Chapter 1 : Black holes do not exist where space and time do not exist, says new theory

Black holes do not exist where space and time do not exist, says new theory January 30, by Lisa Zyga, Phys. The blue color here represents radiation pouring out from material very close to the black hole. The grayish structure surrounding the black hole, called a torus, is made up of gas and dust. At least, this is what happens in traditional black hole models based on general relativity. In general, the existence of the event horizon is responsible for most of the strange phenomena associated with black holes. As the event horizon is a place in space which exists at a point in time, it also does not exist below that scale. However, for the event horizon it does matter, and this causes the main difference in our calculations. To fully solve the problems related to black holes, or even the beginning of our universe, physicists require a theory of quantum gravity. This difference is very small for objects like the Earth. However, it becomes significant for objects like black holes. At that time, Hawking proposed that black holes emit radiation as they rotate, causing them to lose mass faster than they gain mass, so that they steadily evaporate and eventually disappear altogether. The paradox in this scenario is that Hawking radiation originates from the mass of objects that fell into the black hole, but in theory the radiation does not carry complete information about these objects as it radiates away from the black hole. Eventually this radiation is expected to cause the black hole to evaporate completely. So the question then arises: In everyday life, shredding or burning paper documents may be common practice to destroy information, but according to quantum theory, information can never be completely destroyed. In principle, the initial state of a system can always be determined by using information about its final state. Many proposals have been put forth to solve this paradox, including the possibility that some information slowly leaks out over time, that information is stored deep inside the black hole, and that Hawking radiation actually does contain complete information. One of the most developed explanations of the paradox is called black hole complementarity, which is based on the idea that an observer falling into a black hole and an observer watching from a distance see two completely different things. Instead, the distant observer sees the information being reflected away from the event horizon in the form of radiation. Since the two observers cannot communicate, there is no paradox though to many people, such a solution may sound even stranger than the paradox itself. Instead of it appearing to the distant observer that it takes an infinite amount of time for the in-going observer to reach the event horizon, in the new theory, that time is finite. In other words, the distant observer eventually sees the in-going observer fall into the black hole. The absence of an effective horizon means that there is nothing absolutely stopping information from going out of the black hole. The scientists explain this idea using the analogy of a metal rod: When we apply a force so great that it breaks the rod, it is meaningless to talk of bending that rod. Hence, it is meaningless to define particles, matter, or any object, including black holes , that exist in space and time below that scale. Thus, as long as we keep ourselves confined to the scales at which both space and time exist, we get sensible physical answers. However, when we try to ask questions at length and time intervals that are below the scales at which space and time exist, we end up getting paradoxes and problems.

Chapter 2 : Private Dining Room - Rainbow Room

Geoffrey's forgotten he had to make a rocket for a children's party, but luckily Gabrielle Bradshaw comes round and helps him. She shows Zippy, Bungle, Georg.

