DOWNLOAD PDF HOW DO ASTRONOMERS STUDY STARS?

Chapter 1 : How do we study the stars? - Yuan-Sen Ting | TED-Ed

Just recently, astronomers discovered a distant solar system, light years away with up to seven planets orbiting a Sun-like star called HD Like the very first exoplanet Pegusus.

Ancient times[edit] In early times, astronomy only comprised the observation and predictions of the motions of objects visible to the naked eye. In some locations, early cultures assembled massive artifacts that possibly had some astronomical purpose. In addition to their ceremonial uses, these observatories could be employed to determine the seasons, an important factor in knowing when to plant crops, as well as in understanding the length of the year. As civilizations developed, most notably in Mesopotamia , Greece , Persia , India , China , Egypt , and Central America , astronomical observatories were assembled, and ideas on the nature of the Universe began to be explored. Most of early astronomy actually consisted of mapping the positions of the stars and planets, a science now referred to as astrometry. From these observations, early ideas about the motions of the planets were formed, and the nature of the Sun, Moon and the Earth in the Universe were explored philosophically. The Earth was believed to be the center of the Universe with the Sun, the Moon and the stars rotating around it. This is known as the geocentric model of the Universe, or the Ptolemaic system , named after Ptolemy. Greek astronomy is characterized from the start by seeking a rational, physical explanation for celestial phenomena. Technological artifacts of similar complexity did not reappear until the 14th century, when mechanical astronomical clocks appeared in Europe. However, astronomy flourished in the Islamic world and other parts of the world. This led to the emergence of the first astronomical observatories in the Muslim world by the early 9th century. Some of the prominent Islamic mostly Persian and Arab astronomers who made significant contributions to the science include Al-Battani , Thebit , Azophi , Albumasar , Biruni , Arzachel , Al-Birjandi , and the astronomers of the Maragheh and Samarkand observatories. Astronomers during that time introduced many Arabic names now used for individual stars. An astronomical chart from an early scientific manuscript, c. His work was defended by Galileo Galilei and expanded upon by Johannes Kepler. Kepler was the first to devise a system that described correctly the details of the motion of the planets with the Sun at the center. However, Kepler did not succeed in formulating a theory behind the laws he wrote down. Newton also developed the reflecting telescope. More extensive star catalogues were produced by Lacaille. The astronomer William Herschel made a detailed catalog of nebulosity and clusters, and in discovered the planet Uranus , the first new planet found. This work was further refined by Lagrange and Laplace , allowing the masses of the planets and moons to be estimated from their perturbations. Fraunhofer discovered about bands in the spectrum of the Sun in â€”15, which, in , Kirchhoff ascribed to the presence of different elements. The observed recession of those galaxies led to the discovery of the expansion of the Universe. Space telescopes have enabled measurements in parts of the electromagnetic spectrum normally blocked or blurred by the atmosphere. Observational astronomy Our main source of information about celestial bodies and other objects is visible light , more generally electromagnetic radiation. Specific information on these subfields is given below.

Chapter 2 : What is Astronomy? Definition & History

Astronomers are those scientist that study different aspects of the universe which include planets, stars and other galaxies. Stars are basically huge balls of plasma which are very luminous. Astronomers need to understand many different things while trying to study stars as there are so many elements that need to be equated.

