PHENOMENAL PHYSICS AND ASTRONOMY pdf

1: A Few Fundamental Physics and Astronomy Questions for the Next Few Decades | HuffPost

This information will be used for the purpose of evaluating the application for admission to the Phenomenal Physics Summer Camps. Questions about the collection of this information may be directed to .

Joanna Chisolm Mission The mission of the Physics and Astronomy Department at Barnard College is to provide students with an understanding of the basic laws of nature, and a foundation in the fundamental concepts of classical and quantum physics, and modern astronomy and astrophysics. Majors are offered in physics, astronomy, or in interdisciplinary fields such as, astrophysics, biophysics, or chemical physics. The department strives to be a source of distinguished women scientists. All majors engage in at least one summer of independent research that is often continued during the semester, or the following summer. Perform laboratory experiments to study various physical phenomena, and use statistical approaches to analyze and interpret the data obtained in these experiments. Acquire effective oral and written presentation skills to communicate scientific ideas. Participate in a research project and stimulate the ability of empirical thought. Demonstrate the ability to give a scientific talk on a research topic. Student Learning Outcomes Upon successfully completing the major, students should have the ability to: Physicists were, in essence, natural philosophers, seeking knowledge of the observable phenomenal world. Astronomy originally concentrated on the study of natural phenomena in the heavens with the intent to understand the constitution, relative positions, and motions of the celestial bodies in our universe. Though practitioners of these disciplines have become somewhat more specialized in the past century, the spirit that guides them in their research remains the same as it was more than two millennia ago. In cooperation with the faculty of the University, Barnard offers a thorough pre-professional curriculum in both physics and astronomy. The faculty represents a wide range of expertise, with special strength and distinction in theoretical physics, condensed matter physics, and observational astrophysics. Separate majors in physics and astronomy are offered. A major in astrophysics is also possible. Furthermore, there are many special interdisciplinary majors possible, such as biophysics, chemical physics, engineering physics, and mathematical physics. There is a physics minor as well. Students should consult members of the department early on in their undergraduate careers in order to plan the most effective course of study. Qualified seniors are invited to participate in the seniors honors program, in which they carry out a year-long research project leading to the thesis. There are several quite distinct introductory sequences in physics, only one of which may be taken for credit: Note, however, that does not satisfy the premedical nor physics requirement for any major. It should also not be taken to satisfy the BC lab science requirement. This course is taught at Columbia in a large lecture hall setting. It is not recommended as a foundation for more advanced work in the field. Characterized by modest class sizes, it is designed specifically for Barnard women with a serious interest in any of the natural sciences or mathematics. Moreover, it is especially appropriate for majors in physics, chemistry, or biochemistry, whether premedical or not. Biology majors with some calculus background are also encouraged to take this sequence. Electricity and Magnetism in their first year, if possible, or in their second at the latest, to be followed by the third-semester course, Classical Waves and Optics. Students considering this sequence are strongly encouraged to consult a Barnard faculty member at the start of the term. Students unsure about the most appropriate sequence should consult members of the department. The following courses may be substituted for each other: Electricity and Magnetism sect. Thermodynamics, Electricity, and Magnetism 3. Classical and Quantum Waves 3. Janna Levin Lab Director: Stiliana Savin Other officers of the University offering courses listed below:

2: Physics & Astronomy < Barnard College | Columbia University

Phenomenal Physics Camps By Kahlan Gibson on September 21, We asked Outreach Program's summer coop student Kahlan to share her experience working with the Phenomenal Physics Summer Camps this year.

Others had been destroyed earlier, when his house at Arcueil near Paris was looted by house breakers in Rouse Ball , [5] his father, Pierre de Laplace, owned and farmed the small estates of Maarquis. It was here that Laplace was educated and was provisionally a professor. Thus before he was 20 he was in touch with Lagrange in Turin. He did not go to Paris a raw self-taught country lad with only a peasant background! In at the age of sixteen Laplace left the "School of the Duke of Orleans" in Beaumont and went to the University of Caen , where he appears to have studied for five years and was a member of the Sphinx. His parents were from comfortable families. The Laplace family was involved in agriculture until at least , but Pierre Laplace senior was also a cider merchant and syndic of the town of Beaumont. Pierre Simon Laplace attended a school in the village run at a Benedictine priory , his father intending that he be ordained in the Roman Catholic Church. This provided the first intercourse between Laplace and Lagrange. About this time, recognising that he had no vocation for the priesthood, he determined to become a professional mathematician. Some sources state that he then broke with the church and became an atheist. But upon questioning him, he realised that it was true, and from that time he took Laplace under his care. In their experiments they measured the specific heat of various bodies, and the expansion of metals with increasing temperature. They also measured the boiling points of ethanol and ether under pressure. That March he was elected to the academy, a place where he conducted the majority of his science. The two disciplines would always be interlinked in his mind. However, though Newton had privately developed the methods of calculus, all his published work used cumbersome geometric reasoning, unsuitable to account for the more subtle higher-order effects of interactions between the planets. Newton himself had doubted the possibility of a mathematical solution to the whole, even concluding that periodic divine intervention was necessary to guarantee the stability of the Solar System. The problem had been tackled by Leonhard Euler in and Joseph Louis Lagrange in but without success. He ultimately returned to an intellectual investment in Newtonian gravity. Laplace noted that though the terms themselves were small, when integrated over time they could become important. Laplace carried his analysis into the higher-order terms, up to and including the cubic. Using this more exact analysis, Laplace concluded that any two planets and the sun must be in mutual equilibrium and thereby launched his work on the stability of the Solar System. As long as his results were true he took but little trouble to explain the steps by which he arrived at them; he never studied elegance or symmetry in his processes, and it was sufficient for him if he could by any means solve the particular question he was discussing. Viewed from above the Northern Hemisphere. Red up, blue down. In , Laplace formulated a single set of linear partial differential equations , for tidal flow described as a barotropic two-dimensional sheet flow. Coriolis effects are introduced as well as lateral forcing by gravity. Laplace obtained these equations by simplifying the fluid dynamic equations.

