UNIVERSE

EXPLORING THE ASTRONOMICAL WORLD
Universe: Exploring the Astronomical World is a groundbreaking exploration of one of the world’s oldest sciences. Following in the footsteps of the international bestsellers Map: Exploring the World and Plant: Exploring the Botanical World, this fascinating survey brings together a curated selection of over 300 images of our universe, reflecting the creative efforts of celebrated astronomers, artists, and photographers. The diverse examples featured include rare manuscripts, photographs and prints, contemporary telescope and satellite images, painting and sculpture, sketches and cutting-edge digital images.

Chosen by an international panel of scientists, astronomers, cosmologists, historians and curators, the selection highlights some of the greatest names in astronomy, including Imad al-Din Mahmud al-Kashi, Claudius Ptolemy, Galileo Galilei, Nicolaus Copernicus, Albrecht Dürer and Leonardo da Vinci, alongside contemporary artists and photographers, such as Michael Light, David Malin, Thomas Ruff, and Wolfgang Tillmans, as well as numerous lesser-known, or previously unpublished works.

Comprehensive in scope, Universe: Exploring the Astronomical World also features useful reference information to guide the reader through the remarkable history of astronomy, including biographies of key astronomers and artists and an illustrated timeline detailing significant discoveries and innovations. Each image is accompanied by a concise, explanatory text written by leading international specialists to help the reader understand the historical importance of the work and its significance.
Verro estias pore, unt undunti aeriand ucitio magnat que il ius exeratem dolores equatque sunt atem rendis vent.
Aborecto esedis aut arumquias dolore maiorest perum ipic tem. Ficiur? Fuga. Vid ut rerorum quia conseque exerovi tibusam qui ut officae doloribus siminve reiur, consece arcius eum venis nobis eum estiones quodit lia qui acepudi ditis et ulloreperum volum quatus es pore ped quasi dilaphe tideranm acum nobil velitiae ulcttis

THE AURICHS WITH THE PLEIADES
17000 BC
UNKNOWN
Pigments on rock, dimensions variable, Lascaux

THE PLEIADES
2012
EMIL IVANOV
Digital, dimensions variable

Messer 45, the Pleiades is an open star cluster in the constellation of Taurus. It is one of the nearest star clusters to Earth and is the most obvious to the naked eye cluster. It is dominated by extremely luminous hot blue stars that have formed within the last 100 million years. Dust that forms a faint reflection nebulosity around the brightest stars is unrelated dust cloud in the interstellar medium that the stars are currently passing through. Perhaps the most famous star cluster on the sky, the bright stars of the Pleiades can be seen without binoculars even from the heart of a light-polluted city. With a long exposure from a dark location, though, the dust cloud surrounding the Pleiades star cluster becomes very evident. The featured image was a long duration exposure taken last month from Namibia and covers a sky area many times the size of the full moon. Also known as the Seven Sisters and M45, the Pleiades lies about 400 light years away toward the constellation of the Bull (Taurus). A common legend with a modern twist is that one of the brighter stars faded since the cluster was named, leaving only six stars visible to the unaided eye. The actual number of visible Pleiades stars, however, may be more or less than seven, depending on the darkness of the surrounding sky and the clarity of the observer’s eyesight.
Among those involved in the many scientific advances made during the 17th century, Christiaan Huygens, the Dutch mathematician, astronomer and scientist, stands out as an extraordinarily gifted man. He invented the pendulum clock, formulated the first wave theory of light, pioneered studies on games of chance, and published major studies on mechanics and optics. But it is for his work in astronomy that his name is remembered. This page from his publication Systema Saturnium (1659) shows two important discoveries he made in 1655. The top diagram demonstrates how Saturn’s appearance to us changes due to the changing positions of the Earth (E) and Saturn as they orbit the Sun (G). The lower diagram shows that Huygens accurately gauged the shape of Saturn’s rings. His observations corrected knowledge of Saturn’s shape first seen by Galileo and recorded in his notebook as ear-like appendages on each side of the planet. Initially Huygens studied law at the University of Leiden, but realised that his interests and greater talents lay in the areas of astronomy, mathematics, and physics. He is known as a Huygenian eyepiece. In the same year, he became the first astronomer to observe Titan, the largest of Saturn’s moons, and the first moon of a planet to be detected.