Spectrum[edit] For a given transparent material, such as glass, the refraction of light varies with frequency. A white light consists of photons of various energies. The red photons in the light will be deflected at a different angle than the blue photons. If the light passes through a transparent material with parallel sides, such as a sheet of glass, the beam will emerge at the same angle as it entered. However when the two sides are not parallel, the angle will vary depending on the frequency. This is the principle behind the prism. A glass prism is used to separate the photons from a light source into a spectrum of frequencies from red to blue. A similar principle is what creates a rainbow as the light from the sun passes through droplets of water. The index of refraction varies by frequency, causing parallel, monochromatic light rays from the left to emerge from the prism at different angles. An instrument specifically designed to display the spectrum of a radiating object, such as a star, is called a spectroscope. The early spectroscopes were constructed using a series of prisms that would successively spread the spectrum further apart. The problem with this arrangement, however, is that each of the prisms would absorb some of the light passing through. This limited the brightness of the objects that could be observed. An instrument called a diffraction grating, which was a mirror with a series of ruled parallel grooves, used the principle of diffraction to produce a spectrum with only minor loss of intensity. Isaac Newton discovered that a light beam can be diffracted only so far, and no farther. The diffraction can be recombined into white light. Lens[edit] The lens takes advantage of the property of refraction to bend the light from a distant object and to make it appear closer or more distant. A lens is, in a simplified sense, a prism that has been "wrapped" around in a circle, so that the light is bent symmetrically. Because light of different frequencies is bent at different angles, however, the point at which the light comes to a focus varies with frequency. An observer looking through a lens would see light sources near the edge have a rainbow-like appearance. This is called chromatic aberration. To adjust for this variation in the focus by frequency, opticians typically use combinations of lenses made of different materials with differing indices of refraction. Judicious use of materials and lens shapes will result in a lens that focuses all the light at the same distance, producing a good quality image that does not suffer from chromatic aberration. Magnification[edit] When you observe an object nearby, it subtends an certain angle within your sight. That is, if you had an imaginary line running from the top of the object and your eye and a similar line from the bottom of the object to your eye, there would be a certain angle between these lines. As the object recedes into the distance, the angle it subtends across your sight steadily decreases until it becomes nearly a point. The imaginary lines from the top and bottom of the object are now nearly parallel. In fact, for an astronomical object such as a star, these lines are essentially parallel. In order to enlarge the appearance of an object, it is necessary to modify the paths of the incoming light rays so that they are no longer parallel but instead arrive at an angle as they enter your eyes. The eye then perceives the object as if it were much closer. There are two common means for causing the parallel light rays to converge in this manner. The first involves the use of a curved, concave mirror. The second takes advantage of the refraction ability of materials such as glass to redirect the light inward at an angle. The shape of glass needed to accomplish this is a convex lens. The portions of the lens near the center need little curvature since they will are required to bend the light only slightly toward your eye. At the edges of the lens, however, the light needs to be bent at a sharper angle, so the sides of the lens become bent toward each other like a prism. Overall the sides of the lens form a smooth curve that gradually increases in slope toward its edges. A well-made convex lens will cause the parallel light from a distant light source to focus at a point. When there are multiple such light sources, they are each focused at a point on a plane, known as the focal plane. The human eye can perceive the image of this plane, and the result is a magnification of the view. If the images do not focus on a plane, then the image will appear blurry. Diffraction[edit] Another wave-like property of light is a tendency to bend and spread whenever it meets an obstacle. Any beam of light will also tend to spread with distance, so that it becomes impossible to maintain a tight beam of an arbitrary length. The property of diffraction is what limits the resolution of a distant object. When a beam of coherent light, such as that produced by a laser, is passed through two slit openings, the light radiates from the slits like ripples in a pond. The semi-circular ripples from the two slits interact with each other, sometimes adding together their wave heights and at other times cancelling each other out. This is called constructive and destructive interference. If a screen is placed in the area where these ripples interact, alternating bands of light and darkness would appear. Resolution[edit] The resolution of a viewing instrument is a measurement of how well it can be used to distinguish two points that are very close together. For example, the two points could be the two stars in a binary star system. In astronomy, resolution is usually measured in seconds of arc. The resolution can vary depending on a number of environmental and quality conditions, but it is always limited by the aperture of the observing instrument. That is, there is a best possible resolution that any particular telescope can achieve. To get better resolution, a larger aperture is needed. To see why this is so, imagine a telescope that consists of only two vertical slits separated by some distance, with a viewing screen behind. When the light from a distance star enters this telescope, it passes through the slits and forms an interference pattern on the screen. The distance between the light and dark bands is proportional to the wavelength of the light and inversely proportional to the distance between the slits. Thus increasing the separation of the slits will reduce the width of each band. Now suppose there are two stars. They will both form bands of light and dark light on the screen, which may overlap. The closer the two stars are two each other, the closer their interference bands approach until they become indistinguishable. But if the separation of the slits is increased, then the bands become narrower and the stars can be distinguished again. This is the principle behind the interferometer. Interferometer[edit] In an ordinary telescope, the resolution is determined by the aperture. In this respect, a telescope can be thought of as a whole series of slits allowing light through, with the light at the outer edge providing the maximum resolution. The resolution of the telescope can be improved by adding a set of mirrors outside the maximum aperture that collect peripheral light rays, and effectively increase the aperture. Similarly, two or more telescopes can be configured to work together and provide an aperture at least equal to the separation of their collecting surfaces. This setup is called an interferometer, because the images from both telescopes are integrated through a process of diffraction interference. Radio telescopes have successfully used this technique for many years to achieve very high levels of resolution. Optical interferometers are more difficult to build due to the requirements for extreme precision and the need to dampen out any vibrations. Reflection gratings[edit] Reflection gratings are surfaces that have been very precisely ruled with a series of parallel grooves. The grooves have a saw-tooth pattern, with each groove consisting of a long flat surface machined at a slight angle, with a sharp step at the edge. Each of the grooves is very narrow, with about lines per mm 15, per inch. As light is reflected from each of the grooves, it is slightly behind the light from the adjacent grooves. This difference produces an interference effect that reinforces the light at certain angles and cancels out the light at others. The grating is very efficient at destructively interfering with the light except at one particular angle, where the light constructively interferes and produces a peak intensity. The angle of this peak varies by the wavelength of the light, so a spectrum is produced. Polarization[edit] In addition to a direction of travel, a photon is composed of an electric and magnetic field. These lie at right angles to each other and to the direction of travel. This is known as a transverse wave. These perpendicular fields give the photon an orientation. The fields of each photon will maintain their orientation while traveling in a vacuum. Fields of this type are called plane-polarized. Normally light from a source consists of a large number of photons that have a random polarization. However, it is possible for a number of the photons to become oriented in the same direction, becoming polarized. This coherent orientation can be detected by means of a sheet of polarizing material. When the sheet is oriented in the direction of the polarization, the polarized light passes through. As the sheet is rotated, it transmits a decreasing portion of the polarized light until finally, at right angles to the plane of polarization, it blocks all of the polarized light. Light can become partly polarized by reflecting from a surface, such as sunlight reflecting off a pool of water. Reflected sunlight provides a source of glare for somebody driving a vehicle. Because this light is partially polarized, the use of polarized sunglasses helps reduce glare by blocking the polarized light preferentially. Astronomers can examine a stellar light source to determine whether it is a source of polarized light. The presence of polarization is an indication of certain physical properties in effect at the source of the light, or along the line of sight of the light rays. For example, a magnetic field can polarize a light source, as can the acceleration of an electron to a velocity near the speed of light. Spectral lines[edit] When an atom absorbs a photon of light, the energy is forces the absorbing electron in the atom into an excited state. The electron changes its behavior, effectively becoming more energized and entering a new orbital pattern about the nucleus. A sufficiently energetic photon, or a combination of photons with enough energy, can even knock the electron from the atom. The atom then becomes ionized and gains a net positive charge. Due to the quantum nature of small particles, the changes in energy allowed for an electron in an atom is fixed to very specific amounts.