3: 10 Bizarre Physics Phenomena - Listverse

Welcome to Phenomenal Physics, where we hope to give you interesting facts and answer any questions you have about physics. Please have a look and like our page.

Mechanics Mechanics is generally taken to mean the study of the motion of objects or their lack of motion under the action of given forces. Classical mechanics is sometimes considered a branch of applied mathematics. It consists of kinematics , the description of motion, and dynamics , the study of the action of forces in producing either motion or static equilibrium the latter constituting the science of statics. The 20th-century subjects of quantum mechanics, crucial to treating the structure of matter, subatomic particles , superfluidity , superconductivity , neutron stars , and other major phenomena, and relativistic mechanics , important when speeds approach that of light, are forms of mechanics that will be discussed later in this section. Thus in the first approximation even objects as large as the Earth and the Sun are treated as pointlikeâ€”e. In rigid-body dynamics , the extension of bodies and their mass distributions are considered as well, but they are imagined to be incapable of deformation. The mechanics of deformable solids is elasticity ; hydrostatics and hydrodynamics treat, respectively, fluids at rest and in motion. The three laws of motion set forth by Isaac Newton form the foundation of classical mechanics, together with the recognition that forces are directed quantities vectors and combine accordingly. The first law, also called the law of inertia , states that, unless acted upon by an external force , an object at rest remains at rest, or if in motion, it continues to move in a straight line with constant speed. Uniform motion therefore does not require a cause. Accordingly, mechanics concentrates not on motion as such but on the change in the state of motion of an object that results from the net force acting upon it. Taken together, these mechanical laws in principle permit the determination of the future motions of a set of particles, providing their state of motion is known at some instant, as well as the forces that act between them and upon them from the outside. From this deterministic character of the laws of classical mechanics, profound and probably incorrect philosophical conclusions have been drawn in the past and even applied to human history. Lying at the most basic level of physics, the laws of mechanics are characterized by certain symmetry properties, as exemplified in the aforementioned symmetry between action and reaction forces. Other symmetries, such as the invariance i. The symmetry properties of the theory can be shown to have as mathematical consequences basic principles known as conservation laws , which assert the constancy in time of the values of certain physical quantities under prescribed conditions. The conserved quantities are the most important ones in physics; included among them are mass and energy in relativity theory, mass and energy are equivalent and are conserved together , momentum , angular momentum , and electric charge. The study of gravitation This field of inquiry has in the past been placed within classical mechanics for historical reasons, because both fields were brought to a high state of perfection by Newton and also because of its universal character. No further principles are required to understand the principal aspects of rocketry and space flight although, of course, a formidable technology is needed to carry them out. By measuring the transmission of laser signals between the spacecraft essentially a giant Michelson interferometer in space , scientists hope to detect and accurately measure gravity waves. The modern theory of gravitation was formulated by Albert Einstein and is called the general theory of relativity. Completed in , the theory was valued for many years mainly for its mathematical beauty and for correctly predicting a small number of phenomena, such as the gravitational bending of light around a massive object. Only in recent years, however, has it become a vital subject for both theoretical and experimental research. Curved space-timeThe four dimensional space-time continuum itself is distorted in the vicinity of any mass, with the amount of distortion depending on the mass and the distance from the mass. The study of heat , thermodynamics, and statistical mechanics Heat is a form of internal energy associated with the random motion of the molecular constituents of matter or with radiation. Temperature is an average of a part of the internal energy present in a body it does not include the energy of molecular binding or of molecular rotation. An isolated body eventually reaches uniform temperature, a state known as thermal equilibrium , as do two or more bodies placed in contact. The formal study of states of matter at or near thermal equilibrium is called thermodynamics ; it is capable of analyzing a large variety of thermal systems without considering their detailed microstructures. First law The first law of thermodynamics is the energy conservation principle of mechanics i. Second law The second law of thermodynamics asserts that heat will not flow from a place of lower temperature to one where it is higher without the intervention of an external device e. The concept of entropy involves the measurement of the state of disorder of the particles making up a system. For example, if tossing a coin many times results in a random-appearing sequence of heads and tails, the result has a higher entropy than if heads and tails tend to appear in clusters. Another formulation of the second law is that the entropy of an isolated system never decreases with time. Third law The third law of thermodynamics states that the entropy at the absolute zero of temperature is zero, corresponding to the most ordered possible state. Statistical mechanics The science of statistical mechanics derives bulk properties of systems from the mechanical properties of their molecular constituents, assuming molecular chaos and applying the laws of probability. Regarding each possible configuration of the particles as equally likely, the chaotic state the state of maximum entropy is so enormously more likely than ordered states that an isolated system will evolve to it, as stated in the second law of thermodynamics. Such reasoning, placed in mathematically precise form, is typical of statistical mechanics , which is capable of deriving the laws of thermodynamics but goes beyond them in describing fluctuations i. An example of a fluctuation phenomenon is the random motion of small particles suspended in a fluid , known as Brownian motion. Left Random motion of a Brownian particle; right random discrepancy between the molecular pressures on different surfaces of the particle that cause motion. Quantum statistical mechanics plays a major role in many other modern fields of science, as, for example, in plasma physics the study of fully ionized gases , in solid-state physics, and in the study of stellar structure. Particles with electric charge interact by an electric force , while charged particles in motion produce and respond to magnetic forces as well. Many subatomic particles, including the electrically charged electron and proton and the electrically neutral neutron, behave like elementary magnets. On the other hand, in spite of systematic searches undertaken, no magnetic monopoles, which would be the magnetic analogues of electric charges, have ever been found. The field concept plays a central role in the classical formulation of electromagnetism, as well as in many other areas of classical and contemporary physics. The field describing the electric force between a pair of charged particles works in the following manner: Classical electromagnetism is summarized by the laws of action of electric and magnetic fields upon electric charges and upon magnets and by four remarkable equations formulated in the latter part of the 19th century by the Scottish physicist James Clerk Maxwell. The latter equations describe the manner in which electric charges and currents produce electric and magnetic fields, as well as the manner in which changing magnetic fields produce electric fields, and vice versa. The light to which the human eye is sensitive is but one small segment of an electromagnetic spectrum that extends from long-wavelength radio waves to short-wavelength gamma rays and includes X-rays , microwaves , and infrared or heat radiation. Radio waves, infrared rays, visible light, ultraviolet rays, X-rays, and gamma rays are all types of electromagnetic radiation. Radio waves have the longest wavelength, and gamma rays have the shortest wavelength. Optics Because light consists of electromagnetic waves, the propagation of light can be regarded as merely a branch of electromagnetism. However, it is usually dealt with as a separate subject called optics: More recently, there has developed a new and vital branch, quantum optics , which is concerned with the theory and application of the laser , a device that produces an intense coherent beam of unidirectional radiation useful for many applications. Spectrum of white light by a diffraction grating. With a prism, the red end of the spectrum is more compressed than the violet end. The formation of images by lenses , microscopes , telescopes , and other optical devices is described by ray optics, which assumes that the passage of light can be represented by straight lines, that is, rays. The subtler effects attributable to the wave property of visible light, however, require the explanations of physical optics. One basic wave effect is interference , whereby two waves present in a region of space combine at certain points to yield an enhanced resultant effect e. Another wave effect is diffraction , which causes light to spread into regions of the geometric shadow and causes the image produced by any optical device to be fuzzy to a degree dependent on the wavelength of the light. Optical instruments such as the interferometer and the diffraction grating can be used for measuring the wavelength of light precisely about micrometres and for measuring distances to a small fraction of that length.