Colour is used in artistic images for effect but also to make evident the interrelationships of the details being pictured, and colour is used in scientific images to convey complicated information. This picture of Saturn colour-codes radio measurements by the Cassini spacecraft of the sizes of the particles that are in orbit in the planet’s rings, having originated in the break-up of a moon or comet that ventured too close. The colour purple indicates regions populated predominantly by particles larger than 5 cms, green regions with small particles less than 1 cm. The white areas are high density regions where it was difficult to make a good determination, the black areas where there is a paucity of particles and the rings are transparent. Some of the gaps are wide enough to be seen from Earth. Some particles in the rings are several metres across, all the way up to particles that better deserve the name ‘moons’. Some of the individually identified moons influence the orbits of the particles by shepherding them through the force of gravity into groups with similar orbits, creating the appearance of a vinyl record. It is an intriguing mix of scientific simplicity and complexity, order and randomness, enhanced into a work of art by the choices that its creator made in the presentation of the data, such as the colour palette.
American artist Alexander Calder looked at the form of the universe when making his sculptures, and while ostensibly abstract, the spheres, circles, lines and ellipses that comprise A Universe conjure planets elegantly turning within the cosmos. A mechanical motor sets this scene in motion, as two small globes of white and red glide at different speeds along undulating steel wires, its full rotation taking forty minutes. A black iron pipe reinforces its composition, a bold central axis that curves as a helix, around which thinner lines arc to recall the rings of Saturn. Calder was a pioneer of ‘drawing’ in three dimensions, using wire as a means of rendering line as volume in space. Furthermore, he innovatively experimented with movement in his artworks; the motorized sculptures later developed into hanging forms, which he termed ‘Mobiles’ and that moved with the breeze (serenely, his non-kinetic sculptures were referred to as ‘Stabiles’). Advances in astronomy during 1930 had led to the discovery of the dwarf planet Pluto; feeding Calder’s fascination with an ever-changing, ever-expanding universe, the world of science looked back at Calder with equal captivation, demonstrated by Albert Einstein, who was spellbound by A Universe when it was first exhibited at New York’s Museum of Modern Art.

**A UNIVERSE**
1934

**ALEXANDER CALDER**

Painted copper, steel wire, motor, and wood with string, 102.9 x 76.2 cm / 40 ½ x 30 in, Museum of Modern Art, New York

The idea to depict the entire universe in a single image came to the Argentine artist Pablo Carlos Budassi while he was playing with his son making hexaflexagons – paper polygons that children make and use in games. Budassi began sketching the central planets of the solar system and came up with the logarithmic approach that makes this image possible; radiating from the center, the scale increases by a factor of 10 with each concentric section. He based his work on logarithmic maps of the universe produced at Princeton University using data from the Sloan Digital Sky Survey, and used Photoshop to assemble images from various NASA telescopes. The Sun is at the center of the image, surrounded by the planets, with the nearest bright star, Alpha Centauri, at lower left in the haze of the Milky Way. Most of the Milky Way is at top center, part of a belt of fainter, distant galaxies that eventually merge into a network of filaments, the cosmic web, a frothy structure of sheets and walls of galaxies structured around voids at the edge of what we can see with visible light. At the red edge of the image is the feeble cosmic microwave background, the echo of the Big Bang itself, which occurred about 13.7 billion years ago. It signals the edge of our understanding, as dictated by the travel time of light reaching us from farther away. **OBSERVABLE UNIVERSE**
2013