Chapter 3 : Space-time tradeoff - Simple English Wikipedia, the free encyclopedia

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Much like white light, spacetime is also composed of a certain rainbow Much like white light, spacetime is also composed of a certain rainbow brian wang January 16, When white light is passed through a prism, the rainbow on the other side reveals a rich palette of colors. The mechanism predicts that instead of a single, common spacetime, particles of different energies essentially sense slightly modified versions thereof. We have probably all seen the experiment: This is because white light is in fact a mixture of photons of different energies, and the greater the energy of the photon, the more it is deflected by the prism. Thus, we might say that the rainbow arises because photons of different energies sense the same prism as having slightly different properties. For years now it has been suspected that particles of different energies in quantum universe models essentially sense spacetimes with slightly different structures. Arxiv â€" Rainbow metric from quantum gravity Warsaw physicists are using a cosmological model that contains just two components: Under the general theory of relativity, a gravitational field is described by deformations of spacetime, whereas matter is represented as a scalar field the simplest type of field where every point in space is assigned only one value. Therefore, we formulated our model in very general terms so that it can be applied to any of them. Someone might assume the kind of gravitational field â€" which in practice means spacetime â€" that is posited by one quantum theory, and someone else might assume another. We start with the fuzzy world of quantum geometry, where it is even difficult to say what is time and what is space, yet the phenomena occurring in our cosmological model still look as if everything was happening in ordinary spacetime! Things took a more interesting turn when physicists looked at excitations in the scalar field, which are interpreted as particles. Calculations showed that in this model, particles that differ in terms of energy interact with quantum spacetime somewhat differently â€" much as photons of different energies interact with a prism somewhat differently. This result means that even the effective structure of classical spacetime sensed by individual particles must depend on their energy. The occurrence of a normal rainbow can be described in terms of a refractive index, the value of which varies depending on the wavelength of light. In the case of the analogous spacetime rainbow, a similar relationship has also been proposed: This function reflects the degree of non-classicalness of quantum spacetime: Today the Universe is in a classical-like state, so now the beta value should be near zero, and estimates performed by other groups of physicists indeed suggest that it does not exceed 0. This small value for the beta function means that currently the spacetime rainbow is very narrow and cannot be detected experimentally. The spacetime rainbow is a result of quantum gravity. Physicists generally share the view that effects of this type only become visible at gigantic energies near the Planck energy, millions of billions of times the energy of particles now being accelerated in the Large Hadron Collider LHC. However, the beta function value depends on time, and at moments close to the Big Bang it could have been much higher. When beta is close to one, the spacetime rainbow expands considerably.

Chapter 4 : Rainbow table - Wikipedia

In a 'Rainbow' Universe, Time May Have No Beginning. after traveling somewhat altered courses through billions of light-years of time and space. "So far we have no conclusive evidence that.

