *quanta,* at which fundamental forces abide to –the Planck Length. (Duck, Sudarshan 3, 12) ***A Distant Star*** portrays the logical fallacy of Zeno and its solution of the Planck Length with the movement of the sun. Utilizing the low resolution of a Gameboy camera, the vast size of the sun is simplified down to countable square pixels in the resulting images; each pixel references a quanta of space. As it moves through the sky, the represented sun jumps through space pixel-by-pixel. As seemingly infinite amounts of space are represented as regions of the sun simply

being “there” and “not there”, the series explores the concept of motion in indivisible units of space and suggests a binary quality of nature.

The scientifically inspired techniques of camera capture in the three series require imaging systems outside the conventional attributes of the common consumer camera –that is, lens, body, and shutter. The camera used for ***Earth at 970MPH*** comprises of a modified pinhole camera with a mounted riflescope to accurately position the sun; ***Waves*** utilizes a modified Polaroid Big Shot camera, SLR shutter, and an improvised pinhole and double slit to replicate Thomas Young’s experiment to-scale. The Gameboy camera used for ***A Distant Star*** is outfitted with a set of ultraviolet, infrared, and neutral density filters to reduce the intensity of the sunlight for the accurate depiction of the spherical shape of the sun. My artistic process of inventing equipment to photograph specific subject matter is influenced by the early history of photography.

**2. Photographic Reference**

My artistic practice of inventing equipment for a specific photographic purpose is influenced by the historical photographers Eadweard Muybridge, Etienne-Jules Marey, and Harold Edgerton. These photographers had a workflow of inventing equipment to achieve specific results. In order for Muybridge to capture a running horse with clarity, he devised a system of rapid shutters in front of the cameras; an innovating method of controlling film exposure during an era when removing and replacing the lens cap was the

standard. (Clegg 127-130) Marey similarly invented the disc shutter for chronophotography (Braun 64), and Edgerton was able to achieve precision timing and clarity in his high-speed photographs from the use to strobes and sound-activated triggers. (Edgerton 34-35)

I implement techniques that preceded photography's invention. The camera obscura is the phenomenon which light travels through a small hole in a darkened room resulting in a projected image of the outer area inside the opposite end of the darkened interior. (Young 454) Originally utilized as an aid for drawing, the camera obscura, or pinhole, is considered the precursor to the invention of photography. The cameras of ***Earth at 970MPH*** and ***Waves*** utilize the technique of pinhole imaging.

The photographers previously mentioned all use the camera as a tool for capturing high-speed events unseen to the naked eye. Their main focus is to study the clarity of subjects free from the effects of time. My use of pinhole photography is the inversion of Muybridge, Marey, and Edgerton's focus; the effect of time is the primary subject in my photographs. My work suggests that the "abstraction" of the thing photographed through the effects of time is closer to reality than sharp, still photographs –the nature of time does not stop. The method of pinhole imaging unifies light and time in long-exposure photographs that extend and expand our visualization of time, offering the unrecognizable view of entropy, the inevitable path of time.

# III. Compressing Time

## 1. Visualizing Entropy

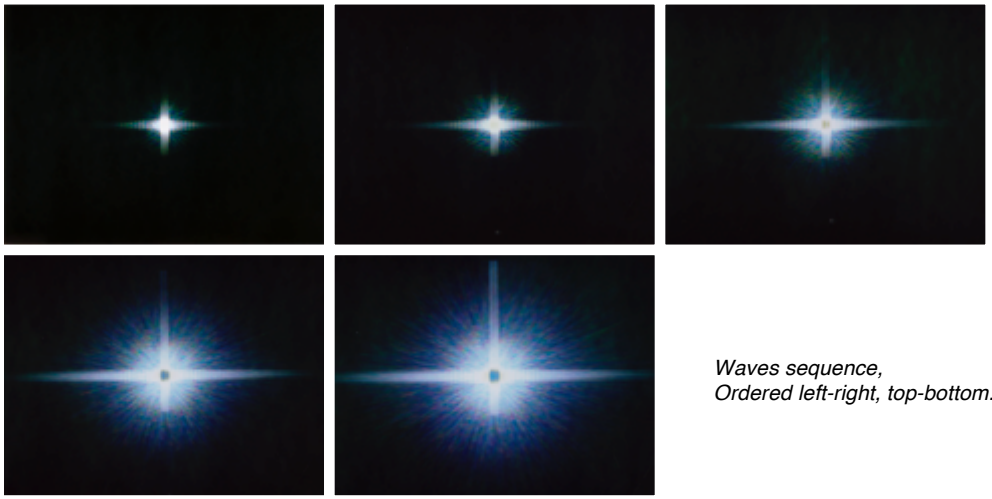
The second law of thermodynamics states that entropy, the measure of disorder in a system, will never decrease. (Mackey ix) This process can be demonstrated with the dissolving of a sugar cube in a glass of water; the ordered structure of the cube will practically always transform to a chaotic mixture of sugar and water molecules. The irreversible path from order to disorder is the inherited direction of time all of nature abides. The two five-image sequences of ***Earth at 970MPH*** and ***Waves*** from part.I section.3 of this paper visualize the increase of disorder in natural occurrences through their progression of photographs through increasing exposure duration. In ***Earth at 970MPH,*** the first image in the sequence entails the exposure duration of seven seconds. The images are of the same location; however, made sequentially and each progressively contains an exponential increase in exposure duration -seven seconds, seven minutes, fifteen minutes, thirty minutes, and one hour. The increase of exposure duration displays an increase of disorder in the progression of images as the familiar landscape dissolves to unrecognizability.