Exoplanets Stars Stars are the most widely recognized astronomical objects, and represent the most fundamental building blocks of galaxies. The age, distribution, and composition of the stars in a galaxy trace the history, dynamics, and evolution of that galaxy. Moreover, stars are responsible for the manufacture and distribution of heavy elements such as carbon, nitrogen, and oxygen, and their characteristics are intimately tied to the characteristics of the planetary systems that may coalesce about them. Consequently, the study of the birth, life, and death of stars is central to the field of astronomy. Star Formation Stars are born within the clouds of dust and scattered throughout most galaxies. A familiar example of such as a dust cloud is the Orion Nebula. Turbulence deep within these clouds gives rise to knots with sufficient mass that the gas and dust can begin to collapse under its own gravitational attraction. As the cloud collapses, the material at the center begins to heat up. Known as a protostar, it is this hot core at the heart of the collapsing cloud that will one day become a star. Three-dimensional computer models of star formation predict that the spinning clouds of collapsing gas and dust may break up into two or three blobs; this would explain why the majority the stars in the Milky Way are paired or in groups of multiple stars. Smith University of Arizona As the cloud collapses, a dense, hot core forms and begins gathering dust and gas. Not all of this material ends up as part of a star â€” the remaining dust can become planets, asteroids, or comets or may remain as dust. In some cases, the cloud may not collapse at a steady pace. In January , an amateur astronomer, James McNeil, discovered a small nebula that appeared unexpectedly near the nebula Messier 78, in the constellation of Orion. Main Sequence Stars A star the size of our Sun requires about 50 million years to mature from the beginning of the collapse to adulthood. Our Sun will stay in this mature phase on the main sequence as shown in the Hertzsprung-Russell Diagram for approximately 10 billion years. Stars are fueled by the nuclear fusion of hydrogen to form helium deep in their interiors. The outflow of energy from the central regions of the star provides the pressure necessary to keep the star from collapsing under its own weight, and the energy by which it shines. As shown in the Hertzsprung-Russell Diagram, Main Sequence stars span a wide range of luminosities and colors, and can be classified according to those characteristics. Despite their diminutive nature, red dwarfs are by far the most numerous stars in the Universe and have lifespans of tens of billions of years. On the other hand, the most massive stars, known as hypergiants, may be or more times more massive than the Sun, and have surface temperatures of more than 30, K. Hypergiants emit hundreds of thousands of times more energy than the Sun, but have lifetimes of only a few million years. Although extreme stars such as these are believed to have been common in the early Universe, today they are extremely rare - the entire Milky Way galaxy contains only a handful of hypergiants. Stars and Their Fates In general, the larger a star, the shorter its life, although all but the most massive stars live for billions of years. When a star has fused all the hydrogen in its core, nuclear reactions cease. Deprived of the energy production needed to support it, the core begins to collapse into itself and becomes much hotter. Hydrogen is still available outside the core, so hydrogen fusion continues in a shell surrounding the core. The increasingly hot core also pushes the outer layers of the star outward, causing them to expand and cool, transforming the star into a red giant. If the star is sufficiently massive, the collapsing core may become hot enough to support more exotic nuclear reactions that consume helium and produce a variety of heavier elements up to iron. However, such reactions offer only a temporary reprieve. These variations cause the star to pulsate and throw off its outer layers, enshrouding itself in a cocoon of gas and dust. What happens next depends on the size of the core. Average Stars Become White Dwarfs For average stars like the Sun, the process of ejecting its outer layers continues until the stellar core is exposed. This dead, but still ferociously hot stellar cinder is called a White Dwarf. What force supported the mass of the core? Quantum mechanics provided the explanation. Pressure from fast moving electrons keeps these stars from collapsing. The more massive the core, the denser the white dwarf that is formed. Thus, the smaller a white dwarf is in