March 30, When I learned about colors in grade school everything started with red, yellow, and blue and getting fancier colors was easy. I mixed some blue into my yellow to get green, or into red to get purple, and so on. I was struggling to make my rogue diodes look quite the way I wanted when I stumbled into the realization that maybe there was another approach. What did the numbers representing R G and B actually mean? Could there be others? Why do we represent color this way at all? The first step might be to search the web for a color picker to help visualize the color wheel or ask your OS to present one. The software library may represents color as a composition of three 8 bit integers; Red, Green, and Blue. Simply, the red channel is set to 86 counts in the range , green to 0 counts, and blue to counts. To be explicit the RGB values represent three wavelengths of light which our eyes are built to absorb and our brains interpret to create images out of visible light. When the emitted light hits the wall above your workbench it reflects into your eyes or photosensor as the case may be and you see approximately the target color. If you wanted it to be brighter you would increase the energy being emitted by turning each channel up. As long as the ratios stayed the same so should the color. Your first grade teacher would be proud of your scholastic accomplishments. When I choose a color on my Mac I see the familiar color picker above by default. Switching back and forth between the first and second tab at the top it is clear the same color is represented two ways; the RGB values on tab two and the dot-and-slider on tab one. If I slide it to the right the disk becomes progressively darker until it turns fully black. If I slide it left the colors become more vibrant until the get as vibrant as the model allows. If the color wheel above is taken as a disk on a plane, you can imagine the slider at the bottom as the upward facing Z axis, giving you a cylinder. It would look something like the figure to the left. A color space is the mathematical model we use to represent color. This color cylinder can represent exactly the same information as a three-integer RGB value can. Every visible color is somewhere on the surface or inside! Cylinders can be addressed in, well, cylindrical coordinates by a less familiar 3-tuple of values. To represent any point in a cylindrical volume there is a radius, Z height, and angle. Z selects the vertical height. Changing the spinner the interface alters to give us three different sliders with which to traverse our color cylinder. Keeping in mind our 3D cylinder these can be looked at as spatial coordinates. Thus the RGB 3-tuple of values we use to specify color actually represents a single point in a Cartesian coordinate space. And royal purple is still buried in that cube somewhere. Want to fade through a series of colors at the same saturation and brightness? Just adjust your hue. Want to dim the same color until it fades to black? Just decrease brightness, everything else will stay the same. You, astute reader, may have caught on that there must be yet more ways to represent colors. In printing CMYK cyan, magenta, yellow, and key AKA black is common, though it is not a different spatial projection of the same components. CMYK represents colors by the proportions of ink you might use when printing! Quite a neat trick to redefine the chosen units to better fit the task at hand instead of adapting something ill suited. But it turns out that being aware of the spatial nature of color representation makes certain blinkey-LED related tasks easier. At least it can if you know how to apply it. Want to play around with some of these concepts at home? We recommend the FastLED library.

Chapter 5 : "Rainbow" Time/Space (TV Episode) - Plot Summary - IMDb

European astronaut Alexander Gerst was surprised to see a circular, rainbow-like gleam â€" a phenomenon known as a glory â€" in the clouds below the International Space Station on Sept. 14,