*Earth at 970MPH sequence,*
*Ordered left-right, top-bottom.*

The five images progressively deemphasize the static location, and turn attention to the movement of the earth's rotation in relation to the sun. Contrasting to this image is a video (78 min) included in the exhibition, mentioned in part.I section.3 of this paper, which documents the entire process of making the fifth and final image of the sequence. The video is made with a GoPro camera attached to the camera that produced ***Earth at 970MPH***. The footage shows my hand emerging into frame to adjust the camera every minute to compensate for the minute movements of the sun. This event occurs 60 times; the mounted GoPro and camera incrementally faces down towards the ground while the scope remains in line with the position of the sun. The video portrays the familiar experience of the passing of one hour in contrast to the compression of the same duration in the final photograph.

*Earth at 970MPH Video Screenshots.*
*Ordered left-right, top-bottom.*

The five-image sequence of ***Waves*** is arranged similar to ***Earth at 970MPH***, from the shortest exposure to the longest. The increase of duration is in the factor of two - ¼ second, ½ second, one second, five seconds, and ten seconds. The increase of time allows the recording of light beyond Thomas Young's predicted behavior discussed in part.II section.1. Young's original experiment projects the interference pattern of sunlight onto a non-photographic surface; his observed pattern remains consistent, similar to the first image in my sequence due to light reflecting off his observation surface which then dissipates within the room. My use of photographic film records all light received without dissipation during a set amount of time. In later images of the ***Waves*** sequence, light is given substantial time to stray in multiple directions, eventually smearing the original interference pattern from the overabundance of light.



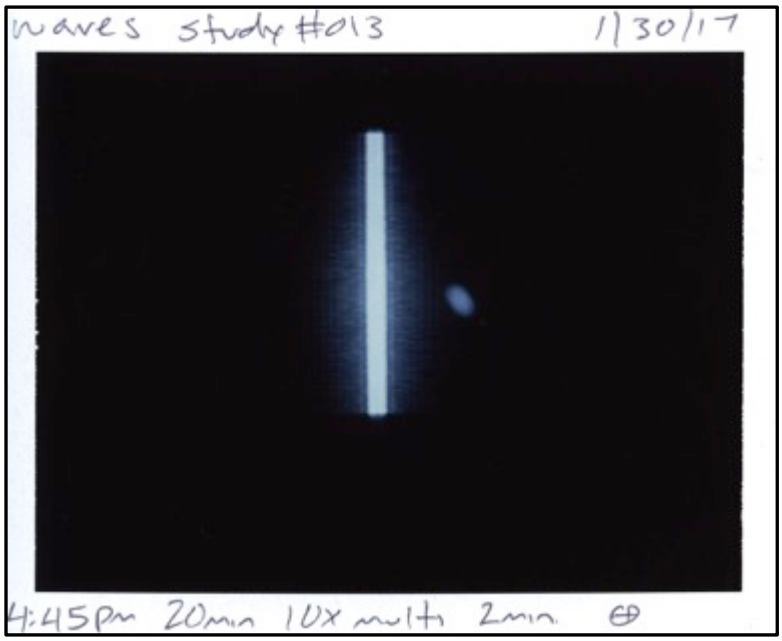
*Waves sequence,*
*Ordered left-right, top-bottom.*

As illustrated earlier by the sugar cube example, the effects of entropy are displayed in the later images of the ***Waves*** sequence. Young's orderly interference pattern obscures to disorder from the extended periods of time light waves are given to interact; the resulting visual entropy is captured on the film at locations beyond their intended path.

