



COSMOS ODYSSEY

Our Quest to Discover the Universe

KWON OCHUL
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Ancient Ideas of the Universe



When ancient people looked upward - at the Sun, the moon, the Milky Way, and the myriad of stars - what did they think about them?

It must have been a huge mystery.

To explain these natural phenomena, ancient civilizations created myths and legends.

In ancient Egypt, people believed that there existed a goddess of the sky, Nut, and a god of the earth, Geb. The sky-goddess gave birth to the Sun each morning and swallowed it in the evening. This is how the change from day to night was understood.



Geocentric Model vs Heliocentric Model

There were also attempts to scientifically understand the universe.

In Ancient Greece, Plato, Aristotle, and Ptolemy thought that the Sun, the moon, and stars rotated around Earth - they thought that the universe was eternal, unchanging.



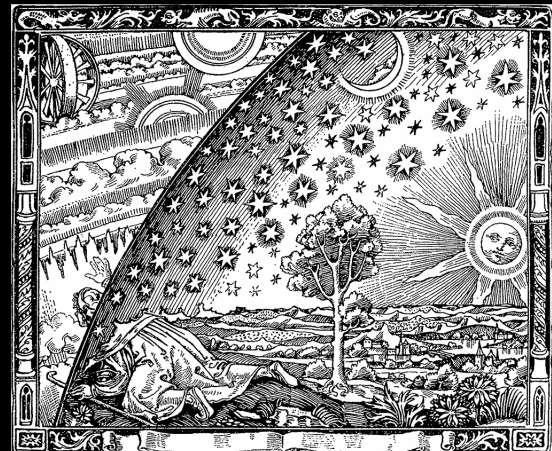
To illustrate the motion of the planets, they had to think of a very complicated universe of overlapping circles.



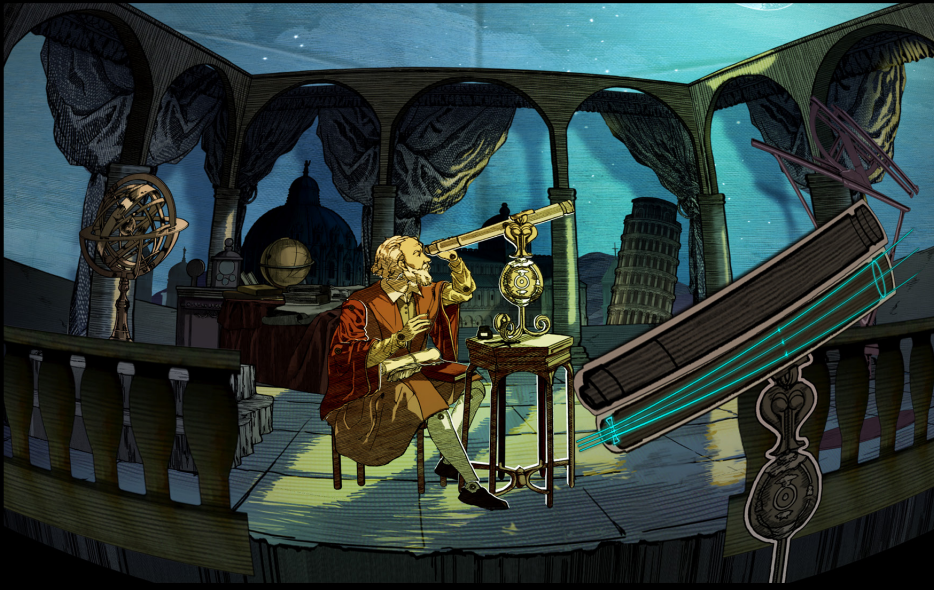
In the early 1500s, Copernicus thought that the Sun was in the center, not Earth. This explained the motion of the planets much more simply and clearly.

His idea shattered the old way of thinking. It was the beginning of the Scientific Revolution.

The above image, which depicts the paradigm shift brought by the heliocentric theory, pays homage to the "Flammarion engraving," an illustration representative of medieval cosmology.



Early Telescopes



Galileo Galilei, 1564-1642

In 1609, Galileo created a telescope to observe the night sky. A new era in astronomy began.