Variations Double rainbows "Double rainbow" redirects here. For other uses, see Double Rainbow. Also note the pronounced supernumerary bows inside the primary bow. In theory, all rainbows are double rainbows, but since the secondary bow is always fainter than the primary, it may be too weak to spot in practice. Secondary rainbows are caused by a double reflection of sunlight inside the water droplets. As a result of the "inside" of the secondary bow being "up" to the observer, the colours appear reversed compared to those of the primary bow. The secondary rainbow is fainter than the primary because more light escapes from two reflections compared to one and because the rainbow itself is spread over a greater area of the sky. Each rainbow reflects white light inside its coloured bands, but that is "down" for the primary and "up" for the secondary. A "normal" secondary rainbow may be present as well. Twinned rainbows can look similar to, but should not be confused with supernumerary bands. The two phenomena may be told apart by their difference in colour profile: The cause of a twinned rainbow is the combination of different sizes of water drops falling from the sky. Due to air resistance, raindrops flatten as they fall, and flattening is more prominent in larger water drops. When two rain showers with different-sized raindrops combine, they each produce slightly different rainbows which may combine and form a twinned rainbow. That small difference in droplet size resulted in a small difference in flattening of the droplet shape, and a large difference in flattening of the rainbow top. These requirements are not usually met when the viewer is at ground level, either because droplets are absent in the required position, or because the sunlight is obstructed by the landscape behind the observer. From a high viewpoint such as a high building or an aircraft, however, the requirements can be met and the full-circle rainbow can be seen. In the right circumstances, a glory and a circular rainbow or fog bow can occur together. Supernumerary rainbows Contrast-enhanced photograph of a rainbow with additional supernumerary bands inside the primary bow In certain circumstances, one or several narrow, faintly coloured bands can be seen bordering the violet edge of a rainbow; i. These extra bands are called supernumerary rainbows or supernumerary bands; together with the rainbow itself the phenomenon is also known as a stacker rainbow. The supernumerary bows are slightly detached from the main bow, become successively fainter along with their distance from it, and have pastel colours consisting mainly of pink, purple and green hues rather than the usual spectrum pattern. The alternating faint bands are caused by interference between rays of light following slightly different paths with slightly varying lengths within the raindrops. Some rays are in phase , reinforcing each other through constructive interference , creating a bright band; others are out of phase by up to half a wavelength, cancelling each other out through destructive interference , and creating a gap. Given the different angles of refraction for rays of different colours, the patterns of interference are slightly different for rays of different colours, so each bright band is differentiated in colour, creating a miniature rainbow. Supernumerary rainbows are clearest when raindrops are small and of uniform size. The very existence of supernumerary rainbows was historically a first indication of the wave nature of light, and the first explanation was provided by Thomas Young in Their names are slightly different. A reflected rainbow may appear in the water surface below the horizon. The reflected rainbow is frequently visible, at least partially, even in small puddles. A reflection rainbow may be produced where sunlight reflects off a body of water before reaching the raindrops see diagram and [1] , if the water body is large, quiet over its entire surface, and close to the rain curtain. The reflection rainbow appears above the horizon. Due to the combination of requirements, a reflection rainbow is rarely visible. Up to eight separate bows may be distinguished if the reflected and reflection rainbows happen to occur simultaneously: The normal non-reflection primary and secondary bows above the horizon 1, 2 with their reflected counterparts below it 3, 4 , and the reflection primary and secondary bows above the horizon 5, 6 with their reflected counterparts below it 7, 8. Monochrome rainbow Unenhanced photo of a red monochrome rainbow Occasionally a shower may happen at sunrise or sunset, where the shorter wavelengths like blue and green have been scattered and essentially removed from the spectrum. Further scattering may occur due to the rain, and the result can be the rare and dramatic monochrome or red rainbow. The order of a rainbow is determined by the number of light reflections inside the water droplets that create it: One reflection results in the first-order or primary rainbow; two reflections create the second-order or secondary rainbow. More internal reflections cause bows of higher ordersâ€”theoretically unto infinity. Nevertheless, sightings of the third-order bow in nature have been reported, and in it was photographed definitively for the first time. Felix Billet â€" depicted angular positions up to the 19th-order rainbow, a pattern he called a "rose of rainbows". Up to the th-order rainbow was reported by Ng et al. Rainbows under moonlight Main article: Moonbow Like most atmospheric optical phenomena, rainbows can be caused by light from the Sun, but also from the Moon. In case of the latter, the rainbow is referred to as a lunar rainbow or moonbow. They are much dimmer and rarer than solar rainbows, requiring the Moon to be near-full in order for them to be seen. For the same reason, moonbows are often perceived as white and may be thought of as monochrome. The full spectrum is present, however, but the human eye is not normally sensitive enough to see the colours. Long exposure photographs will sometimes show the colour in this type of rainbow. Fog bow Fogbows form in the same way as rainbows, but they are formed by much smaller cloud and fog droplets that diffract light extensively. They are almost white with faint reds on the outside and blues inside; often one or more broad supernumerary bands can be discerned inside the inner edge. The colours are dim because the bow in each colour is very broad and the colours overlap. Fogbows are commonly seen over water when air in contact with the cooler water is chilled, but they can be found anywhere if the fog is thin enough for the sun to shine through and the sun is fairly bright. They are very largeâ€”almost as big as a rainbow and much broader. Circumhorizontal and circumzenithal arcs A circumhorizontal arc bottom , below a circumscribed halo Circumzenithal arc The circumzenithal and circumhorizontal arcs are two related optical phenomena similar in appearance to a rainbow, but unlike the latter, their origin lies in light refraction through hexagonal ice crystals rather than liquid water droplets. This means that they are not rainbows, but members of the large family of halos. Both arcs are brightly coloured ring segments centred on the zenith , but in different positions in the sky: The circumzenithal arc is notably curved and located high above the Sun or Moon with its convex side pointing downwards creating the impression of an "upside down rainbow" ; the circumhorizontal arc runs much closer to the horizon, is more straight and located at a significant distance below the Sun or Moon. Both arcs have their red side pointing towards the sun and their violet part away from it, meaning the circumzenithal arc is red on the bottom, while the circumhorizontal arc is red on top. Droplets or spheres composed of materials with different refractive indices than plain water produce rainbows with different radius angles. Due to a much higher refractive index, rainbows observed on such marbles have a noticeably smaller radius. The displacement of the rainbow due to different refractive indices can be pushed to a peculiar limit. For a material with a refractive index larger than 2, there is no angle fulfilling the requirements for the first order rainbow. For example, the index of refraction of diamond is about 2.