My early tests of ***Waves*** are informed by the factor of atmospheric pressure determining the clarity of recording light-wave interference. Similar to the effects of fog diffusing the headlights of a car, these early photographs of the interference pattern are depicted blurry due to the scatter of light from high levels of moisture and humidity in my location of Honolulu. My desire for a visually defined interference pattern is to replicate Young's 1801 observation to the upmost similarity and record the effects of time in multiple photographs. The pursuit for optical clarity is one of the reasons why I chose to produce the work of ***Waves*** and ***Earth at 970MPH*** at the summit of Mauna Kea on the island of Hawai'i.

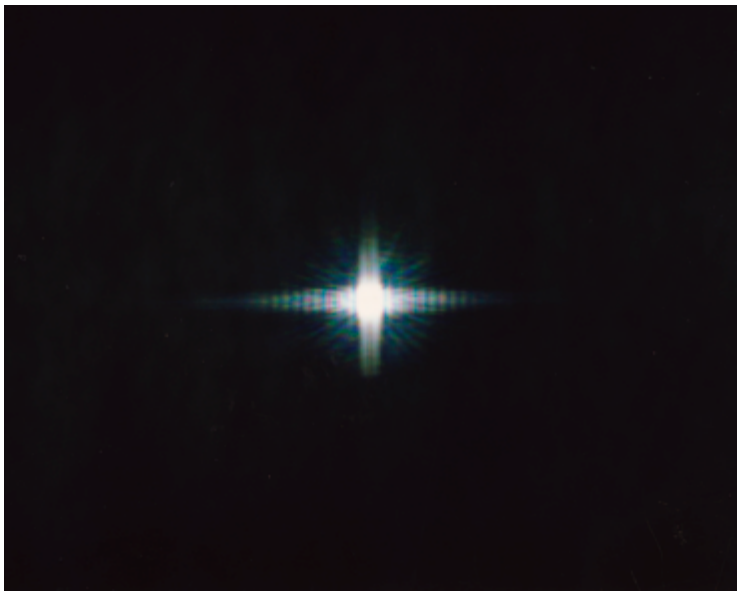
**2. Mauna Kea**

At an elevation of 13,700 feet higher than Honolulu with an atmospheric drop of 40%, the ***Waves*** photographs in the exhibition displays a contrasting result in time and clarity of Young's interference pattern at the summit of Mauna Kea. (*ifa.hawaii.edu* 2010-2017)




(*Waves Study #013,* FP-100C Instant Picture, 2017)

Earlier tests to photograph an interference pattern in Honolulu took upwards to ten minutes and light diffusion from the dense atmosphere renders the pattern out of focus. The low pressure of Mauna Kea provides minimal amounts of light diffusion, allowing a straighter path of light producing a defined pattern.



(*Waves Study #023,* Archival Pigment Print from FP-100C Instant Picture, 2017)

To my surprise, the durations of exposure to achieve the pattern are compressed to mere fractions of a second discussed in the previous section, in comparison to earlier tests requiring minutes. Explained in section.I part.2, Rob Bryanton's method of simplifying space to a dot moving within the line of time is applied to the durations required for each photograph; the significantly shorter exposures at Mauna Kea suggest the compression of past and present in comparison to Honolulu.

The contraction of past and "present" at Mauna Kea is reflected in the inclusion of current manmade structures among the dormant volcano aged to be approximately one million years old. (*malamamaunakea.org* 2004-2017) These structures amid an ancient setting are utilized to collect information of the distant past of the universe. My work ***Earth at 970MPH*** in the exhibition is a visual representation of this relationship between the past and "present." The images in the series include the Sub-Millimeter Array, a device used to detect wavelengths

of light undetectable in the visible spectrum. (Blundell 2007) The inclusion of the SMA in my photographs draws a parallel to my presence atop the summit to visualize events invisible to our perception.