**PABLO CARLOS BUDASSI**

Digital, dimensions variable

The idea to depict the entire universe in a single image came to the Argentine artist Pablo Carlos Budassi while he was playing with his son making hexaflexagons – paper polygons that children make and use in games. Budassi began sketching the central planets of the solar system and came up with the logarithmic approach that makes this image possible; radiating from the center, the scale increases by a factor of 10 with each concentric section. He based his work on logarithmic maps of the universe produced at Princeton University using data from the Sloan Digital Sky Survey, and used Photoshop to assemble images from various NASA telescopes. The Sun is at the center of the image, surrounded by the planets, with the nearest bright star, Alpha Centauri, at lower left in the haze of the Milky Way. Most of the Milky Way is at top center, part of a belt of fainter, distant galaxies that eventually merge into a network of filaments, the cosmic web, a frothy structure of sheets and walls of galaxies structured around voids at the edge of what we can see with visible light. At the red edge of the image is the feeble cosmic microwave background, the echo of the Big Bang itself, which occurred about 13.7 billion years ago. It signals the edge of our understanding, as dictated by the travel time of light reaching us from farther away.
While conditions in the very early Universe are both unobservable and inconceivable in any conventional sense they can be modelled in a way that seems to reflect a version of reality. However depicting that understanding presents unusual challenges, since temperatures, pressures and densities were unimaginably high and everyday matter as we know it had yet to form. One model of that transition is visualised in this remarkable artist’s impression of the “Epoch of Reionisation”, where the gravitational effects of dark matter allows hydrogen and helium to coalesce into stars and galaxies. This image covers the two billion years from the Big Bang through the period some 390,000 years later when “everyday” matter formed from the ultra-hot primordial plasma and it became transparent, perhaps unevenly as suggested by the bubbles. As the Universe continued to expand and cooled the first stars and black holes appeared and eventually galaxies, appear, themselves merging into the shapes that we are familiar with today, becoming increasingly dusty over cosmic time, and offering the prospect of life. The expanding Universe is now 13.80 billion years old, and about 5 billion years ago its expansion rate began to accelerate, suggesting that there’s much left to learn.
This drawing, made by William Parsons, the Third Earl of Rosse, records the discovery of what we now call spiral galaxies. It was made in April 1845, with a telescope that Parsons had just built on his estate in Ireland. The so-called Leviathan of Parsonstown was the largest telescope in the world, with a mirror of 72 inches. Rosse and two astronomer-friends, Dr Thomas Romney Robinson and Sir James South, immediately deployed it to examine what were then called nebulae, small, glowing clouds of celestial light. The observers were struck by the experience, suspended at night, sixty feet in the air on a skeletal platform. Limitations in the telescope’s mounting meant that they could observe something for only half an hour each day. Robinson and South were first to look at M51, the nebula numbered 51 in a catalogue by the French astronomer, Charles Messier, and noted that it had a bright central nucleus with a second, less bright nucleus nearby. When in April, Rosse himself observed it, he immediately noticed for the first time the spiral structure, and christened M51 ‘the Great Spiral’. Showing his drawing in July 1845 to a meeting in Cambridge, Rosse was hailed by the meeting’s chairman, Sir John Herschel, who expressed ‘strong feelings and emotion’ at seeing ‘a new feature in the history of nebulae.’

The Whirlpool Galaxy is a face-on spiral galaxy, with two main arms spiralling out from a central bulge. The arms are composed of young, pale blue stars, delineated on the inside edge of the spiral by red nebular gas, and dark lanes of dust that obscure the stars in places. One arm ends near a second galaxy, which is passing by and tearing at the arm, whose dust lanes are silhouetted against the background of stars in the second galaxy. The centre of M51 and the companion galaxy are made of older, redder stars. The picture was made by assembling many exposures by the Hubble Space Telescope into a tiled mosaic, with four exposures, one each through blue, green, red and infrared filters, superimposed on each tile to provide the colours. The colours are true and fully based in reality, but enhanced for dramatic effect. The Whirlpool Galaxy is a spiral galaxy like our own Galaxy, with the Sun located on the inside edge of one of the arms. The Milky Way is the mass of stars in the spiral arms of our Galaxy and its central bulge, viewed edge on, from the inside. The Whirlpool Galaxy is what our Galaxy would look like if we could leave and look back.
At 03:15 GMT on July 21, 1969, the astronaut Buzz Aldrin became the second person to tread on the Moon, following Neil Armstrong who had stepped out onto Tranquility Base from the Apollo 11 Lander Module twenty minutes earlier. At first Aldrin stood transfixed, looking around at the grey ash-colored lunar scenery, crystal clear under the airless sky of stars. His mind turned from sight-seeing to the objectives of his mission: “We weren’t trained to smell the roses,” he said later, “we had a job to do.” To provide some evidence to the mission engineers of the texture and surface strength of the lunar surface, Aldrin found a flat area and pressed his boot into the lunar dust. The surface was powdery. The boot went in only a few millimeters, and the fine particles preserved the tread of the boot. Aldrin’s close-up photograph of his boot print in the lunar dust recorded the scientific data that he wanted, but also became the iconic, romantic lunar image. It implies his visit, a historic step by a human being on to that precise place at that precise moment, one of the very first steps on another world, even though the photograph does not show the human or the lunar scenery at all.