Atomic and chemical physics One of the great achievements of the 20th century was the establishment of the validity of the atomic hypothesis , first proposed in ancient times, that matter is made up of relatively few kinds of small, identical partsâ€”namely, atoms. However, unlike the indivisible atom of Democritus and other ancients, the atom, as it is conceived today, can be separated into constituent electrons and nucleus. Atoms combine to form molecules , whose structure is studied by chemistry and physical chemistry ; they also form other types of compounds , such as crystals , studied in the field of condensed-matter physics. Such disciplines study the most important attributes of matter not excluding biologic matter that are encountered in normal experienceâ€”namely, those that depend almost entirely on the outer parts of the electronic structure of atoms. Only the mass of the atomic nucleus and its charge, which is equal to the total charge of the electrons in the neutral atom, affect the chemical and physical properties of matter. Millikan oil-drop experimentBetween and the American physicist Robert Millikan conducted a series of oil-drop experiments. By comparing applied electric force with changes in the motion of the oil drops, he was able to determine the electric charge on each drop. He found that all of the drops had charges that were simple multiples of a single number, the fundamental charge of the electron. Although there are some analogies between the solar system and the atom due to the fact that the strengths of gravitational and electrostatic forces both fall off as the inverse square of the distance, the classical forms of electromagnetism and mechanics fail when applied to tiny, rapidly moving atomic constituents. Atomic structure is comprehensible only on the basis of quantum mechanics, and its finer details require as well the use of quantum electrodynamics QED. Atomic properties are inferred mostly by the use of indirect experiments. Of greatest importance has been spectroscopy , which is concerned with the measurement and interpretation of the electromagnetic radiations either emitted or absorbed by materials. These radiations have a distinctive character, which quantum mechanics relates quantitatively to the structures that produce and absorb them. It is truly remarkable that these structures are in principle, and often in practice, amenable to precise calculation in terms of a few basic physical constants: Condensed-matter physics This field, which treats the thermal, elastic, electrical, magnetic, and optical properties of solid and liquid substances, grew at an explosive rate in the second half of the 20th century and scored numerous important scientific and technical achievements, including the transistor. Among solid materials , the greatest theoretical advances have been in the study of crystalline materials whose simple repetitive geometric arrays of atoms are multiple-particle systems that allow treatment by quantum mechanics. Because the atoms in a solid are coordinated with each other over large distances, the theory must go beyond that appropriate for atoms and molecules. Thus conductors , such as metals , contain some so-called free electrons, or valence electrons , which are responsible for the electrical and most of the thermal conductivity of the material and which belong collectively to the whole solid rather than to individual atoms. Semiconductors and insulators , either crystalline or amorphous , are other materials studied in this field of physics. Brattain, and William B. Other aspects of condensed matter involve the properties of the ordinary liquid state, of liquid crystals, and, at temperatures near absolute zero , of the so-called quantum liquids. The latter exhibit a property known as superfluidity completely frictionless flow , which is an example of macroscopic quantum phenomena. Such phenomena are also exemplified by superconductivity completely resistance-less flow of electricity , a low-temperature property of certain metallic and ceramic materials. Besides their significance to technology, macroscopic liquid and solid quantum states are important in astrophysical theories of stellar structure in, for example, neutron stars. Nuclear physics This branch of physics deals with the structure of the atomic nucleus and the radiation from unstable nuclei. About 10, times smaller than the atom, the constituent particles of the nucleus, protons and neutrons, attract one another so strongly by the nuclear forces that nuclear energies are approximately 1,, times larger than typical atomic energies. Quantum theory is needed for understanding nuclear structure. Particle tracks from the collision of an accelerated nucleus of a niobium atom with another niobium nucleus. The single line on the left is the track of the incoming projectile nucleus, and the other tracks are fragments from the collision. Courtesy of the Department of Physics and Astronomy, Michigan State University Like excited atoms, unstable radioactive nuclei either naturally occurring or artificially produced can emit electromagnetic radiation. The energetic nuclear photons are called gamma rays. Radioactive nuclei also emit other particles: A principal research tool of nuclear physics involves the use of beams of particles e.