diameter, the larger it is in mass! These paradoxical stars are very common - our own Sun will be a white dwarf billions of years from now. White dwarfs are intrinsically very faint because they are so small and, lacking a source of energy production, they fade into oblivion as they gradually cool down. This fate awaits only those stars with a mass up to about 1. Above that mass, electron pressure cannot support the core against further collapse. Such stars suffer a different fate as described below. White Dwarfs May Become Novae If a white dwarf forms in a binary or multiple star system, it may experience a more eventful demise as a nova. Nova is Latin for "new" - novae were once thought to be new stars. Today, we understand that they are in fact, very old stars - white dwarfs. If a white dwarf is close enough to a companion star, its gravity may drag matter - mostly hydrogen - from the outer layers of that star onto itself, building up its surface layer. When enough hydrogen has accumulated on the surface, a burst of nuclear fusion occurs, causing the white dwarf to brighten substantially and expel the remaining material. Within a few days, the glow subsides and the cycle starts again. Sometimes, particularly massive white dwarfs those near the 1. Supernovae Leave Behind Neutron Stars or Black Holes Main sequence stars over eight solar masses are destined to die in a titanic explosion called a supernova. A supernova is not merely a bigger nova. In massive stars, a complex series of nuclear reactions leads to the production of iron in the core. Having achieved iron, the star has wrung all the energy it can out of nuclear fusion - fusion reactions that form elements heavier than iron actually consume energy rather than produce it. The star no longer has any way to support its own mass, and the iron core collapses. In just a matter of seconds the core shrinks from roughly miles across to just a dozen, and the temperature spikes billion degrees or more. The outer layers of the star initially begin to collapse along with the core, but rebound with the enormous release of energy and are thrown violently outward. Supernovae release an almost unimaginable amount of energy. For a period of days to weeks, a supernova may outshine an entire galaxy. Likewise, all the naturally occurring elements and a rich array of subatomic particles are produced in these explosions. On average, a supernova explosion occurs about once every hundred years in the typical galaxy. About 25 to 50 supernovae are discovered each year in other galaxies, but most are too far away to be seen without a telescope. Neutron Stars If the collapsing stellar core at the center of a supernova contains between about 1. Neutron stars are incredibly dense - similar to the density of an atomic nucleus. Because it contains so much mass packed into such a small volume, the gravitation at the surface of a neutron star is immense. Like the White Dwarf stars above, if a neutron star forms in a multiple star system it can accrete gas by stripping it off any nearby companions. The Rossi X-Ray Timing Explorer has captured telltale X-Ray emissions of gas swirling just a few miles from the surface of a neutron star. Neutron stars also have powerful magnetic fields which can accelerate atomic particles around its magnetic poles producing powerful beams of radiation. Those beams sweep around like massive searchlight beams as the star rotates. If such a beam is oriented so that it periodically points toward the Earth, we observe it as regular pulses of radiation that occur whenever the magnetic pole sweeps past the line of sight. In this case, the neutron star is known as a pulsar. Black Holes If the collapsed stellar core is larger than three solar masses, it collapses completely to form a black hole: Since photons are what our instruments are designed to see, black holes can only be detected indirectly. Indirect observations are possible because the gravitational field of a black hole is so powerful that any nearby material - often the outer layers of a companion star - is caught up and dragged in. As matter spirals into a black hole, it forms a disk that is heated to enormous temperatures, emitting copious quantities of X-rays and Gamma-rays that indicate the presence of the underlying hidden companion. From the Remains, New Stars Arise The dust and debris left behind by novae and supernovae eventually blend with the surrounding interstellar gas and dust, enriching it with the heavy elements and chemical compounds produced during stellar death. Eventually, those materials are recycled, providing the building blocks for a new generation of stars and accompanying planetary systems.