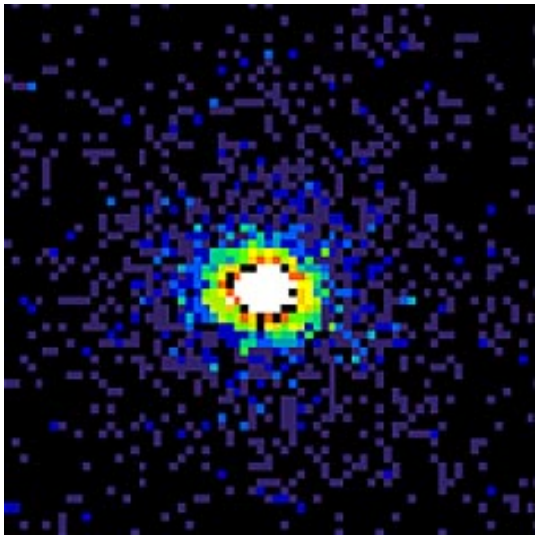
### 3. A Perspective Beyond my Position

My decision to photograph at Mauna Kea is to produce work at a location with minimal atmospheric distortion and to draw a parallel between my work and the compression of time. The focus of my photographs, however, is the effects of time on the common subject matter of the sun and light. As mentioned in the introduction, Hiroshi Sugimoto's *Seascapes* depicts only ocean and sky; with his simplification, *Seascapes* offers the viewer a perspective free from the time period and location the photograph was produced. Free from a specific point in time and space, Sugimoto interprets his photographs as the first conscious view of humanity and the search for habitable exoplanets containing liquid water. (Sugimoto, *sugimotohiroshi.com)*

Similar to Sugimoto's interpretation of his *Seascapes*, I interpret my series ***Earth at 970MPH*** and ***Waves*** as views from the distant future. The intensifying presence of the sun and light in both image sequences suggest the later stages of the life of the sun, as scientific research indicates the sun will increase size and luminosity in the next five billion years. (*www-istp.gsfc.nasa.gov* 2000) The inclusion of the currently operated Sub-Millimeter Array in ***Earth at 970MPH*** establishes of the existence of humanity, however, the exclusion of living humans in both series denotes any specific point in time of which the photographs were

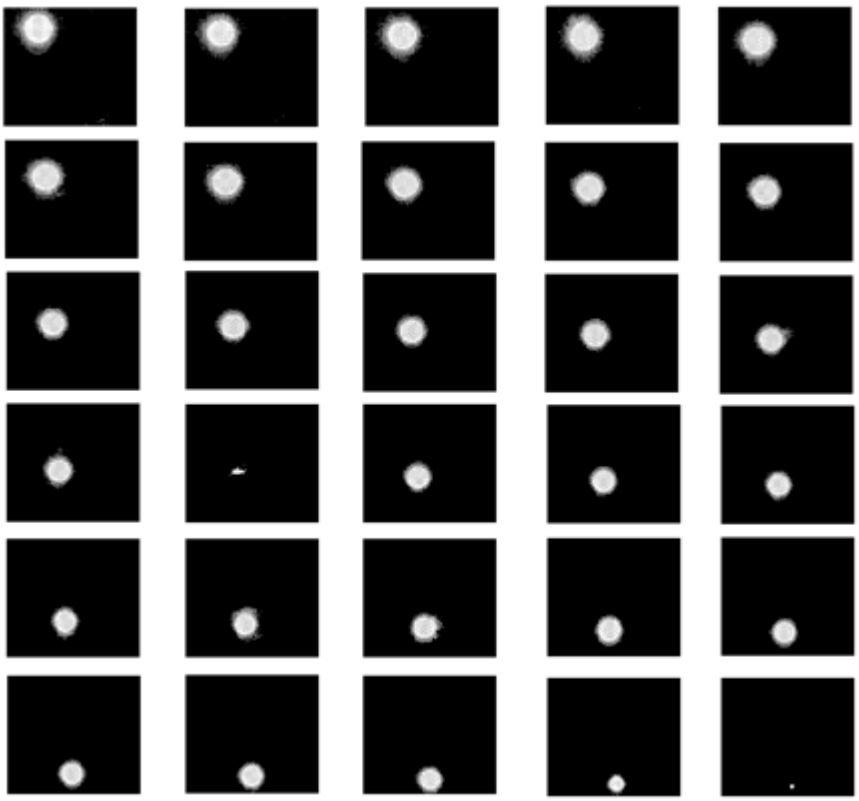
made. The increasing abstraction from the effects of time in both image sequences also suggests a passing of immeasurable time and a view of the distant future.

The two previously mentioned series are from the familiar perspective of earth; ***A Distant Star*** aims to provide a view of our sun from a perspective thousands of light years away.