Recoiling particles and any resultant nuclear fragments are detected, and their directions and energies are analyzed to reveal details of nuclear structure and to learn more about the strong force. A much weaker nuclear force, the so-called weak interaction, is responsible for the emission of beta rays. Nuclear collision experiments use beams of higher-energy particles, including those of unstable particles called mesons produced by primary nuclear collisions in accelerators dubbed meson factories. Exchange of mesons between protons and neutrons is directly responsible for the strong force. For the mechanism underlying mesons, see below Fundamental forces and fields. In radioactivity and in collisions leading to nuclear breakup, the chemical identity of the nuclear target is altered whenever there is a change in the nuclear charge.

4: Physics | science | www.enganchecubano.com

Many physics and astronomy Ph.D. holders begin their careers in a temporary postdoctoral research position, which typically lasts two to three years." Colleges for Astronomy Majors According to U.S. News, the top five ranked universities for astronomy in the U.S. are.

Share13 Shares We often take our daily experience of life on Earth for granted, but every moment, a plethora of forces are controlling our lives. There are a surprising amount of unusual, counterintuitive, or yet-to-be-explained principles of physics that we encounter on a daily basis. In a fascinating survey of must know physics phenomena, we will discover frequently encountered occurrences that remain a mystery, bizarre forces that we fail to perceive, and how science fiction could become reality through manipulation of light. Humidity, individual physiology, and even our mood can change our perception of hot and cold temperatures. This insulating cushion of air actually keeps people warm. When the wind blows on you, the cushion of air is blown away, and you are exposed to the true temperature, which feels much colder. Wind chill only affects entities that produce heat. However, the forces that control our universe frequently subscribe to a more exponential model of reaction that follows a power distribution. An object moving at a speed of 40 kilometers per hour, will strike a wall with a corresponding degree of energy. If you double the speed of an object to 80 kilometers per hour, the impact force will not double, but quadruple. This principle explains why highway crashes are far more devastating than urban accidents. We know the general ideaâ€"an object circles around a planet or other large object in space and never falls. But the reason orbit happens is surprisingly counterintuitive. When an object is dropped it falls back to the surface. However, if it is high enough and moving fast enough, the earth curves away from it before it can impact. The same effect prevents Earth from colliding with the Sun. It is not fully understood why, but the phenomenon, known as the Mpemba effect, was originally discovered by Aristotle over 3, years ago. The mysterious effect has been attributed to a range of phenomena, but it remains a mystery. We are adapted to withstand this pressure, and avoid being crushed by absorbing equally pressurized air into our bodies. Its atomic number of 1 means it has only 1 proton, 1 electron, and no neutrons. Although Hydrogen is known as the quintessential gaseous element, it displays some rather peculiar properties that link it to the alkali metals, rather than other gases such as helium. Hydrogen is located in the column of the periodic table just above Sodium, the volatile metal that makes up table salt. Physicists have long understood that Hydrogen behaves like a metal under extreme pressure , such as that found in stars and the core of gas giant planets. Attempts to produce the compound on Earth have been fraught with challenges, but some scientists believe they have created small samples through pressure treatments involving diamond crystals. The opposite occurs in the southern hemisphere. As a result, navigation systems must compensate for the Coriolis Force to avoid deviation to the right or left of the target. Austrian physicist Christian Doppler discovered that when a moving object such as a siren produces sound waves, the waves bunch in front of the object and disperse behind it. This induced wave disturbance, known as the Doppler Effect, causes the sound of an approaching object to rise in pitch due to wavelength shortening. When the object passes, the trailing waves extend and are perceived lower in pitch. The Doppler Effect is also seen in the bunching of waves in front of a ship and the dispersing wake. However, water is capable of transforming straight from a solid into a gas in certain situations. Sublimation may cause glaciers to disappear into thin air as lens-like concentration of sunlight turns the ice into steam. Likewise, metallic elements such as Arsenic may actually transform directly into a gaseous state when heated, releasing toxic fumes. Water may sublime at temperatures below the melting point upon application of a heat source. We only see objects when light bounces off of them, producing an image with a range of wave lengths. Scientists have long theorized that objects could be rendered invisible by disrupting the way light interacts with them. If light can be deflected around an object, it could become invisible to the human eye. Recently, theory became reality when scientists produced a clear hexagonal prism that deflected light around any object inside of it. When placed in an aquarium, the prism caused a goldfish swimming into it to become invisible, while a land based cloak caused farm animals to vanish from site. Mike Williams is an ardent follower of science with a passion for the unexplained or unusual. His writing interests include mysteries and the more perplexing facets of natural history.

5: Was Aristotle the first physicist? | Science | The Guardian

Then our Phenomenal Physics Summer Camps are the perfect fit! Come build planes, go SCUBA diving, learn the physics of sound, build a Martian habitat or a cardboard boat. We offer camps appropriate for children from Grade 2 to 10; each student camp is led by a certified teacher, an undergraduate students, and high school volunteers.