He discovered four moons orbiting Jupiter, and complete phases of Venus to be similar to Earth's moon phases. It proved that Copernicus was right.



Johannes Kepler, 1571-1630

Kepler improved the refracting telescope.

He found that the orbits of planets were not circular, but elliptical. This discovery helped complete the heliocentric model of the Solar System.



Isaac Newton, 1643-1727

Isaac Newton was the first to invent a reflecting telescope which uses a concave mirror instead of a lens.

Newton pointed out that gravity, the force that causes an apple to fall to the ground, also makes Earth and other planets orbit around the Sun.

Prelude to the Modern Observatory



The 100-inch (2.5m) telescope
Mount Wilson Observatory
California, USA



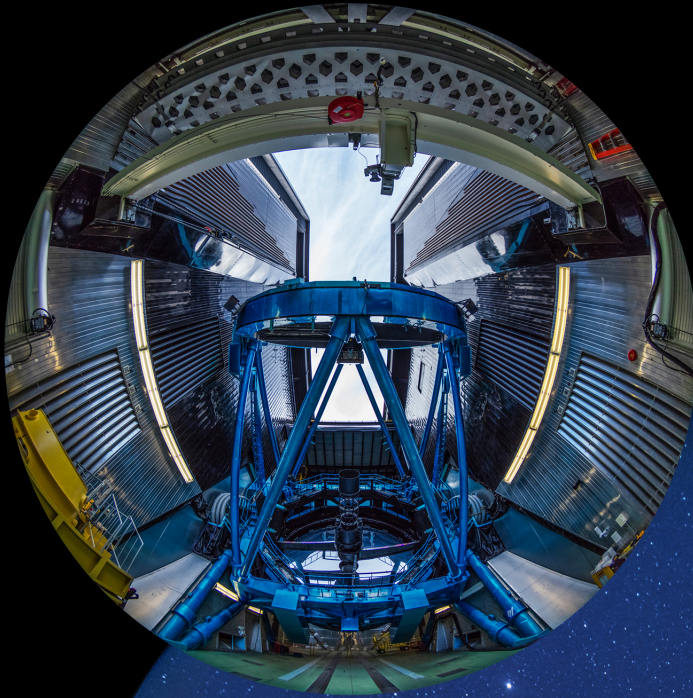
George Ellery Hale (1868-1938) founded the Yerkes Observatory in 1897, which houses a 40-inch refractor. He also established the Mount Wilson Observatory with the installment of 60-inch and 100-inch reflectors. In 1928 he built the Palomar Observatory which boasted a 200-inch reflector. His telescopes were the largest in the world until 1975.

In 1929, using the world's largest telescope at the time, astronomer Edwin Hubble discovered that the universe was expanding.



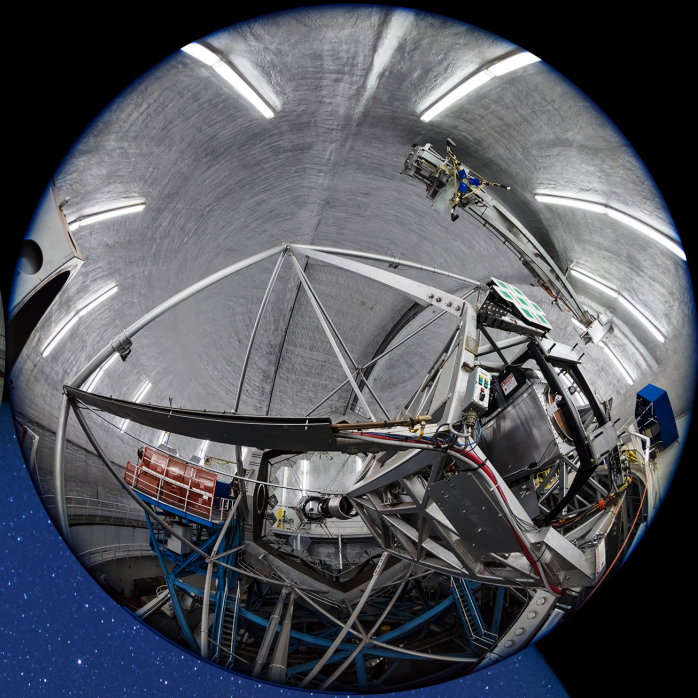
Edwin Hubble, 1889-1953

Modern Observatories



Subaru Telescope / Hawaii, USA

The Subaru Telescope has one of the largest mirrors in the world with a diameter of 8.2 meters. Hundreds of tiny actuators attached to the backside of the mirror precisely correct the distortion in real time.