**THE FIRST FOOTPRINT ON THE MOON**

1969

**EDWIN ALDRIN**

Photograph, 45.4 x 32.3 cm / 17¾ x 12¾ in, NASA

**MOONWALK**

1987

**ANDY WARHOL**

Screen print, 96.5 x 96.5 cm / 38 x 38 in, The Andy Warhol Museum, Pittsburgh

Andy Warhol’s Moonwalk explores the overlapping boundaries of time. Warhol’s Moonwalk depicts Neil Armstrong’s photograph of Edwin “Buzz” Aldrin, Jr. walking on the moon for the first time in 1969 during the Apollo 11 mission. Warhol created the Moonwalk Portfolio to commemorate this momentous achievement of the first man on the moon. He captures the magic, drama, and fantasy of the moon walk. No other artist can transform man’s first steps on the moon, and turn it into a screenshot from a movie. The Moonwalk images by Andy Warhol were created in 1987 only months before his death. In this Series, the translucent colors capture your gaze in classic Warhol fashion. He chooses to color the American flag of similar coloring with blue, reds, and grays. He uses the color scheme to embellish the primarily dimmer and darker colors of the background.

Like any other great artist Andy was looking to the future. By using this landmark moment in history as the focus of his art work, he preserves the emotion that everyone felt as one Neil took ‘one small step for man, one giant leap for mankind’.
Sandwiched between the mundane earthly world beneath and the saints and angels in heaven above, the fourteenth-century German scholar and theologian Konrad von Megenberg (1309–1374) depicts “The Sky Above Me” as a series of colored bands depicting the orbits of the heavenly bodies. The result is a highly unusual cross-section of the more common medieval cosmology in which Earth is surrounded by perfectly spherical concentric orbits of the Sun, Moon and planets. In a prescient, if unintentional, gesture, von Megenberg places the Sun at the very centre of his diagram, long before the radical views of Copernicus placed it at the very centre of the solar system. Near the top of the painting, just beneath heaven itself, is the thick band of stars of the Milky Way. Von Megenberg’s Das Buch der Natur (The Book of Nature) was based on the thirteenth-century Latin text Liber de natura rerum by the Dominican priest Thomas of Cantimpré, but with many revisions and additional observations from von Megenberg. This painting comes from the second part of the work, which includes thirty-three chapters on heaven, the seven planets known at that time, astronomy and meteorology.
The constellation of Taurus in Johann Bayer’s highly successful star atlas, Uranometria, of 1603 shows the Bull with his muscular head down, charging along the ecliptic region (the grey horizontal strip, the area of the sky in which the Sun, Moon and planets appear), and running with his horns into the zone of the Milky Way (the light grey, cloudy, inclined strip). The Hyades star cluster forms the Bull’s muzzle, the star Aldebaran his eye. The size of each star image represents its brightness. There are 49 plates, one per classical constellation, plus the constellations of the southern sky, seen, measured and invented by Europeans only years earlier. The plates were engraved on copper plate by Alexander Mair. 2000 stars are plotted. The brighter stars of the constellation are labelled with Greek letters, and some of the fainter ones in the larger constellations by lower case Roman letters. This was an innovation by Bayer. His designations, called ‘Bayer letter’, are still used. Usually the stars are labelled within a constellation in order of brightness as best he knew it, although there are constellations where he used another system (e.g. the stars of the Plough or Big Dipper are lettered in order across the constellation) or none at all.

TAURUS

1565

JOHANN BAYER

Engraving, 29 x 39 cm / 11 ¼ x 15 ¼ in.
The Metropolitan Museum, New York

OURS MAJOR AND OURSA MINOR

2015

ESMERALDA KOSMATOPOULOS

Neon, transformer, 160 x 150 x 1.3 cm / 63 x 60 x 0.5 in.
Private collection
Nocturne is a term usually associated with pieces of music. James Whistler adopted it, adding it to the titles of a series of night-time paintings he made in London, usually of settings near the Thames. For Whistler, his works were not pictures with a narrative or allusion but attempts to capture the essence of particular scenes or moments. His work was based on artistic appreciation alone, and exemplifies the Art for art’s sake movement that gained prominence in the later part of the 19th century. Using a restricted palette of blue, green, and yellow, here Whistler evokes the ephemeral nature of a night-time firework display at Cremorne Gardens. Years spent perfecting his splatter technique of paint application is amply demonstrated. The blackest mass gives spatial depth and creates the dark void of night or ‘space’ through which the rocket has flown, out of the smoky, swirling fog. Dots and dabs of bright coloured piece cascade from the heavens, capturing the rocket’s trail or ‘galaxies’ created by smaller fireworks. In the foreground, mysterious shadowy shapes suggest figures viewing the scene. There is a real sense of place, space and feeling of unworldliness about it. The last of Whistler’s series of nocturnes, this painting was exhibited for the first time at The Grosvenor Gallery, London in 1877.