The fraction of papers in major astronomy journals from U. Europe, with its Very Large Telescope VLT; four 8-meter telescopes and an array of smaller telescopes used for infrared interferometry at the European Southern Observatory ESO and new Grand Telescopio Canarias 11 meters , has achieved parity with the United States in ground-based optical and infrared astronomy. Although aperture is important for radio telescopes, angular resolution and frequency coverage are as important. For all three parameters, U. The Expanded Very Large Array is by far the dominant centimeter-wavelength telescope in the world, and will remain so until the Square Kilometer Array is built. Among ground-based telescopes that led to the most influential papers, defined as those with 1, or more citations, in U. European funding of astronomy adopts accounting conventions that complicate direct comparisons with U. Managing International Collaboration Thanks to the growth of astronomy across the globe and the emergence of international partnerships on all scalesâ€”from individual scientific collaborations to major multinational projects and sharing of major data setsâ€”science agendas around the globe are converging. At the same time, the growth in the costs and complexity of new telescopes and instruments is pressing the need for expanded international cooperation at all stages, from conceiving and building to using Page 83 Share Cite Suggested Citation: The National Academies Press. Astronomy planning exercises are now conducted around the world. Although there is remarkable convergence on the most compelling science questions and considerable overlap in plans for facilities, there is relatively little or no formal international input to or coordination between these activities. Additional, major international activities include those involving Australia e. These pressures are most evident in ground-based facilities. The advantages of such partnerships are manifest: Traditional international partnerships, in which two or more national partners collaborate in the construction, operation, and management of a facility, also carry with them inherent disadvantages and overheads. The involvement of multiple organizations inevitably increases the complexity of decision making and management, which translates into a significant overhead in project costs. If government agencies are involved, either as direct partners or as managing agencies for one or more partners, the increase in bureaucratic requirements and the delays in decision Page 84 Share Cite Suggested Citation: The presence of additional approval layers can hinder the ability of a project to respond to changes in performance and cost that often occur during the development of a facility. Legal requirements such as the U. Finally, international commitments can make it much more difficult to terminate or descope projects but can also smooth out funding profiles if partners are able to contribute at different times or rates. Overall, the implied financial stability of government agency involvement can be a double-edged sword. An alternative approach to partnership is to coordinate access across a suite of facilities. A more limited form of partnership is the sharing of archival data from a facility, even in cases where observing time is restricted. Other arrangements may prove to be just as effective. For example, access to both the northern and southern skies is essential for many areas of astronomy; a partnership could take the form of time swaps on solely owned telescopes in the two hemispheres. Likewise, one international partner might have a unique facility e. The principle of open skies is compatible with the guiding principle of maximizing future scientific progress. In an increasingly international arena, flexibility will be a key to optimizing the science return from U. A prerequisite for a successful partnership is that all parties view the arrangements as being fair and equitable, at least when considered across the sum of shared facilities. As a result, overseas investigators make substantial use of those facilities, accounting for typically one-third for the NRAO telescopes; less for Arecibo of the allocated observing time. At present, it can be said that U. In addition, private U. However, the astronomical community does get access to ground-based optical infrared facilities through the Telescope System Instrument Program scheme. Such imbalances are likely to arise, and when they do, it is incumbent on the agencies and observatory directors to take corrective action. For example, when the fraction of foreign users of a U. Likewise, if a serious asymmetry develops between the United States and foreign facilities, then that is the time to propose reciprocal arrangements that will preserve the principle of open skies. There are two caveats to this approach. An important goal for the U. To encourage reciprocal arrangements for broad merit-based access to telescopes worldwide, the observing rights and access to survey data, e. In any restriction of access to U. Page 86 Share Cite Suggested Citation: These approaches could include not only shared construction and operation costs but also strategic time-sharing and data-sharing agreements. The long-term goal should be to maximize the scientific output from major astronomical facilities throughout the world, a goal that is best achieved through opening access to all astronomers. International partnership should be regarded as an element of a broader strategy to coordinate construction and support of and access to astronomical facilities worldwide and to build scientific capability around the world. International Strategic Planning Beyond the arena of science coordination and shared access to individual facilities, greater international consciousness and coordination in the planning of the future astronomical agenda as a whole are increasingly evident. These and similar plans from other communities are loosely modeled after the NRC decadal survey process, but up to now have not interacted to any substantive degree with the planning in the United States or elsewhere. Recognizing the potential value of international coordination and planning, the Organisation for Economic Cooperation and Development OECD Global Science Forum and the International Astronomical Union have sponsored workshops and other activities for the planning of future large facilities. The Future of International Astronomy. Page 87 Share Cite Suggested Citation: So long as the major share of astronomy research in the United States is underwritten by U. However, as more major projectsâ€”including nearly all of the very large scale astronomy and astrophysics projectsâ€”are conceived and carried out by international partnerships, an international forum for planning the future of astronomy will become increasingly valuable. In order that such a forum be effective, it will be necessary that it have the full support and participation of senior administrators within the agencies. From even modest beginnings, a foundation could be laid for more substantive cooperation and joint planning in the future and a context provided for interagency negotiations. Approximately every 5 years the international science community should come together in a forum to share scientific directions and strategic plans, and to look for opportunities for further collaboration and cooperation, especially on large projects. In subsequent years, competition between the private and public sectors dominated cooperation. However, the increasing cost of constructing large telescopes and, especially, the long-term cost of operating them, coupled with the desire of astronomers not affiliated with the institutions operating private telescopes to have access to those facilities, eventually led to the growth of public-private partnerships in the United States. Other important system activities include the enabling of OIR technology development, adaptive optics and interferometry, access to data archives for ground-based OIR telescopes, and training of future astronomers. As summarized in Table 3. The nature of these partnerships varies greatly, some consisting of universities partnering with NSF, or NASA, some between universities and foreign federal agencies, and others between private and state universities. Over this same year period, Europe has taken a different path. The few other non-ESO OIR facilities in Europe still tend to be nationally funded, and there has been a gradual de-emphasis on institutionally operated observatories. Overall, the European model has evolved toward collective public investment in shared major facilities, major investments in new instruments and data systems, and high levels of user support. In the s Europe achieved full parity with the combined public-private U. In some areas, such as high-resolution stellar spectroscopy, integral field spectroscopy, and data archiving, ESO has now established clear international leadership; the United States retains a lead in infrared detectors and high-contrast imaging. Page 89 Share Cite Suggested Citation:

6: Stephen Mecca â€“ Engineering and Physics at Providence College

Department of Physics and Astronomy, University of British Columbia. Megan Nantel. Phenomenal Physics Camp Leader at Department of Physics and Astronomy, University of British Columbi.

