“Europe’s Cosmic Quest” - English Script

	Narration English	Description of scene
Intro	The immense Universe that surrounds us is made up of hundreds of billions of giant star formations called galaxies.	Travel among a multitude of galaxies focusing to one spiral galaxy
Intro	In one of them, there is a pale blue dot that we call home – the planet Earth.	Slow zoom into our galaxy from outside, through its stars to Earth
Intro	This dynamic planet has all the necessary conditions for the development of the extraordinary complexity we call life. One of the many millions of living species that appeared on Earth has evolved so much that it has dominated everything else. It is our species, humans. We managed to develop a very sophisticated technological culture that raised important questions about our very existence and the natural environment we are living in, and eagerly we are seeking for answers.	Views of Earth TL of a city road Scientists in a lab
Title	**Europe’s Cosmic Quest**	ESA and Museum Logo Present (logo). Title of the Show.

ESA organization	On a small part of land on Earth, called Europe, nations cooperate in all areas of human activity, working towards a major economic, cultural and political integration. Part of this common effort is ESA, the European Space Agency - an intergovernmental organization of 22 member states established in 1975. ESA is Europe's gateway to space. Its mission is to provide and to promote, for exclusively peaceful purposes, cooperation among European States in space research and exploration. By coordinating the financial and intellectual resources of its members, it undertakes programmes and activities far beyond the scope of any single European country.	Earth is revealed Zoom above Europe. Flags of countries participating at ESA. Outline of ESA's sites
ESA mission	In short, ESA's job is to draw up the European space programme and carry it through. ESA's programmes are designed to discover more about Earth, the space environment, our Solar System, and the Universe. ESA builds rockets and space carriers that can carry earth observing satellites, space probes to other planets, and astronomical observatories in space, far from Earth's atmosphere.	satellites in labs Ariane Rocket

ISS The last/first frontier of humankind	ESA participates in the most advanced space outpost we have - the International Space Station, or ISS. It is a space station in low Earth orbit. The ISS is a joint project between several space agencies: The US NASA, The Russian Roscosmos, the Japanese JAXA, the European ESA, and the Canadian CSA. The first ISS component was launched in 1998, with the first long-term residents arriving on 2 November 2000. Since then, the station has been continuously occupied and upgrading with new modules and instruments. ISS is one of the most important laboratories for the advancement of our scientific knowledge and especially of our technology. All technology devised for this challenging project combined with the results of the numerous experiments performed there, soon will become part of our everyday life -- changing our civilization and providing solutions to problems we are confronted with today. ISS is one of the most precious investments we have ever made.	ISS flying above Earth. Astronauts perform experiments. Views of ISS interior.
	Study of the Universe	
Study of the Universe Astrophysics Visible light Eye observation telescopes	The Universe is enormously vast. The only messenger that can travel such large distances and bring us knowledge about the distant celestial bodies is light reaching Earth. This is the natural planetary show that we can observe with our eyes each clear night on the dome of the night sky. That is what astronomers called visible Universe – the Universe that we can see. This light, however, is so dim and the signal is getting so weak with the distance, that we need to build huge telescopes to capture it. But would this be enough to see the whole Universe?	Light traveling to Earth from distant object. Night time sky timelapses, Videos of optical telescopes.

Nature of the light Light spectrum Invisible light Observable universe	The visible spectrum — that is, light that we can see with our eyes when we look at a rainbow—makes up only a small fraction of the different types of radiation that celestial bodies emit. This just means that there is a lot more going on in the Universe that we cannot see! On one side of the visible spectrum, we find the types of light that are lower in frequency than visible light. These types of light include infrared (IR) rays, microwaves, and radio waves. On the other side of the visible spectrum is ultraviolet (UV), X-ray, and gamma ray radiation. These types of radiation are with extremely high energies. Gamma rays are the highest in frequency and energy. These invisible types of light can be detected/recorded by specific sensors or cameras. Such images of the night sky in all parts of the light spectrum extend tremendously our ability to observe the Cosmos.	Spectrum animation. Spectrum animation 2. ESA space observatories graphic
Space telescopes Astrophysics Science	Earth's rich atmosphere acts as a shield and protects life from the hostile space environment, but prohibits most of the light to pass through. Furthermore, the turbulent atmosphere degrades the images in telescopes on Earth's surface. Thus, the only way to observe the Universe comprehensively and with clarity is to employ specially designed telescopes in space. Until now, the biggest space telescope is **Hubble**, which has a mirror of 2.4 meters. It orbits Earth every 97 minutes at a distance of 569 kilometers. Hubble can point at an object for 24 hours continuously. Since 1990, it has recorded some of the most detailed visible light images, allowing a deep view into space. Many Hubble observations have led to breakthroughs in astrophysics, such as determining the rate of expansion of the Universe. The successor of the Hubble will soon be the **James Webb** space telescope. This telescope has a 6.5-meter mirror and is designed to observe in infrared light. It will be able to observe galaxies at a distance of 13.5 billion light years from Earth i.e. see not only far into the Universe, but also into its distant past.	Earth with atmosphere and turbulence animation. Hubble telescope emerges above Earth. Hubbe maneuvering. Hubble Deep Sky images. James Webb