W.M.Keck Observatory / Hawaii, USA

The primary mirrors of the two telescopes are 10 meters in diameter. To make the larger mirrors, hexagonal segments were combined.

Gran Telescopio Canarias / La Palma, Spain

At the highest point on the island of La Palma in the Canary Islands sits the largest single standing telescope in the world. 36 hexagonal mirrors were combined to make a 10.4-meter reflector.

The Chase for Larger Telescopes

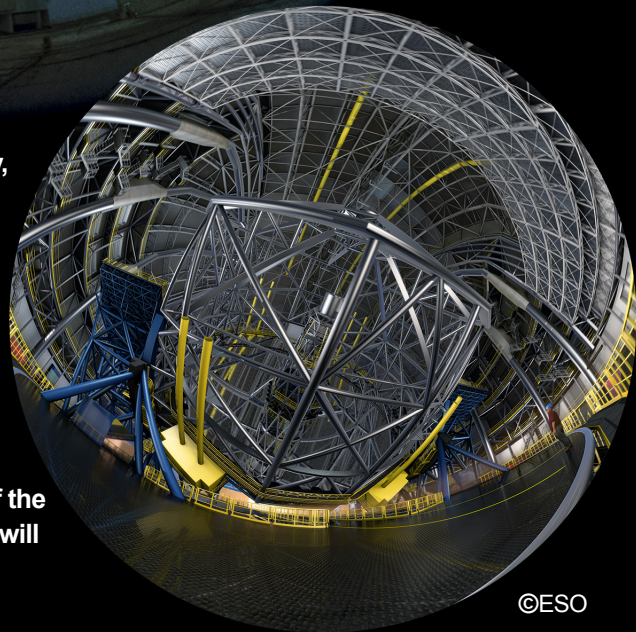
VLT (Very Large Telescope) / Chile

These four 8.2-meter telescopes can be operated separately, or combined to make the largest telescope in the world.

These lasers create artificial stars in the sky to measure and correct atmospheric distortion of light thousands of times per second. They help obtain the finest details.

ELT (Extremely Large Telescope) / Chile

To be built at the top of the mountain, opposite the site of the VLT is the ELT, the Extremely Large Telescope. Its mirror will be 39 meters – large enough to fit two basketball courts.



Radio Telescopes



ALMA (Atacama Large Millimeter/submillimeter Array) / Chile

At an altitude of 5000 meters in the Chilean Andes Mountains, 66 large antennas reach up to the sky.

Connected together, they act as one big telescope.