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Chapter 3 : Instruments Used to Study Stars | Sciencing

SVAL's answer is good but needs help. We study the motions & the light itself of stars. We look at a star with the aid of various tools, in addition to telescopes, like Spectrometers, Photometers, Photography & other tools that I'm not familiar with.

September 5, Famous astronomers â€" many of them great scientists who mastered many fields â€" explained the heavens with varying degrees of accuracy. Over the centuries, a geocentric view of the universe â€" with Earth at the center of everything â€" gave way to the proper understanding we have today of an expanding universe in which our galaxy is but one of billions. On this list are some of the most famous scientists from the early days of astronomy through the modern era, and a summary of some of their achievements. Any list of famous astronomers has to include a varied collection of great scientists from the Greeks to the modern era, big thinkers who tackled many fields as well as modern astronomers who made significant discoveries and helped popularize astronomy. Bartolomeu Velho, Public Domain When most people believed the world was flat, the notable Greek mathematician, astronomer and geographer Eratosthenes â€" B. His measurement of 24, miles 39, kilometers was only miles km off the true measurement. In ancient Greece, astronomer and mathematician Claudius Ptolemy A. Known as the Ptolemaic system, it remained in place for hundreds of years, though it turned out to be flat wrong. Public Domain In 16th century Poland, astronomer Nicolaus Copernicus â€" proposed a model of the solar system that involved the Earth revolving around the sun. Using detailed measurements of the path of planets kept by Danish astronomer Tycho Brahe , Johannes Kepler â€" determined that planets traveled around the sun not in circles but in ellipses. In so doing, he calculated three laws involving the motions of planets that astronomers still use in calculations today. Talk by astronomers of a sky filled with objects moving in non-circular orbits and other phenomena that went against an Earth-centric model threatened their beliefs. As a result, Kepler and his first wife, Barbara, created a code with which to write letters to each other so that their correspondence would not put them at risk of persecution. NASA Born in Italy, Galileo Galilei â€" is often credited with the creation of the optical telescope, though in truth he improved on existing models. He created a telescope later that same year that could magnify objects twenty times. Though a model of the Earth circling the sun was first proposed by Copernicus, it took some time before it became widely accepted. Galileo is most widely known for defending the idea several years after Kepler had already calculated the path of planets, and Galileo wound up under house arrest at the end of his lifetime because of it. Italian astronomer Giovanni Cassini â€" measured how long it took the planets Jupiter and Mars to rotate. Dutch scientist Christiaan Huygens â€" proposed the earliest theory about the nature of light, a phenomenon that puzzled scientists for hundreds of years. English astronomer Sir Isaac Newton â€" is most famous for his work on forces, specifically gravity. Edmond Halley â€" was the British scientist who reviewed historical comet sightings and proposed that the comet that had appeared in , , , and were all the same, and would return in Although he died before its return, he was proven correct, and the comet was named in his honor. French astronomer Charles Messier â€" composed a database of objects known at the time as "nebulae," which included objects at its final publication, though additional objects were added based on his personal notes. Many of these objects are often listed with their catalog name, such as the Andromeda Galaxy, known as M Messier also discovered 13 comets over the course of his lifetime. British astronomer William Herschel â€" cataloged over 2, deep sky objects. William trained his sister, Caroline Herschel â€" , in astronomy, and she became the first woman to discover a comet, identifying several over the course of her lifetime. Henrietta Swann Leavitt â€" was one of several women working as a human "computer" at Harvard College, identifying images of variable stars on photographic plates. She discovered that the brightness of a special flashing star known as a Cepheid variable was related to how often it pulsed. This relationship allowed astronomers to calculate the distances of stars and galaxies, the size of the Milky Way, and the expansion of the universe. Albert Einstein at the blackboard. NASA In the early 20th century, German physicist Albert Einstein â€" became one of the most famous scientists ever after proposing a new way of looking at the universe that went beyond current understanding. Einstein suggested that the laws of physics are the same throughout the universe, that the speed of light in a vacuum is constant, and that space and time are linked in an entity known as space-time, which is distorted by gravity. In a lecture given in , fellow scientist Robert Oppenheimer said, "Einstein was a physicist, a natural philosopher, the greatest of our time. Prior to his observations, the discussion over the size of the universe was divided as to whether or not only a single galaxy existed. American astronomer Harlow Shapley â€” calculated the size of the Milky Way galaxy and general location of its center. Frank Drake with a young observer at the Lick Observatory. He was one of the founders of the Search for Extraterrestrial Intelligence SETI and devised the Drake equation, a mathematical equation used to estimate the number of extraterrestrial civilizations in the Milky Way galaxy able to be detected. American astronomer Carl Sagan â€” may not have been a great scientist in comparison to some on this list, but he is one of the most famous astronomers. Sagan not only made important scientific studies in the fields of planetary science, he also managed to popularize astronomy more than any other individual. His charismatic teaching and boundless energy influenced people around the world as he broke down complicated subjects in a way that interested television viewers even as he educated them. Sagan founded the Planetary Society , a nonprofit organization devoted to advancing space science and exploration. Hartmann born put forth the most widely accepted theory on the formation of the moon in He proposed that, after a collision with a large body scooped, debris from the Earth coalesced into the moon. Stephen Hawking born has made many significant insights into the field of cosmology. He proposed that, as the universe has a beginning, it will likely also end. He also suggested that it has no boundary or border.

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Chapter 4 : How do astronomers use light to study stars and planets? â€º Ask an Expert (ABC Science)

Astronomers use patterns on the spectroscope to find out what elements a stars contains. Telescope A device built to observe distant objects by making them appear closer.