Microwave	The Planck space observatory was launched in 2009 for cosmological studies, and also to map the Cosmic Microwave Background Radiation, turning the clock back and revealing the infant Universe as it was only 380 000 years after the Big Bang.	Planck in space. Sky turns from optical to CMB
IR	Infrared radiation is primarily 'heat', or thermal radiation. The Infrared Space Observatory (**ISO**) - a cooperation between ESA, NASA, and JAXA - and the **Herschel** Space Observatory, operated in the infrared light spectrum. They could observe astronomical objects that remain hidden for optical telescopes, such as the star hatcheries and nurseries - the coldest and dustiest cocoons where stars are born, as well as dusty galaxies just starting to bulk up with new stars. Active from 2009 to 2013, Herschel was the largest infrared telescope ever launched, carrying a 3.5-metre mirror and instruments sensitive to the far infrared and submillimetre wavebands. It sifted through star-forming clouds - “slow cookers” of star stuff - to trace the path by which potentially life-defining molecules, such as water, are synthesized.	IR video demonstration ISO appears, The sky background changes to infrared Fly into the Orion's nebula, by the trapezium showing GMC and cocoons. Herschel appears Herschel star-forming clouds images

Stars, **Visible light**	ESA has also aimed to observe the positions of billions of stars in our galaxy with unprecedented accuracy, known as astrometry. Using observations in visible light, the space observatory **Hipparcos** managed to measure and catalogue the positions of 118000 stars. The **Gaia** satellite, which is designed to measure the brightness, position, and motion of more than 1.3 billion stars, has already produced the most detailed three-dimensional map ever made of the Milky Way.	Fly through stars of our galaxy. Hipparcos appears Gaia satellite observing Gaia Milky Way Image
IUE	Launched in the late 70s, the International Ultraviolet Explorer (**IUE**) astronomical observatory satellite was designed to detect ultraviolet spectra. The ultraviolet light observed by the satellite cannot be detected on Earth due to the Earth's atmosphere and protective ozone layer. Astronomers made observations of objects ranging from solar system bodies to distant quasars. Among the significant scientific results from IUE data was measurements of the way interstellar dust absorbs light, and measurements of the supernova SN1987A, which showed that it defied stellar evolution theories as they then stood. When the mission ended, it was considered the most successful astronomical satellite ever.	IUE in orbit SN 1987A animation

X-γ ray	X-ray and Gamma-ray radiation originate from the most violent and high-energy cosmic events such as supernova explosions, star collisions, Black hole environments, and even the Big bang itself. This type of light is known as ionizing radiation - its photons are so energetic that they can separate atoms and molecules into ions and free electrons! ***XMM-Newton***, also known as the X-ray Multi-Mirror Mission, is an X-ray space observatory launched in December 1999. The spacecraft investigates interstellar X-ray sources, performing the first simultaneous imaging of objects in both X-ray and optical wavelengths. The XMM-Newton is helping scientists to solve a number of cosmic mysteries, ranging from enigmatic black holes to the origins of the Universe itself. ESA plans to succeed *XMM-Newton* with the Advanced Telescope for High Energy Astrophysics (**ATHENA**), an X-ray telescope designed to map hot gas structures as well as supermassive black holes. Another important observatory is the **INTEGRAL**, which is a space telescope for observing gamma rays. INTEGRAL is an ESA mission in cooperation with the Russian Space Agency and NASA. It was launched into Earth orbit in 2002. Integral is the first space observatory that can simultaneously observe objects in gamma rays, X-rays and visible light. Its principal targets are violent explosions known as gamma-ray bursts, powerful supernova explosions, and regions in the Universe thought to contain black holes.	Stars merge to Supernova. Gamma-ray sky XMM-Newton ATHENA observatory. INTEGRAL observatory Crab nebula picture in gamma rays, X-rays and visible light Active Black Hole
	A walk around our cosmic neighborhood – the Solar system	
Planetary missions/ science	Fortunately, some of the celestial bodies are close enough to visit them. ESA designs and builds special spacecraft that can reach and study in situ almost all objects within our Solar System.	Solar System view from a distance. Planets revolving around the Sun.
Sun	Our planet revolves around a rather ordinary star, the Sun. The Sun is a middle-aged yellow dwarf, which however, produces copious amounts of energy in a more or less stable manner.	Earth revolving around the Sun.