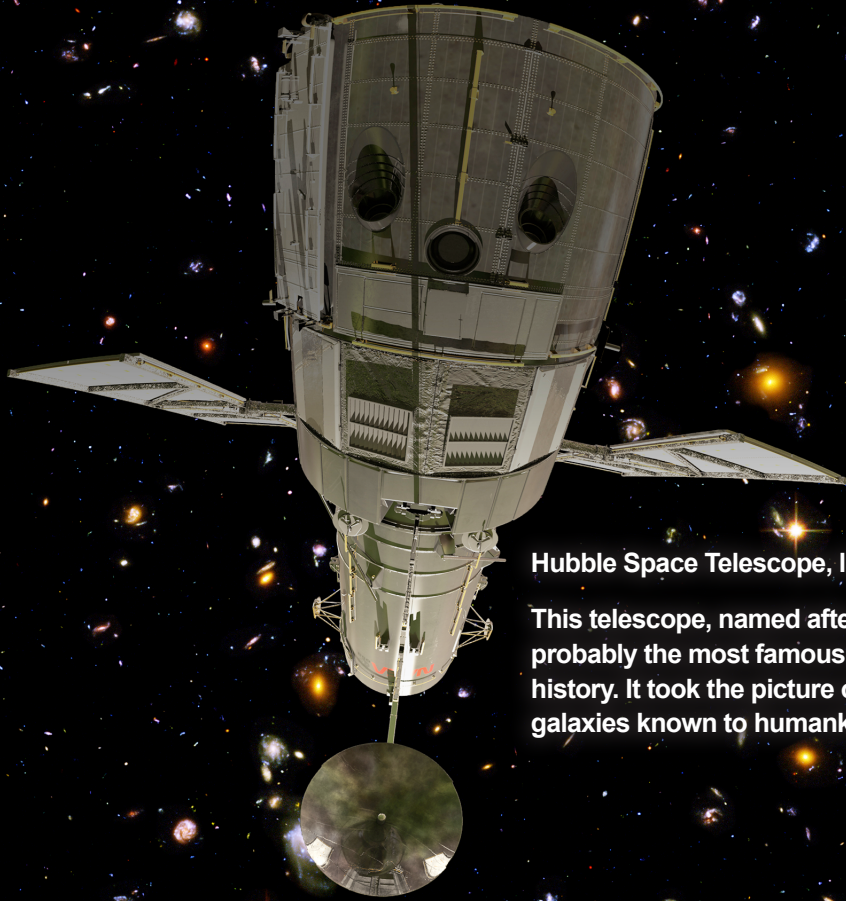
VLA (Very Large Array) / New Mexico, USA

This radio telescope, which was featured in the movie *Contact*, consists of 27 giant antennas.

Radio telescope can be used for observations during daytime.



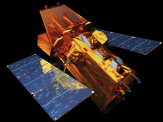
Space Telescopes



Hubble Space Telescope, launched 1990

This telescope, named after Edwin Hubble, is probably the most famous space telescope in history. It took the picture of the oldest galaxies known to humankind.

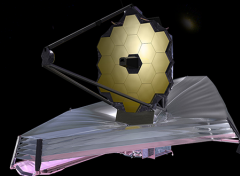
Earth's atmosphere is constantly shimmering and blocking wavelengths outside the visible light spectrum. Because of this interference, space is the best place for carrying out astronomical observations.