Astronomy, the study of stars, represents one of the oldest sciences. Over time, humans developed instruments to track the stars, magnify them, and study their behavior and their contents. By trying to understand the universe, humans have learned more about their place in it. Ancient instruments included quadrants, astrolabes, star charts and even pyramids. Optical telescopes ranged from refracting to reflecting. Radio telescopes, telescopes detecting infrared radiation, gamma rays, and X-rays and space-based telescopes are essential in modern astronomy. Instruments in Antiquity Ancient humans used the stars to navigate oceans, tell time and determine seasons. An ancient instrument called a quadrant used spherical trigonometry to measure the altitude of a star in relation to the horizon. The armillary sphere, comprised of metal rings and using the zodiac, allowed for observation of the sky and demonstrated the movement of the stars. The astrolabe represented a multifunctional device that calculated the positions of the Sun and bright stars, and also worked as a kind of clock to tell time. Over the centuries, various cultures made star charts either to categorize stellar groups or to catalog the magnitude of stars. Astronomers also made broadsides, sheets of paper informing people about eclipses and other celestial phenomena. The Evolution of Optical Telescopes Optical telescopes later became the instruments of choice for observing distant stars. Refracting telescopes used two lenses, with the front lenses bending or refracting light, and an eyepiece for magnification. However, such telescopes became impractical at large sizes. Sir Isaac Newton invented a reflecting telescope that used a concave mirror for focusing light. This enabled astronomers to observe much more distant stars than before. Telescopes grew larger and more sophisticated over time. Telescope mirrors reached their upper limit in size with one primary mirror. Now, primary mirrors can be segmented to aid with the glass weight problem. Sciencing Video Vault Radio Telescopes Astronomers expanded their repertoire by using radio telescopes to detect the radio waves emitted by stars, which gives the astronomers information about stellar light wavelength. Larger antennae in arrays allow for much higher resolution of radio waves. Space Telescopes Telescopes launched into space represent the next phase of studying stars. Space telescopes orbit the Earth but are programmed to study stars in various ways. Infrared radiation, microwave and gamma ray detection must be performed away from the atmosphere, so telescopes such as the Hubble Space Telescope have very high resolution. The Kepler Space Telescope, originally designed for exoplanet detection, granted new life in supernova star explosion research. Kepler and its subsequent mission K2 can focus continuously on one patch of space over a period time. This allows astronomers to follow the progression of exploding stars. The Fermi Gamma-ray Space Telescope facilitated the detection of neutron star mergers, revealing gravitational waves in the cosmos. Cooperative ground-based observatories around the world quickly responded to try multiple forms of observations, including looking for neutron particles. Other telescopes detect X-rays, given off when neutron stars pull material into their gravity. A relatively new field of stellar astronomy involves gravitational lensing, in which space telescopes such as Hubble can observe incredibly distant stars through the natural magnifying effect of foreground galaxies. The Influence of Astronomical Instruments By studying the Sun, astronomers aid weather forecasters and water managers. By studying other stars, humans gain knowledge of the elements of the universe and how humans fit in. Additionally, the technology derived from modern astronomical instruments aids people in everyday life, such as in Wi-Fi, cellular phones, digital cameras, defense warning systems and GPS devices.

Chapter 5 : Astronomical spectroscopy - Wikipedia

Astronomy, the study of stars, represents one of the oldest sciences. Over time, humans developed instruments to track the stars, magnify them, and study their behavior and their contents. By trying to understand the universe, humans have learned more about their place in it.

Giant telescopes that are located around the world are used by astronomers to observe many different stars. These telescopes are extremely powerful and capable of seeing celestial bodies that exist far away. Many of these high powered telescopes can calculate different things like distance and the type of light that a particular star is emitting. Once this information is calculated by an astronomer, a general profile about the star can be recorded. It is important for an astronomer to determine how hot a particular star is to help classify it. There are also different types of telescopes like those based on radio waves that are used to study the stars. Astronomers use a tremendous amount of physics to help them calculate the size and distance of the stars. Most astronomers are fluent with many different aspects of physics to make scientific comparisons and classifications of various stars. Physics allows for complex equations that can calculate large numbers which represent celestial forces present in the galaxy. In order to make massive calculations regarding the stars, astronomers use a ton of mathematics. These are very complicated equations that require a lot of components and a decent amount of time to solve, even on super computers. Astronomers also use chemistry to help identify the different elements that make up a star. This chemistry allows astronomers to classify the different components to help keep track of different stars. By studying the motion and the amount of light that a star emits, astronomers can determine the chemical composition of the star. In order to calculate massive equations and factor in all elements through physics, chemistry and mathematics, astronomers also need to master computer science. There is no doubt that computers are needed to help calculate everything quickly. Very powerful computers are used by astronomers to help study the stars. In order to use these powerful machines, astronomers need to understand the different aspects of programming to help solve large mathematical equations. Astronomers use motion and light to understand and study the stars. The extreme distances between the stars can be calculated using these factors.

Chapter 6 : Famous Astronomers | List of Great Scientists in Astronomy

Start studying Stars. Learn vocabulary, terms, and more with flashcards, games, and other study tools.