**NOCTURNE IN BLACK AND GOLD: THE FALLING ROCKET**

**JAMES WHISTLER**

Oil on panel, 60.2 x 46.7 cm / 23 ¾ x 18 ½ in, Detroit Institute of Arts, Detroit

The Eagle Nebula is a cloud of gas and dust in the constellation of Serpens, surrounding a cluster of bright hot stars called NGC 6611. The energy radiated from the stars has excavated a cavity in the cloud, pushing back the gas and dust. Where the retreating material runs into denser regions, it creates so-called ‘elephants’ trunks’. In 1995, the Hubble Space Telescope imaged these structures and released the picture as the ‘Pillars of Creation’, a phrase derived from a sermon by preacher, Charles Spurgeon, to signify the way foundations that hold up the world—foundations that were scientific but also reckoned to be spiritual. Orbited in 1990, the HST was optically flawed and disappointing until repaired in a rescue mission in 1993. In April 1995, the HST delivered the Pillars of Creation picture, so clear, colourful and dramatic that it redeemed the telescope in public view. At the tip of the pillars, is a second generation of stars, formed as the outward surge of motion in the Eagle Nebula compresses the gas of which the pillars are made. The pillars are 7,000 light years away and 5 light-years long but probably no longer exist. As we will see when the image reaches us, they were destroyed by a supernova explosion 1,000 years ago, stripping the newly formed stars of their swaddling blankets.

**PILLARS OF CREATION IN EAGLE NEBULA**

**NASA**

Digital, dimensions variable

The Eagle Nebula is a cloud of gas and dust in the constellation of Serpens, surrounding a cluster of bright hot stars called NGC 6611. The energy radiated from the stars has excavated a cavity in the cloud, pushing back the gas and dust. Where the retreating material runs into denser regions, it creates so-called ‘elephants’ trunks’. In 1995, the Hubble Space Telescope imaged these structures and released the picture as the ‘Pillars of Creation’, a phrase derived from a sermon by preacher, Charles Spurgeon, to signify the way foundations that hold up the world—foundations that were scientific but also reckoned to be spiritual. Orbited in 1990, the HST was optically flawed and disappointing until repaired in a rescue mission in 1993. In April 1995, the HST delivered the Pillars of Creation picture, so clear, colourful and dramatic that it redeemed the telescope in public view. At the tip of the pillars, is a second generation of stars, formed as the outward surge of motion in the Eagle Nebula compresses the gas of which the pillars are made. The pillars are 7,000 light years away and 5 light-years long but probably no longer exist. As we will see when the image reaches us, they were destroyed by a supernova explosion 1,000 years ago, stripping the newly formed stars of their swaddling blankets.
In this image from Sidereal chromatics by the English amateur astronomer William Henry Smyth, he tried to show, as best the contemporary printing techniques could, the colours of the stars in a chart which astronomers could use as a reference work. He had earlier classified by eye thousands of stars into a colour scheme of nearly 40 shades ranging from Amethyst to Vanilla (by which he meant the brown colour of the bean). The list attracted some criticism from his peers, who wondered whether he could really distinguish so many colours in the stars. As a result, he condensed the list, which he recognised had contained some ‘inexact epithets’, into eight basic colours, graded by intensity. His colour chart omitted shades between white and pale yellow (the vast majority of stars, including the Sun) as being ‘unfit for representation and lamplight reference’.