Sun	Sun’s energy drives the climate and sustains life on the Earth’s surface. Occasionally, violent solar explosions, called solar flares and coronal mass ejections, occur in its outer layers, which can affect dramatically Earth's environment.	Coronal mass ejection - Earth
Sun	Since this is the closest star to us, we can study it in detail in order to reveal all its secrets. This knowledge helps us to predict its violent behaviour, as well as to understand the structure and evolution of stars in general.	Active Sun
Sun	ESA's missions for Solar observation began with the **Ulysses** which flew in a heliocentric orbit over the solar poles, and recorded valuable measurements of the solar wind. More recently, the greatly successful ESA-NASA **SOHO mission** has been observing the Sun since 1995 providing real time data for forecasting space weather, or how solar activity affects the near-Earth environment.	Ulysses orbits the Sun. SOHO Spacecraft in orbit
Sun	The most recent solar mission of ESA is **Solar Orbiter**, launched in 2020. This probe observes the Sun in extreme detail since its highly elliptical orbit brings it within the orbit of Mercury. It is the first mission to image the Sun's polar regions.	Solar orbiter moving into Sun
Mercury	Mercury is a rather small rocky planet, on the closest orbit to the Sun. The ***BepiColombo*** mission, run by ESA and JAXA, comprises two satellites launched together on October 20, 2018, and is currently flying towards Mercury with the arrival planned for December 2025: The two satellites are the Mercury Planetary Orbiter and the Mercury Magnetospheric Orbiter. The mission will perform a comprehensive study of Mercury, including characterization of its magnetic field, magnetosphere, as well as its interior and surface structure.	Mercury - The two probes approaching the planet.

Venus	Venus is the closest planet to Earth. Its diameter is similar to Earth's, and it has no satellites. The Venusian atmosphere is very dense and active, composed mainly of greenhouse gases such as carbon dioxide, which cause the extremely high surface temperature of the planet. ESA explored the poisonous atmosphere of this planet with the mission **Venus Express**, launched in 2005. The main objective of the mission was the long term observation of the Venusian atmosphere. The observation over such long periods of time had never been done in previous missions to Venus, and was key to a better understanding of its atmospheric dynamics.	Approach to rotating Venus. Satellite in orbit. Fly over its surface.
Mars	Mars is the next planet beyond Earth's orbit. Its proximity to our planet made it the next target for detailed exploration. With an armada of spacecraft, we have studied the red planet for several decades. ESA contributed with the mission **Mars Express**, launched in 2003, which studied Mars and its satellites by providing high resolution images for more than 16 years and measuring the interaction between the Mars environment and the rest of the Solar System. The ESA **ExoMars** programme is its current two-mission effort to explore the Red planet further, together with Roscosmos. The first mission, Trace Gas Orbiter, is already orbiting Mars examining its atmosphere, while the second mission – comprising a surface science platform and a rover – is foreseen for launch in 2022. The mission includes a Russian launch vehicle, an ESA carrier module, and a Russian lander named **Kazachok**, that will deploy the rover to Mars' surface. Once safely landed, the solar powered rover will begin a seven-month mission to search for the existence of past life on Mars.	Planet Mars Mars Express appears orbiting Mars ExoMars rocket Trace Gas Orbiter Rover on mars landscape.

Jupiter	The giant gaseous planet Jupiter is a very active world with an intense magnetic field, turbulent atmosphere full of exotic features, and many interesting moons. In 2022, ESA will launch the mission **JUICE**, which will study in detail 3 of the most interesting satellites in the Jovian system: Europa, Ganymede and Callisto -- all of which are thought to contain significant amounts of liquid water beneath their surfaces, making them potentially habitable environments. The mission will search for these oceans and will try to detect subsurface water reservoirs. It will also do a topographical, geological and compositional mapping of the surface of these satellites. JUICE will also study the physical properties of the icy crusts, the internal mass distribution, the dynamics and evolution of their interior. For Europa, the focus is on the chemistry essential to life, including organic molecules, and on understanding the formation of surface features. Furthermore, JUICE will provide the first subsurface sounding of this moon, and will determine the thickness of its icy crust.	Zoom to rotating Jupiter. JUICE - Jupiter JUICE orbits Ganymede and Callisto, Europa closeup

Saturn	The next planet is Saturn, the most impressive object in our Solar System, surrounded by a conspicuous set of rings. Saturn is similar to Jupiter but smaller. It has the most complex satellite system among the planets in our Solar System, which exhibits a great diversity in dimensions, structure and morphology. ESA joined forces with NASA to create a really revolutionary mission to the ringed planet. The mission **Cassini - Huygens** was launched in October 1997 and visited Jupiter on its way to Saturn, which was its main target. It made the closest approach to Jupiter in December 2000, collecting over 26000 images of the planet and studying its atmospheric circulation. Cassini-Huygens continued on to Saturn where it arrived in 2004, and spent 13 years undertaking an extensive exploration of the Saturnian system, the rings and satellites, before the mission ended by plunging into Saturn's atmosphere on Sept. 15, 2017. In January 2005, Cassini deployed the Huygens probe to land on the biggest Saturn's moon, Titan. Huygens studied the composition of the surface, and upper atmosphere. It has revealed Titan to have rain, rivers, lakes and seas of mainly organic composition, and a thick, nitrogen-rich atmosphere that might be similar to what ancient Earth was like long ago.	Zoom to Saturnian System. Cassini at Jupiter. Fly over satellites. Cassini at Saturn Cassini deploys Huygens. Descent journey to Titan. Titan's surface revealed.