Grades 3â€"5, 6â€"8, 9â€"12 The following questions were answered by astronomer Dr. Astronomy is the scientific study of the universe â€" stars, planets, galaxies, and everything in between. Are there any different fields of astronomy? First, many astronomers consider themselves to be either theoreticians, instrumentalists, or observationalists. The theoreticians specialize in creating models using computer programs to simulate a star, or a supernova, or whatever it is that they are studying. The instrumentalists specialize in designing and building new instruments to make measurements or designing new telescopes. The observationalists specialize in obtaining, analyzing, and interpreting the data. Of course there are also some astronomers who do all of these things. We also tend to classify ourselves by what type of astronomical object we study. There are those who specialize in studying the solar system, and they usually concentrate on just the gaseous planets, the rocky planets, comets, asteroids, etc. There are astronomers who specialize in studying stars. Usually they concentrate on just hot stars, cool stars, or certain types of stars like binaries, variable stars, etc. The same is true for nebulae, galaxies, and so on. How long is a light-year? A light-year is the distance that a beam of light can travel in one year. Since light moves very fast, that is a long distance. It is over 5,,,, miles! The term "light-year" is very confusing to many people. It sounds like a measure of time, but it is actually a measure of distance. The nearest star to our sun is a little over one light-year away. How many light-years are in one parsec? So the nearest star, Alpha Centauri, is about 4. Astronomers normally use parsecs in our research, as you may know. But putting distances in terms of light-years is useful too because it tells you how long it took for the light to get to you. What are the characteristics of light? For example, why do all of the colors in a rainbow always appear in the same distinct pattern? As you may know, light acts like a wave, and that means it has a wavelength. Each photon, or bit of light, has its own wavelength. The wavelength tells us how much energy the photon carries and also what color it is. The light from the sun is made of light of many wavelengths. When the light passes through a raindrop or a prism, the light is refracted bent. The amount that the light is bent depends on its wavelength. The violet light is bent the most, the blue next, then green, yellow, orange, and red. That is because violet has the smallest wavelength, then blue, then green So the raindrop or prism has spread the mixed white light out by wavelengths, which correspond to colors as perceived by our eyes. It was Sir Isaac Newton who proved this about light. You might want to try his experiment that proved that white light is made up of many colors and that those colors are distinct and unchanging. If you pass some of that colored light, say the blue, through another prism, only blue light will come out. Isaac Newton was an interesting guy! You might want to read about him and his experiments with light. Do you know where the ozone hole is and what it is over right now? You asked about ozone. Ozone is actually just a special form of oxygen. The oxygen that we breathe is a molecule formed of two oxygen atoms. Normally there is a layer of ozone high in the atmosphere all around the earth. Our concern though is that the ozone layer is very thin â€" a "hole" â€" in an area above the South Pole. We are trying to understand how the hole forms so that hopefully we can keep from making the hole bigger or affecting the rest of the earth. Have astronomers found life on other planets? Astronomers have been looking for planets outside our solar system for some time. Planets are small and very dim compared to stars. This is one of the tasks that the Hubble Space Telescope is working on. So it can see faint things and things that are very close together in the sky very well. It seems to most scientists that there must be life elsewhere. The elements and chemicals that make up life on Earth are very common throughout the universe. But finding life "out there" is very hard. How does the Hubble Telescope take pictures of things and then send them down to Earth? The Hubble Space Telescope has several instruments onboard. These are electronic cameras that record the images with numbers, not with film. Then those numbers are sent by radio to antennas on the ground, relaying to computers, which can then put the numbers back together again into a picture. Has the Hubble Telescope allowed you to find out about any new galaxies? Yes, astronomers have been especially excited to look at the most distant, youngest galaxies. They turn out to be much more irregular, less organized than the more familiar, nearer galaxies. We think the young galaxies must interact with each other a lot, sometimes even colliding. Later they move further apart and settle down into the more regular shapes spirals, ellipticals that we are familiar with. What does an astrolabe look like and how do you use it? The astrolabe is an early instrument used to help measure time and the position of the sun and stars in the sky. Typically it is made of brass and is about 6 inches across. It consists of several flat, circular plates all rotating on a pin. The plates are inscribed with circles of altitude and azimuth for a given latitude on the earth. Astrolabes were used mostly between A. How do computers help you in studying the universe? You may be surprised to learn that astronomers use computers a whole lot for almost everything we do. Here are some of the ways: For instance, the satellite that I work on has taken over , images, which are stored on a computer. I never realized how much astronomers use computers until I had some teachers and students working with me on a research project. We discovered that they had to learn about the computers before they could help work on the research analysis! I use about six computers of various kinds every day in my work! How was space made? Boy, you ask hard questions! We think that it was created in a great big explosion that occurred about 15 billion years ago. People have called it the "Big Bang. But when we look far out into the universe, we can see that everything is moving away, just as if it is all being blown apart by a big explosion! How is gravity measured? We measure it by dropping something! Of course to measure gravity correctly, we have to be careful. For instance, the air helps to slow something that is falling. So to do the measurement properly, we would have to have a long tube with no air in it, then very carefully measure how long the tube is and how long it takes for something to fall. If gravity is what holds things together, is gravity everywhere? And what is gravity made of? Gravity is one of the fundamental forces in the universe. Anything which has mass weight also has gravity. So yes, gravity is everywhere. Also the more massive something is, the more gravity it has. But how much gravitational pull we feel from something depends also on how far away we are from it. So even though Earth is much smaller than the sun, we are much much closer to Earth, so its gravitational pull on us is larger. Everyday objects, like a chair or bus, actually do have gravity too, but they are so much smaller that their gravitational pull is extremely small. Which direction would a compass point in outer space? It depends on where you are in space. If you were near the sun, though, your compass would respond to the magnetic field around the sun.