(Cygnis X-1, *hubblesite.org)*

I chose to utilize the Gameboy camera, with its low image fidelity, in order to mimic the visual aesthetics of our current technological ability to image distant stars; the example above is the binary star system Cygnus X-1, 8,100 light-years away, photographed by the Hubble Space Telescope. (*hubblesite.org)*



(*Solar-Track #002: September 2017*,Digital Vinyl Print from Gameboy Camera, 134”x122”. 2017)

In a thirty-image sequence, the pixelated representation of the sun varies in size and shape from the passing of clouds and the diminishing intensity of sunset from my location. In the context of a distant perspective, the varying representation of the sun refers to our current methods of detecting non-luminous objects interacting with distant stars such as exoplanets in orbit. ***A Distant Star*** portrays the sun as a star whose light elapses a similar amount of time the photons the sun generates to reach our view.

# Conclusion

> *"It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known."* (Sagan 9)

The exhibition makes visible the temporality of my own existence in comparison to the natural world. The presented photographs are informed by the past at the service of imagining the future. Although questioning human limitations, *Ancient Light* is not a condemnation of our presence, but rather, a celebration of our ability to understand the hidden qualities of our surroundings. Our current understandings of the accelerating expanding universe predicts the sheer vastness of the cosmos will shroud our ability to view any celestial objects, as light will not be able to reach earth. In my opinion, our accumulated knowledge and experience during our existence offers a privileged perspective provided by the light of the past illuminating the present.

# Bibliography

Abbott, Edwin. *Flatland: A Romance of Many Dimensions.* New York: Dover Publications, Inc., 1952.

Blundell, Raymond. "The Sub Millimeter Array." *cfa.harvard.edu.* 2007. Harvard Smithsonian Center for Astrophysics. November 2017. <https://www.cfa.harvard.edu/sma/general/IEEE.pdf>

Braun, Marta. *Picturing Time: The Work of Etienne-Jules Marey (1830-1904)* Chicago: The University of Chicago Press, 1992.

Bryanton, Rob. *Imagining the Tenth Dimension.* Victoria, B.C.: Trafford Publishing, 2006.

Clegg, Brian. *The Man who Stopped Time.* Washington, D.C.: Joseph Henry Press, 2007.

Duck, Ian & Sudarshan, E.C.G. *100 Years of Planck's Quantum.* Singapore: World Scientific Publishing Co. Pte. Ltd., 2000.

Duncan, A.M., editor. *Copernicus: On the Revolutions of the Heavenly Spheres.* Great Britain: David & Charles Ltd., 1976.

Edgerton, Harold. *Moments in Vision*. Cambridge, Massachusetts: The MIT Press, 1979.

*hubblesite.org* 2008. National Aeronautics and Space Administration. November 2017.

"Environmental Factors." *malamamaunakea.org.* 2007-2017. Office of Maunakea Management. November 2017. <http://www.malamamaunakea.org/environment/environmental-factors>

Lawrence, Stephen. "Some Interesting Facts About the Sun." *International Solar-Terrestrial Physics Program.* 1998. NASA. Oct. 2017. < https://www-istp.gsfc.nasa.gov/istp/outreach/workshop/thompson/facts.html>

Mackey, Michael. *Time's Arrow: The Origins of Thermodynamic Behavior.* New York: Springer-Verlag Inc., 1992.

"Mauna Kea Observatories." *Institute for Astronomy University of Hawaii.* 2016. Institute for Astronomy. Oct. 2017. < http://www.ifa.hawaii.edu/mko/>

Mitalas, R. & Sills, K. R. "On the Photon Diffusion Time Scale for the Sun." *Astrophysical Journal* vol. 401 no.2 (1992). 01 February 2017. <http://articles.adsabs.harvard.edu//full/1992ApJ...401..759M/0000759.000.html>

"PIA00452: Solar System Portrait - Earth as 'Pale Blue Dot'" *Jet Propulsion Laboratory.* 12 Sept. 1996. NASA and JPL. <https://photojournal.jpl.nasa.gov/catalog/PIA00452>

Sagan, Carl. *Pale Blue Dot.* New York: Random House, Inc., 1994.

Salmon, Wesley, editor. *Zeno's Paradoxes.* New York: The Bobbs-Merrill Company, Inc., 1970.

Sugimoto, Hiroshi. "*Seascapes." Hiroshi Sugimoto.* October 2017. <http://www.sugimotohiroshi.com>

Williams, Robert. "Hubble's Deepest View of the Universe Unveils Bewildering Galaxies across Billions of Years." *Hubblesite.* 7 Jan. 1996. NASA and STScI. Oct. 2017. < http://hubblesite.org/news_release/news/1996-01>

Young, Thomas. "A Course of Lectures on Natural Philosophy and the Mechanical Arts." London: William Savage, Bedford Bury, 1807. Digitized Article from the Internet Archive, 2008. October 2017. <http://www.archive.org/details/lecturescourseof01younrich>