Swift Gamma Ray Burst Explorer



Hubble Space Telescope



James Webb Space Telescope



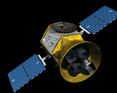
COBE



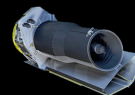
Chandra X-ray Observatory



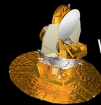
Galaxy Evolution Explorer



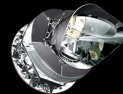
TESS



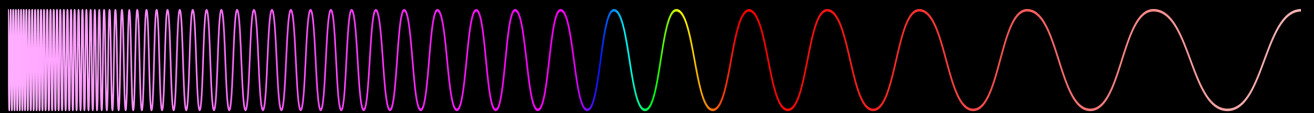
Spitzer Space Telescope



WMAP



PLANCK



Gamma ray

X-ray

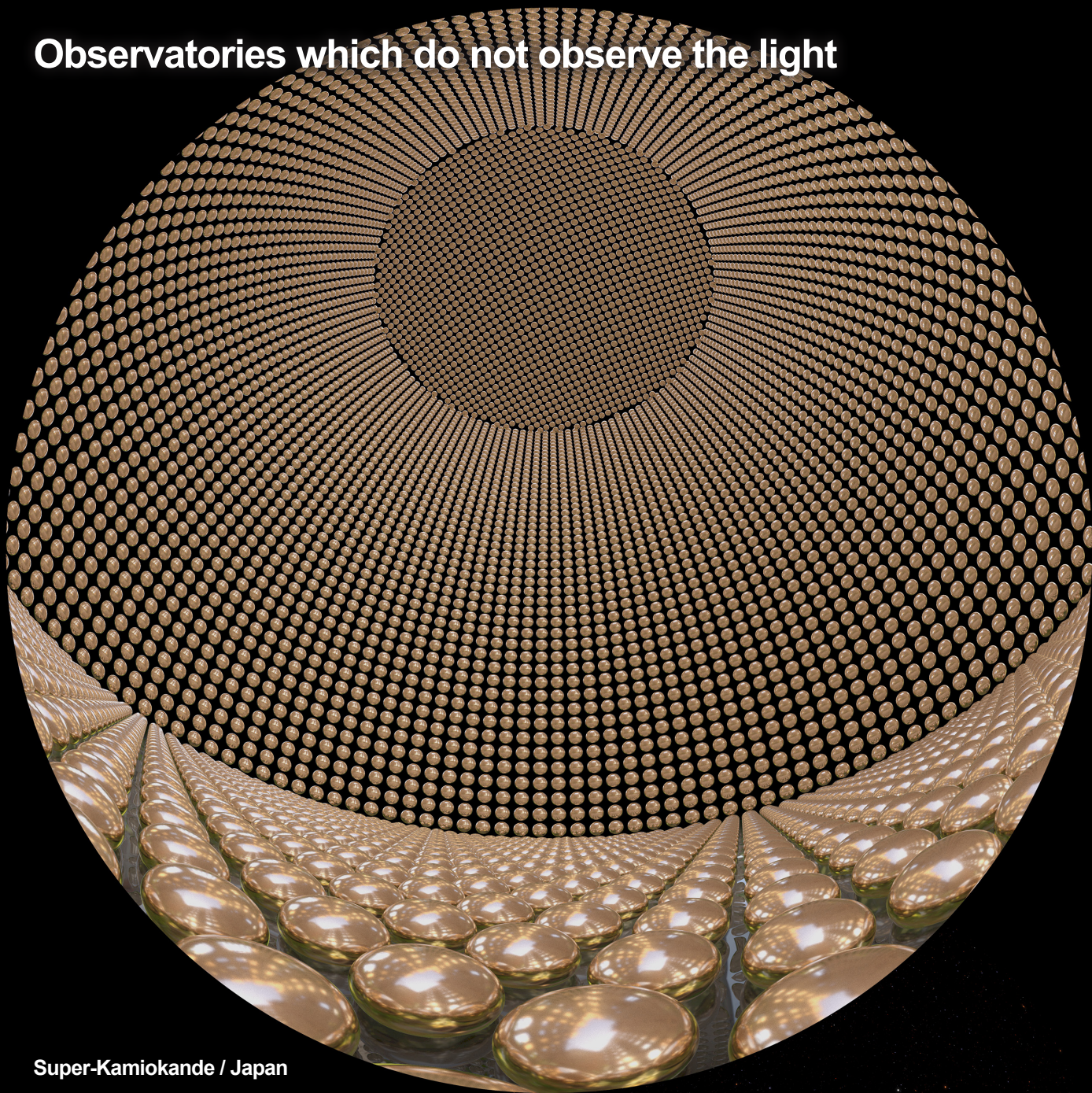
ultraviolet

visible

infrared

radio

Observatories which do not observe the light

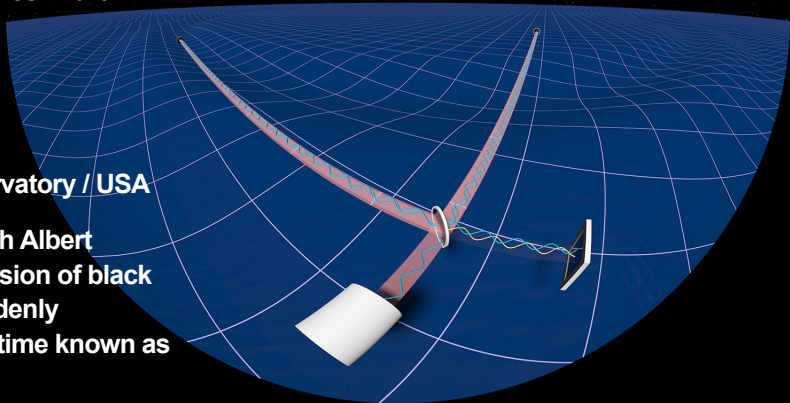


Super-Kamiokande / Japan

The Super-Kamiokande is located 1000 meters underground in an abandoned mine. Its purpose is to observe particles called neutrinos. Other particles in the universe are unable to reach so deep below the Earth's surface.