Chapter 6 : Watch Rainbow Time () Full Movie - Spacemov

When white light is passed through a prism, the rainbow on the other side reveals a rich palette of colors. Theorists from the Faculty of Physics, University of Warsaw have shown that in models of the Universe using any of the quantum theories of gravity there must also be a 'rainbow' of sorts, composed of different versions of spacetime.

The mechanism predicts that instead of a single, common spacetime, particles of different energies essentially sense slightly modified versions thereof. We have probably all seen the experiment: This is because white light is in fact a mixture of photons of different energies, and the greater the energy of the photon, the more it is deflected by the prism. Thus, we might say that the rainbow arises because photons of different energies sense the same prism as having slightly different properties. For years now it has been suspected that particles of different energies in quantum universe models essentially sense spacetimes with slightly different structures. Earlier hypotheses were not derived from quantum theory, however, but based on guesses. Jerzy Lewandowski, has formulated a general mechanism responsible for the emergence of such a spacetime rainbow. Now it turns out that the situation is even more complicated. In the current discussion the Warsaw physicists are using a cosmological model that contains just two components: Under the general theory of relativity, a gravitational field is described by deformations of spacetime, whereas matter is represented as a scalar field the simplest type of field where every point in space is assigned only one value. Therefore, we formulated our model in very general terms so that it can be applied to any of them. Someone might assume the kind of gravitational field â€" which in practice means spacetime â€" that is posited by one quantum theory, and someone else might assume another. The model so devised was then quantized â€" in other words continuous values, which may differ from one another in terms of any arbitrarily small amount, were converted to discrete values, which may only differ by specific intervals quanta. Research on the dynamics of the quantized model revealed an amazing result: We start with the fuzzy world of quantum geometry, where it is even difficult to say what is time and what is space, yet the phenomena occurring in our cosmological model still look as if everything was happening in ordinary spacetime! Things took a more interesting turn when physicists looked at excitations in the scalar field, which are interpreted as particles. Calculations showed that in this model, particles that differ in terms of energy interact with quantum spacetime somewhat differently â€" much as photons of different energies interact with a prism somewhat differently. This result means that even the effective structure of classical spacetime sensed by individual particles must depend on their energy. The occurrence of a normal rainbow can be described in terms of a refractive index, the value of which varies depending on the wavelength of light. In the case of the analogous spacetime rainbow, a similar relationship has also been proposed: This function reflects the degree of non-classicalness of quantum spacetime: Today the Universe is in a classical-like state, so now the beta value should be near zero, and estimates performed by other groups of physicists indeed suggest that it does not exceed 0. This small value for the beta function means that currently the spacetime rainbow is very narrow and cannot be detected experimentally. The spacetime rainbow is a result of quantum gravity. Physicists generally share the view that effects of this type only become visible at gigantic energies near the Planck energy, millions of billions of times the energy of particles now being accelerated in the Large Hadron Collider LHC. However, the beta function value depends on time, and at moments close to the Big Bang it could have been much higher. When beta is close to one, the spacetime rainbow expands considerably.

DOWNLOAD PDF A RAINBOW, OF TIME AND OF SPACE

Chapter 7 : Astronaut Basks in Earth's 'Glory' Rainbow from Space Station (Photo)

Sci-Tech Spacetime is a rainbow. Just as white light is made up of various wavelengths of light, so too is spacetime composed of various versions of spacetime.