The reality of Smyth’s eight basic colours is supported by modern measurements of the distribution of light in the spectrum of the stars, by instruments that do not suffer from the psychological effects of colour perception by the naked eye and human brain. Orange and red stars are rather easily distinguished from blue and green ones, particularly when stars of contrasting hue are seen together in a double star.
Nequentis qui idem nam nem later aures dent adit quo id quis si ornamentos suascerit. Nequiemtemperim quem flectit qui doluptas quaeque
repe con sectoria etsi non propepoede. Ut eosum quae voluptatem simeunita volo volo, sueteri, illipris un faciatur vel
ne seque aut obulsioni solvimentis su et sunt vesteud offida
in captus eturbis evenietur re, uti con propest parent
mulipitator re parshita aboremp moneor alti et cernor
quindi in eosum luga. Migienem quae cun mincorbus,
auda del sortonend que volo que amnis apodaria
voluptatem Pudic puneles fervide velucus, sequatemodi
doloremque sequuntur decem, sinti dolore unerer et aut
re ped gubul, volorem posapapracia qui qui debet et
voluptatem alga dilla vollecet existen ten veludin (lab
intem moneor asisst). Borio moneor, in rea a conrem
eure et ut labore.
This masterpiece of Sienese painting combines Giovanni di Paolo’s exquisite visionary effects and narrative detail. The picture presents a vision of Paradise reminiscent of that described by the great Florentine poet Dante in ‘The Divine Comedy.’ The universe is shown as a celestial globe, with the earth at the center surrounded by a series of concentric circles representing first the four elements, the known planets (including the sun, in accordance with medieval and Renaissance cosmology), and finally the constellations of the zodiac. Presiding over the scene of Creation is God the Father, bathed in a glowing celestial light as he is borne aloft by seraphim. Beside the ‘mappamondo’ (map of the world) is the garden of Paradise; its four rivers issuing from the ground at the lower right. The garden’s effulgent flora symbolize the pure and sinless state of man before the Fall. A diminutive Adam and Eve are expelled from the garden by a lithe angel whose unusual nakedness and human form may symbolize his deep compassion for the corrupted state of humankind after the fall from grace. This panel was originally part of the predella of Giovanni di Paolo’s “Guelfi Altarpiece,” formerly in the Church of San Domenico in Siena (now Galleria degli Uffizi, Florence). It originally joined a representation of Paradise.

**CREATION OF THE WORLD AND THE EXPULSION FROM PARADISE**

**GIOVANNI DI PAOLO**

Tempera and gold on wood, 46.4 x 52.1 cm / 18 ¼ x 20 ½ in.
The Metropolitan Museum, New York

**THE ANGEL RUH HOLDING THE CELESTIAL SPHERES**

**ZAKARIYA IBN MUHAMMAD AL-QAZWINI**

Ink, colour and gold on paper, 23.3 x 13.5 cm / 9 x 5 ¼ in.
The Ashmolean, Oxford
The ornate inscription at the top of the Andreas Cellarius’ coloured engraving proclaims it to be Orbium Plantarum Terram Complectentium Scenographia: A Scenography of the planetary orbits encompassing the Earth. The coloured section of the plate is a three-dimensional representation of the conventional Ptolemaic view of the Earth-centred Universe, with the known planets arrayed in divine order around Earth. In black-and-white at lower left and lower right, respectively, are the more usual, flat depiction of Ptolemy’s cosmos and Tycho Brahe’s hybrid model, which was influenced by the ideas of Copernicus. Brahe retains the Earth at the centre, around which revolve the Sun, Moon and stars, but the other five planets revolve around the Sun. Later pages in the Harmonia macrocosmica, from which this engraving comes, show the fully fledged Keplerian model of the Universe, in which all the planets orbit the Sun. The Harmonia is one of the most remarkable cosmographical atlases ever published, notable for its often flamboyant charts and diagrams and extensive Latin text. Of its twenty-nine plates, twenty-one illustrate various historical theories of the shape of the Universe, while the last eight are depictions of the celestial hemispheres and planespheres of the constellations.

HARMONIA MACROCOSMICA
1708
ANDREAS CELLARIUS
Hand-coloured engraving, 45.4 x 32.3 cm / 17¾ x 12¾ in,
Library of Congress, Washington D.C.

The concentric circles of this representation of the solar system in a nineteenth-century quilt might suggest that Ellen Baker (1847–1886) was more interested in a striking composition than in illustrating scientific reality, but in fact the design is based closely on contemporary astronomy textbooks from the 1870s. With a combination of wool appliqué, wool braid, and silk embroidery, Baker shows a central sun being looped by the path of a comet. The comet itself at top left only has one tail, as was believed at the time; now we know that comets have two tails, an ion tail that points away from the Sun and a more obvious dust tail that follows the comet’s orbit. The four tightly grouped circles closest to the Sun mark the orbits of the four inner planets – Earth is accompanied by its moon – inside the brightly colored asteroid belt, with four groups of asteroids. Farther out still lie the giant planets, floating in the emptiness of deep space: Jupiter and its four moons, then Saturn, Uranus, and Neptune, discovered only thirty years earlier. Outside the solar system, Baker illustrates six rings of five-pointed stars with no sense of scale – but the stars were also a mystery 150 years ago. Baker combined the characteristic American pastime ofquilting with an equally characteristic late-nineteenth century enthusiasm for astronomy.

SOLAR SYSTEM QUILT
1876
ELLEN HARDING BAKER
Fabric, wool, cotton, silk, 225 cm x 269 cm / 89 x 106 in,