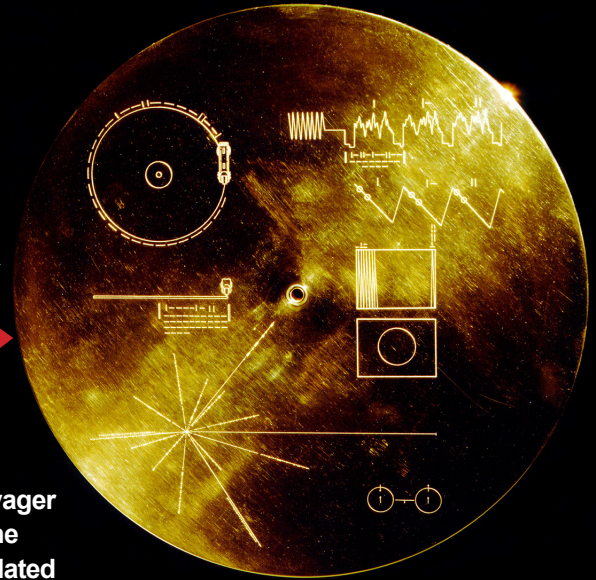
**LIGO
Laser Interferometer Gravitational-Wave Observatory / USA**

This facility observes gravitational waves which Albert Einstein predicted a century ago. With the collision of black holes or neutron stars, a massive mass is suddenly converted to energy, creating ripples in space-time known as gravitational waves.



Space Exploration

Humankind has now left Earth to set foot in space. Astronauts have visited the moon and now live on the International Space Station. We've placed numerous satellites around Earth and sent probes to planets, moons, asteroids, and comets in our solar system. Voyager 1 and 2 are navigating interstellar space beyond the Solar System.



Voyager 2 was launched in August of 1977, and Voyager 1 a month later. Voyager 1 flew by Jupiter and Saturn, and in 2012 entered the interstellar space outside of the Solar System. Voyager 2 flew by Jupiter, Saturn, Uranus, and Neptune, and also left the Solar System in 2018. Both Voyagers carry with them a gold-plated phonograph record that contains a message from humans on Earth in case of an encounter with intelligent extraterrestrial life.



International Space Station

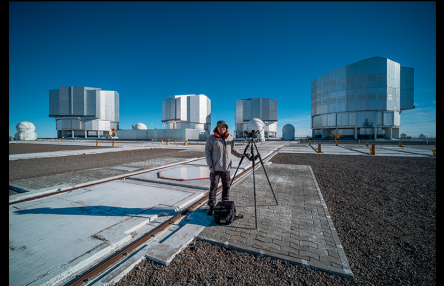
The International Space Station (ISS) is a collaboration of 16 countries. It orbits Earth 16 times a day at an altitude between 330 and 430 kilometers. Over the course of many years modules were launched into space and assembled together, making the ISS currently the size of a soccer stadium.

The History of the Universe and of the Human Effort to Understand It!

The scope of the universe as understood by humankind has expanded with the development of astronomy. Starting from the mythological universe of ancient times, let us explore the Ptolemy's geocentric theory, the heliocentric theory, the revolution brought by the invention of the telescope, spectrum analysis, and the latest technologies in today's astronomical observatories.

Shooting the world's leading astronomical facilities!

Including the three major observatories of the world - Mauna Kea (Hawaii), La Palma (Canary Islands), and Atacama (Chile).



Production : KWON O CHUL www.kwonochul.com

Distributor : METASPACE www.metaspacespace.co.kr

Release date : 2019. 1.

Running time : 29 min

Resolution : 4K / 6K / 8K

※ The original resolution of each scene is either 4K, 6K, or 8K. Live-action shooting is 6K, animation is 4K, and some CG scenes are 8K. To maintain details and sharpness, the finest software technology was used for mastering

Sound : 5.1 ch

Language : English / Korean / Japanese / (more to come)

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www.kwonochul.com/cosmosodyssey

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