There will be limited seating. The answer to life, the universe, and everything may actually be 63 â€” the number of orders of magnitude of physical scale that we can access. The journey from the cosmic horizon to the subatomic is full of fascinating waypoints, but what do we really know about the nature of reality and what are the biggest mysteries still waiting to be solved. Scharf is Director of Astrobiology at Columbia University and has an international reputation as a research astrophysicist and as a lecturer to college and public audiences. Informed, fresh, and thoughtful. Scharf is a regular keynote speaker at academic meetings, such as for the American Physical Society, museums, and both public and private venues, including the American Museum of Natural History, the Rubin Museum of Art in New York. Pick up his Zoomable Universe book on Amazon today before the talk! From build to launch, learn the steps to achieve your Level 1 rocket certification. David will also discuss projects under the high school rocketry club, which include the Team America Rocket Challenge, building for a Level 2 rocket certification, and integrating electronic payloads for remote telemetry. With a background in astronomy and astrophysics from Harvard and the University of Pennsylvania, David brings his passion for all thing space in his work as an educator, stargazer, and scientist. I will discuss how the chemical abundances of stars in the Milky Way can serve as a way of unraveling their origin. Sheffield received her B. Sheffield is involved in public astronomy outreach events in Queens and co-leads a Girl Scout troop in Greenpoint, Brooklyn. We practice emergency communications in a winter environment as it is just as important as the preparations and practice that are done each summer but with some additional unique operational concerns. Urry will cover in her talk: All of which is to try to understand how our present-day Universe came to be. Joshua Tan Life in the Universe: Where Does It Come From? LaGuardia Community College The key ingredients and conditions that allowed for the emergence of life have been identified by biochemists for many decades. What is the astronomical context for this emergence? Where did it come from? In this talk I will discuss the astronomical contexts for the emergence of life and, along the way, look at how seemingly alien and exotic astrophysical events planted the seeds that are necessary for you and I to exist. The implications of this in our search for life outside the Earth will be explored as well. Tan is an optical astronomer at City University of New York: He is intensely interested in observing the counterparts to short period binary millisecond pulsars. Aside from that, open problems in binary modeling, neutron star physics, and three-body dynamics occupy most of his research thinkspace. He received his PhD in astronomy from Columbia University.

7: Astronomy | Physics and Astronomy | Colby College

Jun 21, From staff reports. Two Ohio University Physics and Astronomy faculty members have received prestigious U.S. Department of Energy Early Career Research Program Awards, the DOE announced on June