This is called a false alarm. In this case, we ignore the match and continue to extend the chain of h looking for another match. If the chain of h gets extended to length k with no good matches, then the password was never produced in any of the chains. The table content does not depend on the hash value to be inverted. It is created once and then repeatedly used for the lookups unmodified. Increasing the length of the chain decreases the size of the table. It also increases the time required to perform lookups, and this is the time-memory trade-off of the rainbow table. In a simple case of one-item chains, the lookup is very fast, but the table is very big. Once chains get longer, the lookup slows, but the table size goes down. Simple hash chains have several flaws. Most serious if at any point two chains collide produce the same value , they will merge and consequently the table will not cover as many passwords despite having paid the same computational cost to generate. Because previous chains are not stored in their entirety, this is impossible to detect efficiently. For example, if the third value in chain 3 matches the second value in chain 7, the two chains will cover almost the same sequence of values, but their final values will not be the same. The hash function H is unlikely to produce collisions as it is usually considered an important security feature not to do so, but the reduction function R, because of its need to correctly cover the likely plaintexts, can not be collision resistant. Other difficulties result from the importance of choosing the correct function for R. Picking R to be the identity is little better than a brute force approach. Only when the attacker has a good idea of what the likely plaintexts will be they can choose a function R that makes sure time and space are only used for likely plaintexts, not the entire space of possible passwords. Also it can be difficult to design the function R to match the expected distribution of plaintexts. Rainbow tables[edit] Rainbow tables effectively solve the problem of collisions with ordinary hash chains by replacing the single reduction function R with a sequence of related reduction functions R1 through Rk. In this way, for two chains to collide and merge they must hit the same value on the same iteration. Consequently, the final values in each chain will be identical. A final postprocessing pass can sort the chains in the table and remove any "duplicate" chains that have the same final value as other chains. New chains are then generated to fill out the table. These chains are not collision-free they may overlap briefly but they will not merge, drastically reducing the overall number of collisions. This creates a new way of producing a false alarm: Although rainbow tables have to follow more chains, they make up for this by having fewer tables: Rainbow tables can achieve similar performance with tables that are k times larger, allowing them to perform a factor of k fewer lookups. Example[edit] Starting from the hash "re3xes" in the image below, one computes the last reduction used in the table and checks whether the password appears in the last column of the table step 1. If this new test fails again, one continues with 3 reductions, 4 reductions, etc. If no chain contains the password, then the attack has failed. If this test is positive step 3, linux23 appears at the end of the chain and in the table , the password is retrieved at the beginning of the chain that produces linux Here we find passwd at the beginning of the corresponding chain stored in the table. At this point step 4 , one generates a chain and compares at each iteration the hash with the target hash. The test is valid and we find the hash re3xes in the chain. The current password culture is the one that produced the whole chain: This increases the probability of a correct crack for a given table size, at the cost of squaring the number of steps required per lookup, as the lookup routine now also needs to iterate through the index of the first reduction function used in the chain. The more powerful RainbowCrack program was later developed that can generate and use rainbow tables for a variety of character sets and hashing algorithms, including LM hash , MD5 , and SHA In the simple case where the reduction function and the hash function have no collision, given a complete rainbow table one that makes you sure to find the corresponding password given any hash the size of the password set P , the time T that had been needed to compute the table, the length of the table L and the average time t needed to find a password matching a given hash are directly related:

Chapter 8 : "Rainbow" Time/Space (TV Episode) - Quotes - IMDb

*Survival of the Currently Fittest: Genetics of Rainbow Trout Survival Across Time and Space Harri VehvilÃ¤inen, *, 1 Antti Kause, * Cheryl Quinton, * Heikki Koskinen, â€ and Tuija Paananen â€ .*