Chapter 7 : how do astronomers study the stars? | Yahoo Answers

Consequently, the study of the birth, life, and death of stars is central to the field of astronomy. Star Formation Stars are born within the clouds of dust and scattered throughout most galaxies.

September 7, Although the movement of constellations â€" patterns imprinted on the night sky â€" were the easiest to track, other celestial events such as eclipses and the motion of planets were also charted and predicted. Astronomy is the study of the sun, moon, stars, planets, comets, gas, galaxies, gas, dust and other non-Earthly bodies and phenomena. In curriculum for K-4 students, NASA defines astronomy as simple "the study of stars, planets and space. Below we discuss the history of astronomy and related fields of study, including cosmology. NGC , a planetary nebula, lies just beyond the tip of the tail of the constellation of Cygnus The Swan. It is a close cousin to astrophysics. Succinctly put, astrophysics involves the study of the physics of astronomy and concentrates on the behavior, properties and motion of objects out there. However, modern astronomy includes many elements of the motions and characteristics of these bodies, and the two terms are often used interchangeably today. Modern astronomers tend to fall into two fields: Observational astronomers focus on direct study of stars, planets, galaxies, and so forth. Theoretical astronomers model and analyze how systems may have evolved. Unlike most other fields of science, astronomers are unable to observe a system entirely from birth to death; the lifetime of worlds, stars, and galaxies span millions to billions of years. Instead, astronomers must rely on snapshots of bodies in various stages of evolution to determine how they formed, evolved and died. Thus, theoretical and observational astronomy tend to blend together, as theoretical scientists use the information actually collected to create simulations, while the observations serve to confirm the models â€" or to indicate the need for tweaking them. Astronomy is broken down into a number of subfields, allowing scientists to specialize in particular objects and phenomena. Red spots on Jupiter, photographed on Feb. Christopher Go via NASA Planetary astronomers also called planetary scientists focus on the growth, evolution, and death of planets. While most study the worlds inside the solar system , some use the growing body of evidence about planets around other stars to hypothesize what they might be like. According to the University College London , planetary science "is a cross-discipline field including aspects of astronomy, atmospheric science, geology, space physics, biology and chemistry. The University of California, Los Angeles , says, "The focus of stellar astronomy is on the physical and chemical processes that occur in the universe. According to NASA , "The quantity and quality of light from the sun varies on time scales from milli-seconds to billions of years. The sun also helps us to understand how other stars work, as it is the only star close enough to reveal details about its surface. Galactic astronomers study our galaxy, the Milky Way, while extragalactic astronomers peer outside of it to determine how these collections of stars form, change, and die. The University of Wisconsin-Madison says, "Establishing patterns in the distribution, composition, and physical conditions of stars and gas traces the history of our evolving home galaxy. Astronomy is often not always about very concrete, observable things, whereas cosmology typically involves large-scale properties of the universe and esoteric, invisible and sometimes purely theoretical things like string theory, dark matter and dark energy, and the notion of multiple universes. Astronomical observers rely on different wavelengths of the electromagnetic spectrum from radio waves to visible light and on up to X-rays and gamma-rays to study the wide span of objects in the universe. The first telescopes focused on simple optical studies of what could be seen with the naked eye, and many telescopes continue that today. Different telescopes are necessary to study the various wavelengths. More energetic radiation, with shorter wavelengths, appears in the form of ultraviolet, X-ray, and gamma-ray wavelengths, while less energetic objects emit longer-wavelength infrared and radio waves. This large field-of-view image of sunspots in Active Region was observed on July 15, Researchers colored the image yellow for aesthetic reasons. Royal Swedish Academy of Sciences Astrometry, the most ancient branch of astronomy, is the measure of the sun , moon and planets. The precise calculations of these motions allows astronomers in other fields to model the birth and evolution of planets and stars , and to predict events such as eclipses meteor showers, and the appearance of comets. According to the Planetary Society , "Astrometry is the oldest method used to detect extrasolar planets," though it remains a difficult process. Early astronomers noticed patterns in the sky and attempted to organize them in order to track and predict their motion. Known as constellations , these patterns helped people of the past to measure the seasons. The movement of the stars and other heavenly bodies was tracked around the world, but was prevalent in China, Egypt, Greece, Mesopotamia, Central America and India. The image of an astronomer is a lone soul at a telescope during all hours of the night. In reality, most hard-core astronomy today is done with observations made at remote telescopes â€” on the ground or in space â€” that are controlled by computers, with astronomers studying computer-generated data and images. Since the advent of photography, and particularly digital photography, astronomers have provided amazing pictures of space that not only inform science but enthrall the public.