It was strange to think that for two millennia no-one had stood on this spot and known the significance of the place. By persistence and immense good fortune, I found myself being shown round the site - which was at the time still closed to the public - by Ligouri herself. The site is large - some 50 metres across - and consists of the exposed foundations of a large building sitting on bedrock. When Ligouri realized that she had stumbled on a "gymnasio" - a building given over to physical exercise and training - she knew at once that it must have been the Lyceum. It was not exactly in the location traditionally assigned to the Lyceum, but the site satisfied all known requirements: Archaeologists were still working on the site when I visited. However, the future of the site, which is intended to be the venue for a museum of modern art, remains uncertain. The dig was an emergency one before concrete foundations were to be poured onto the site. I hope that these foundations will never be laid. Given its significance in the history of western culture, this is a building that must be preserved for posterity. Although the little room where Aristotle probably taught had space for perhaps just 10 students, the scope of the courses that he gave there, which miraculously survive today in some 30 books of his lecture notes, was phenomenal. It is hard to believe they were written by a single person. Aristotle had an extraordinary range of interests and learning. His courses included philosophy, logic, astronomy, physics, biology, meteorology, poetry, drama, ethics, politics, psychology and economics - in fact, many of the subjects of a modern university. Some of his biological insights were not rediscovered until the 19th century and his logic was not superseded until the work of Gottlob Frege in the early part of the 20th century. We honour the thinkers of antiquity who guessed right - the atomic theory of Democritus, the heliocentric view of Aristarchus - but not the man who we can truly say invented science. For his physics and astronomy, Aristotle has become identified as the barrier to scientific progress in the renaissance. It was not until the 11th and 12th centuries - thanks to Arabic translations from the Islamic kingdoms of Sicily and Spain - that his writings were rediscovered in Europe. We are left with the idea that Aristotle represents all the worst aspects of medieval philosophy. Plato, on the other hand, is still cited with approval by theorists and mathematicians, who love to imagine that their ideas represent some underlying reality about the universe. His concept of a uniform, ever-flowing time was adopted unaltered by Newton and still has its place in relativistic physics in an inertial frame. We can surely not fail to take seriously someone whose scientific ideas are still alive after more than years. Aristotle had no mathematical machinery for dealing with the concept of acceleration, so he analysed only states of uniform velocity. He did not analyse frictionless uniform motion because such motion is not seen in the world. It was not until Newton that this Platonic concept of uniform motion in a straight line under no force was seen to be fundamental to dynamics. The first state that Aristotle did analyse was motion under a constant force resisted by friction - such as a body of mass m being pulled or pushed along the ground. The second state analysed by Aristotle is uniform motion through a resistive medium like air or water - such as a body in free fall through a viscous medium. This was first correctly analysed by Stokes in the 19th century, who recognized that the resistive force is proportional to the velocity. Aristotle, however, stated that the terminal velocity is inversely proportional to the cross-sectional area, rather than the radius. In place of the coefficient of viscosity, he talked of the "thickness" of the medium. A body will move through a given medium in a given time, and through the same distance in a thinner medium in a shorter time, in proportion to the thicknesses of the hindering media. His analysis of the real, frictional and viscous world is therefore superior in some respects to that of Newton. Aristotle was aware that accelerations took place, but he was not able to incorporate them quantitatively. The problem is that the Stokes-Aristotle terminal velocity becomes very large as the viscosity tends to zero as in air and becomes infinite in the limit of a vacuum. Aristotle responded by saying a vacuum was impossible, but this still did not obviate the need to consider accelerations properly for motion of a projectile in air. Aristotle correctly defined the power of a machine lifting a body as being the weight multiplied by the distance moved, divided by time - in other words the rate of doing mechanical work. He also, very practically, pointed out that there is a threshold to get something moving when there is resistance by friction - "One man cannot move a ship," as he put it. Cosmological insights Aristotle had a reasonably clear notion of buoyancy - that a denser body sinks through a medium while a lighter one rises. He elevated this to a universal process of bodies either seeking the centre of the Earth or moving away from it, depending on whether they are lighter hot air or fire or heavier earth than air or water. When he considered if the Earth itself could be moving round the Sun, he found that this idea conflicted with the seemingly more powerful notion of a natural motion towards or away from the centre of the Earth. This led him to postulate that the circular motions of heavenly bodies about the Earth once a day must also be one of the possible natural states of motion. He also had to argue that the universe is finite to avoid infinite circular velocities at the periphery. This picture is another reason why he rejected the idea of uniform motion in a straight line, because it would have implied the concept of an infinite straight line, which is not permitted in a finite universe. Aristotle reduced all forces to pushes or pulls and could not conceive of gravity holding the planets in circular orbits. He did, however, see that forces act at a point and have a definite direction, i. Aristotle also showed some surprising insights into astronomy. He thought that the stars were at a range of distances from the Earth, and believed that the stars were spheres. Thus the crude medieval picture of the stars as "holes" in the surface of a sphere that let through light from behind had absolutely nothing to do with Aristotle. This was taken over without modification by Newton and was not questioned until the rise of relativity theory at the start of the 20th century. In the special theory of relativity, the rate at which time flows depends on the relative motion of the observer and the clock, although an inertial, uniformly moving observer would still see a uniform time pervading the universe within his or her own frame of reference. In general relativity, the patch over which a freely falling, inertial observer can measure such a uniform time becomes localized to the zone in which the gravitational field is uniform. Moreover, it is the same time for every observer co-moving with the universe. I find this one of the most paradoxical features of the universe we appear to find ourselves in. Goethe made one last-ditch attempt to reinstate this Aristotelean goal of comprehending and experiencing the unity of nature. In some senses, however, his physics and astronomy were the least successful of his works. His biology was much more potent and permanent in its influence. This was a teacher who loved science and loved poetry, whereas Plato rejected both. Standing on the stones of the Lyceum, I could hear again the words of the greatest teacher in western culture:

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Welcome to Physics Phenomena This Web Site is dedicated to all of us who are students of Physics or just naturally curious about how our world and our universe works. This Web Site is for students in private, public, and home schools who have a genuine interest or curiosity in science as it relates to physics.

A Few Fundamental Physics and Astronomy Questions for the Next Few Decades One may wonder which crucial questions will almost certainly occupy physicists and astronomers working together in the coming few decades. Here are a few of the remaining puzzles. From the tiny matter particles such as quarks, electrons, neutrinos of the so-called "Standard Model" and the associated force-carrying bosons such as photons, gluons, W, Z , to the cosmic microwave background and the vast, accelerating universe, physicists and astronomers have come together to explore an astonishing range of cosmic phenomena. When you think about the fact that the atomic nucleus was only discovered in , and that only in astronomer Edwin Hubble confirmed that galaxies existed beyond our own Milky Way, you cannot avoid being amazed. The latest journeys into the largest and smallest scales have continued to produce spectacular results. On one hand is the discovery of the Higgs boson -- the particle that endows elementary particles with mass -- at the Large Hadron Collider Figure 1. On the other, are the highly detailed observations of the cosmic microwave background--the afterglow of the Big Bang -- by the Planck satellite Figure 2. Simulated data showing the production of the Higgs boson from the collision of two protons. The Higgs decays into two jets of heavy particles and two electrons. ESA and the Planck Collaboration. One may wonder which crucial questions will almost certainly occupy physicists and astronomers working together in the coming few decades. The first three questions that probably are at the top of the list in no particular order of both cosmologists and particle physicists are: To answer these questions in full will require a complex combination of high-precision astronomical observations with results from accelerator and laboratory experiments, coupled with theoretical advances. On the astronomical side, observations of large-scale structure and of supernovae with facilities such as the upcoming James Webb Space Telescope, and with wide-field imagers in space such as the planned WFIRST, and the next generation of cosmic microwave background telescopes, will work hand-in-hand with large telescopes on the ground such as LSST. Two other fascinating areas in which the interests of astronomers and high-energy physicists coalesce are related to the possibility of our universe containing extra spatial dimensions, and the formulation of a quantum theory of gravity. Various versions of string theory or M-theory --the attempt to unify all the forces of nature, as well as to explain the relative weakness of the gravitational force--assume the existence of more than the three dimensions of space and one of time that we are familiar with in our everyday lives. Accelerator experiments demonstrating some missing energy because energy could escape into extra dimensions or laboratory tests of the behavior of gravity on very short distance scales predicted to vary if extra dimensions exist can test some of the predictions of such theories. Finally, another area likely to draw considerable attention is the physics of black holes. Here, a combination of x-ray observations, which are expected to be capable of resolving the innermost parts of disks accreting x-ray emitting gas onto black holes, together with ambitious attempts to detect gravitation radiation such as Advanced LIGO and LISA , can bring about significant progress. One thing is clear; there is no shortage of fascinating topics for physicists and astronomers to sink their teeth into.