Just as we move through different stages in our life, so we also move through different stages in our career. And just as demands for our time in our personal life can vary, so can demands at work. When peaks of demand in one area match troughs in another, life can be good. This makes it important to find an appropriate balance between your career and your life. He modified his theories in to account for the fact that people were no longer continuing on a straight path of career development. Super called this theory the "Life Career Rainbow. Understanding the Model The Life Career Rainbow see figure 1 below helps us think about the different roles we play at different times in our life. Age is shown by the numbers around the edge of the rainbow. And the amount of time typically taken with each life role is described by the size of the dots in that colored band of the rainbow. Note that we use the word "typically" above â€" this is the pattern that most people find suits the way they want to live their lives. This may or may not suit you and your circumstances. Eight Life Roles 1. Child â€" This is the time and energy you spend relating to your parents. The role begins at birth and continues until both parents are deceased, often into your 50s or 60s. You spend a great deal of time in this role early on which decreases over time until the parents become elderly. At this time, there is often a surge in time and attention spent caring for elderly parents. Student â€" You can become a student starting as early as three or four depending on culture. The student role usually continues until at least the age of 16, although it is now common to see students in their early 20s in many countries. People are also increasingly engaging in masters programs or participating in career training or further education throughout life. Leisurite â€" This is a word created by Super to describe the time people spend pursuing leisure activities. Many people tend to spend more time on leisure as a child or adolescent, and after they have retired. Citizen â€" This describes the time and energy spent working for the community, with time spent in non-paid volunteer work. People often engage in this as their children get older and they have more free time available. Worker â€" This is the time you spend in paid employment. Parent â€" This role describes the time spent raising children and looking after them. The parent role is usually significant until children reach their mid-teens but, with many grown children staying at home during higher education or moving back home as adults, the parent role can continue at a relatively high level for quite a while after this. Spouse â€" This role represents the time and energy spent in a committed relationship. It also includes activities that keep the union strong. Home-maker â€" In this role, people are expending time and energy on maintaining their home: Note that there are no gender associations with the home-maker role. Growth ages 14 and under â€" This Life Stages focuses on physical growth, and is a time when people begin to form ideas about their self-worth. During this time people start to discover many of their interests, talents, and abilities. Exploration typical age range 14 â€" 25 â€" This stage is when people start learning about the different types of work available and what is required to be successful in different careers. During exploration, the more you learn, the more committed you become to a few of the choices and you start to narrow the field to those types of jobs you would like to pursue. Near the end of the exploration stage you will ideally! Explained like this, it sounds like a well-thought-through process. In reality it is not, which means we often make "quirky" career choices. While your first experience with this stage happens usually between the ages of 14 and 25, it is increasingly likely you will return to this stage at least once later in your life as you think through your choices again, hopefully in a more rational and considered way. Establishment typical age range 26 â€" 45 â€" This Life Stage starts as people settle into their chosen career, and become productive members of society. This stage is marked by increased responsibility and personal satisfaction from work and career. Finding This Article Useful? Read our Privacy Policy 4. Maintenance typical age 46 â€" 65 â€" People at this stage are maintaining their current career and participating in career development activities that will keep them up to date in their present job. With the much-heralded "end of lifetime employment", people may or may not enjoy such a settled, stable period. Recent trends have shown discrimination against people in their 50s and 60s, although anti-discrimination laws may reduce this in some countries. Disengagement ages 65 and up â€” This is the stage when someone has chosen to slow down and eventually retire from their career. During this stage, the emphasis moves away from paid work and leaves people with time to concentrate on the other roles they engage in like leisurite, home-maker, and citizen. Re-emphasizing that this was the general pattern of life in industrialized countries when Super developed his model. In particular, the middle of life was taken up with the intense and often-conflicting activities of hard work and parenting, with relatively little time dedicated to the role of leisurite. With forethought and effective time management , you can often find a balance that is more satisfying than this. We do this with three pie charts. Try to be objective when you do this. As an example, people who intensely value professional achievement may spend much more time in the Work Role than people who predominantly value nurturing a healthy family. The latter will emphasize the Parent or Spouse Role. On the second blank pie chart, mark the amount of time you would like to allocate to each of the roles right now. Then think about how you would like your life to look in five years time. Look at Discrepancies and Identify Barriers and Challenges Compare your ideal charts from steps 2 and 3 with the current chart from step 1. Identify the discrepancies, and list the reasons for them. Have you become complacent and let yourself get swept away by events. If so, identify those factors. Look at the discrepancies and barriers you identified in step 4 and set appropriate goals to move from your current state to your desired state. There is no one-way to develop a career and one of the most important aspects of career planning is finding the balance between work and the rest of life. The Life Career Rainbow is a useful tool for thinking about how the demands on your time change depending on life circumstances. It helps you understand why you might be overloaded or experiencing stress, and helps you understand what you can do about it and the trade-offs you should expect as a consequence. Once you can "see" how you split up your work roles and your life roles, it can be much easier to identify where your work and life is out of balance and begin the process of creating the harmony you need. Subscribe to our free newsletter , or join the Mind Tools Club and really supercharge your career!

Chapter 9 : Rainbow - Wikipedia

Though the name is a bit awkward, a glory is an optical phenomenon much like a rainbow that occurs due to the backscattering of sunlight from drops of water when appearing on a [ ].

The English used in this article or section may not be easy for everybody to understand. You can help Wikipedia by reading Wikipedia: How to write Simple English pages , then simplifying the article. July In computer science , a space-time or time-memory tradeoff is a way of solving a problem or calculation in less time by using more storage space or memory , or by solving a problem in very little space by spending a long time. Most computers have a large amount of space, but not infinite space. Also, most people are willing to wait a little while for a big calculation, but not forever. So if your problem is taking a long time but not much memory, a space-time tradeoff would let you use more memory and solve the problem more quickly. Or, if it could be solved very quickly but requires more memory than you have, you can try to spend more time solving the problem in the limited memory. The most common condition is an algorithm using a lookup table. This means that the answers for some question for every possible value can be written down. One way of solving this problem is to write down the entire lookup table, which will let you find answers very quickly, but will use a lot of space. Another way is to calculate the answers without writing down anything, which uses very little space, but might take a long time. A space-time tradeoff can be used with the problem of data storage. If data is stored uncompressed, it takes more space but less time than if the data were stored compressed since compressing the data decreases the amount of space it takes, but it takes time to run the compression algorithm. Larger code size can be used to increase program speed when using loop unwinding. This technique makes the program code longer for each iteration of a loop, but saves the computation time needed for jumping back to the beginning of the loop at the end of each iteration. In the field of cryptography , using space-time tradeoff, the attacker is decreasing the exponential time required for a brute force attack. Rainbow tables use partially precomputed values in the hash space of a cryptographic hash function to crack passwords in minutes instead of weeks. Decreasing the size of the rainbow table increases the time required to iterate over the hash space. The meet-in-the-middle attack attack uses a space-time tradeoff to find the cryptographic key in only 2.