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Yuan-Sen Ting takes us into deep space to show how astronomers study the stars beyond our reach. Lesson by Yuan-Sen Ting, animation by Kozmonot Animation Studio. Category.

Galaxies[edit] The spectra of galaxies look similar to stellar spectra, as they consist of the combined light of millions of stars. Doppler shift studies of galaxy clusters by Fritz Zwicky in found that most galaxies were moving much faster than seemed to be possible from what was known about the mass of the cluster. Zwicky hypothesized that there must be a great deal of non-luminous matter in the galaxy clusters, which became known as dark matter. In , however, four galaxies NGC , NGC , NGC , and NGC were found to have little to no dark matter influencing the motion of the stars contained within them; the reason behind the lack of dark matter is unknown. When the first spectrum of one of these objects was taken there were absorption lines at wavelengths where none were expected. It was soon realised that what was observed was a normal galactic spectrum, but highly red shifted. NGC , a galaxy in the Virgo Cluster, has a large portion of its stars rotating in the opposite direction as the other portion. It is believed that the galaxy is the combination of two smaller galaxies that were rotating in opposite directions to each other. There are three main types of nebula: Absorption or dark nebulae are made of dust and gas in such quantities that they obscure the starlight behind them, making photometry difficult. Reflection nebulae, as their name suggest, reflect the light of nearby stars. Their spectra are the same as the stars surrounding them, though the light is bluer; shorter wavelengths scatter better than longer wavelengths. Emission nebulae emit light at specific wavelengths depending on their chemical composition. In William Huggins noticed that many nebulae showed only emission lines rather than a full spectrum like stars. From the work of Kirchhoff, he concluded that nebulae must contain "enormous masses of luminous gas or vapour. The majority of gaseous emission nebulae are formed of neutral hydrogen. In the ground state neutral hydrogen has two possible spin states: List of interstellar and circumstellar molecules Dust and molecules in the interstellar medium not only obscures photometry, but also causes absorption lines in spectroscopy. Their spectral features are generated by transitions of component electrons between different energy levels, or by rotational or vibrational spectra. Detection usually occurs in radio, microwave, or infrared portions of the spectrum. Because of the Doppler effect , objects moving towards us are blueshifted , and objects moving away are redshifted. The wavelength of redshifted light is longer, appearing redder than the source. Conversely, the wavelength of blueshifted light is shorter, appearing bluer than the source light:

Chapter 9 : How do astronomers use parallax to study stars? | Socratic

Astronomy is the study of the Universe: Everything about stars and planets, galaxies, dark matter and energy Have you ever looked up at the night-time sky on a clear night and marveled at the beauty of the stars, or seen pictures of galaxies, nebulae, or planets and wondered what they are, and how we have learned about them??