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A Few Fundamental Physics and Astronomy Questions for the Next Few Decades. By Mario Livio. There is no doubt that progress in physics and astronomy in the past century has been phenomenal.

Astronomy and astrophysics[edit] Main article: List of unsolved problems in astronomy Astrophysical jet: Why do only certain accretion discs surrounding certain astronomical objects emit relativistic jets along their polar axes? Why are there quasi-periodic oscillations in many accretion discs? What is responsible for the numerous interstellar absorption lines detected in astronomical spectra? Are they molecular in origin, and if so which molecules are responsible for them? How do they form? What is the origin of the M-sigma relation between supermassive black hole mass and galaxy velocity dispersion? Rotation curve of a typical spiral galaxy: Can the discrepancy between the curves be attributed to dark matter? Why is the observed energy of satellites flying by Earth sometimes different by a minute amount from the value predicted by theory? Is dark matter responsible for differences in observed and theoretical speed of stars revolving around the centre of galaxies, or is it something else? What is the exact mechanism by which an implosion of a dying star becomes an explosion? What astrophysical process is responsible for the nucleogenesis of these rare isotopes? Why is it that apparently some cosmic rays emitted by distant sources have energies above the Greisenâ€”Zatsepinâ€”Kuzmin limit? What is the origin of magnetar magnetic field? Is the universe at very large scales anisotropic , making the cosmological principle an invalid assumption? The number count and intensity dipole anisotropy in radio, NRAO VLA Sky Survey NVSS catalogue [38] is inconsistent with the local motion as derived from cosmic microwave background [39] [40] and indicate an intrinsic dipole anisotropy. The same NVSS radio data also shows an intrinsic dipole in polarization density and degree of polarization [41] in the same direction as in number count and intensity. There are several other observation revealing large-scale anisotropy. The optical polarization from quasars shows polarization alignment over a very large scale of Gpc. Why is space roar six times louder than expected? What is the source of space roar? Ageâ€”metallicity relation in the Galactic disk: Is there a universal ageâ€”metallicity relation AMR in the Galactic disk both "thin" and "thick" parts of the disk? Although in the local primarily thin disk of the Milky Way there is no evidence of a strong AMR, [49] a sample of nearby "thick" disk stars has been used to investigate the existence of an ageâ€”metallicity relation in the Galactic thick disk, and indicate that there is an ageâ€”metallicity relation present in the thick disk. Why is there a discrepancy between the amount of lithium-7 predicted to be produced in Big Bang nucleosynthesis and the amount observed in very old stars? Transient radio pulses lasting only a few milliseconds, from emission regions thought to be no larger than a few hundred kilometres, and estimated to occur several hundred times a day. While several theories have been proposed, there is no generally accepted explanation for them. The only known repeating FRB emanates from a galaxy roughly 3 billion light years from Earth. What are the phases of strongly interacting matter, and what roles do they play in the evolution of cosmos? What is the detailed partonic structure of the nucleons? What does QCD predict for the properties of strongly interacting matter? What determines the key features of QCD, and what is their relation to the nature of gravity and spacetime? Do gluons acquire mass dynamically despite having a zero rest mass , within hadrons? Do gluons saturate when their occupation number is large? Do gluons form a dense system called Colour Glass Condensate? Nuclei and nuclear astrophysics: Why is there a lack of convergence in estimates of the mean lifetime of a free neutron based on two separate- and increasingly precise- experimental methods? What is the nature of the nuclear force that binds protons and neutrons into stable nuclei and rare isotopes? What is the nature of exotic excitations in nuclei at the frontiers of stability and their role in stellar processes? What is the nature of neutron stars and dense nuclear matter? What is the origin of the elements in the cosmos? What are the nuclear reactions that drive stars and stellar explosions? Atomic, molecular and optical physics[edit] Abrahamâ€”Minkowski controversy: What is the momentum of light in optical media? How do we rigorously prove the existence of Boseâ€”Einstein condensates for general interacting systems? Does the set of initial conditions for which particles that undergo near-collisions gain infinite speed in finite time have measure zero? The mechanism for superconductivity of these materials is unknown. What is the mechanism that causes certain materials to exhibit superconductivity at temperatures much higher than around 25 kelvins? Is it possible to make a material that is a superconductor at room temperature? What is the nature of the glass transition between a fluid or regular solid and a glassy phase? What are the physical processes giving rise to the general properties of glasses and the glass transition? Why does the electron emission in the absence of light increase as the temperature of a photomultiplier is decreased? What causes the emission of short bursts of light from imploding bubbles in a liquid when excited by sound? Is it possible to make a theoretical model to describe the statistics of a turbulent flow in particular, its internal structures? The latter problem is also listed as one of the Millennium Prize Problems in mathematics. In the solar wind and the turbulence in solar flares, coronal mass ejections, and magnetospheric substorms are major unsolved problems in space plasma physics. Is topological order stable at non-zero temperature? Equivalently, is it possible to have three-dimensional self-correcting quantum memory? What mechanism explains the existence of the u.

PHENOMENAL PHYSICS AND ASTRONOMY pdf

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