Comets	Comets are remnants from the formation of the Solar System. Most of these ghostly travelers originate from its outskirts - a place known as Oort's cloud. Every once in a while, some of them get pulled by the gravitation of the large planets into the inner Solar System, where they develop their marvelous tails. Giotto was ESA's first space mission to a comet. The spacecraft flew by and studied Halley's Comet, and in doing so became the first spacecraft to make close up observations of a comet. On 13 March 1986, the spacecraft succeeded in approaching Halley's nucleus at a distance of 596 kilometers. Images showed Halley's nucleus to be a small dark peanut-shaped body. Analysis showed the comet formed 4.5 billion years ago. It had remained practically unaltered since its formation. Rosetta was a space probe launched on 2 March 2004. Along with **Philae**, its lander module, Rosetta performed a detailed study of comet 67P/Churyumov–Gerasimenko. On its way to the comet, **Rosetta** passed through the main asteroid belt, and made the first European close encounter with several of these primitive objects. On 6 August 2014, after a 10-year journey, the spacecraft reached the comet. On 12 November, its lander module Philae performed the first successful landing on a comet. Rosetta was the first spacecraft to orbit a comet nucleus, and was the first spacecraft to fly alongside a comet as it headed towards the inner Solar System.	Comets. Ort Cloud Hale - Bopp Comet Giotto approach Halley. Halley nucleus images Rosetta approaching the comet passing by asteroids Philae landing
	Earth-like planets outside the Solar system	
Exoplanets	In the past few decades, astronomers have discovered thousands of planets orbiting other stars in our Galaxy. These are strange alien worlds, called exoplanets, which exhibit an enormous variety of planetary environments. The ultimate goal of this search is to discover planets that can develop and sustain life, answering at last the fundamental question: "Are we alone in the Universe?"	Exoplanet orbiting their parent star. Fly over Earth-like exoplanet

Exoplanets	ESA is a pioneer in this difficult search. Its older mission **COROT** searched and discovered numerous rocky exoplanets and also made extensive asteroseismology studies. Launched in 2019, the most recent mission **CHEOPS** already studies in detail, confirmed exoplanets. The future planned missions **PLATO** and **ARIEL**, which will be launched at the end of this decade, will be capable to observe in detail the atmospheres of several exoplanets.	COROT in space Cheops in orbit Plato rotating
End sequence.	For thousands of years, European scientists have been asking questions about the Universe surrounding us, and eagerly looking for answers. Now we know that the Cosmos is far vaster and more complex than we have ever imagined, and its exploration demands huge efforts and sacrifices by all of us. Europe is the cradle of modern science. ESA is leading the way by continuing the scientific inquiry and exploration of the Universe. Caught in our everyday lives, let us remember that we live on a small spinning planet, orbiting around an ordinary yellow dwarf star amongst the billions of other stars in the Milky Way, which, in turn, is a typical spiral galaxy amongst many other hundreds of billions of galaxies in the observable universe. And our young species, seemingly weak, powerless and dispensable in this huge and violent Universe, have one unique strength -- the ability to ask questions and look for the answers. The ability to learn and marvel the magic of the Cosmos.	Nicolas Copernicus Monument Earth focused in Europe - ISS with ESA Logo Slow zoom out from earth to the large scale of the universe. Amature astronomers observing the night sky

End Titles Credits	***MAIN CREDITS*** Film Director - Theofanis Matsopoulos Music - Konstantino Script & Scientific Advice - Dr. Kamen Kozarev, Joanna Kokotanekova, Yordan Hodzhev, Nicolas Matsopoulos MSc, MEd Producer - The Regional Natural History Museum of Plovdiv, Bulgaria Funded by - European Space Agency **Secondary Credits** Audio Mastering & Sound Design - Konstantino Polizois Background Milky Way Image - ESO/S. Brunier **Video Credits** Credits for each clip (long list) **Special Thanks** European Space Agency European Southern Observatory NASA Scientific Visualization Studio ESA/Hubble Space Telescope **End Logos** Regional Natural History Museum-Plovdiv *(english logo)* ESA logo	

Approx running time 40min