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Research Article

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[The Stability and Behaviour of the Superposition of Non-Linear Waves in Space](#)

The superposition of non-linear waves in space refers to the phenomenon where two or more waves overlap and combine to form a new wave pattern. Non-linear waves are characterized by their ability to interact with each other, leading to complex behaviors that are not observed in linear wave systems. Understanding the stability and behavior of the superposition of non-linear waves in space is crucial in various fields such as physics, engineering, and oceanography.

When non-linear waves superpose, their interactions can lead to a range of behaviors, including wave breaking, formation of solitons (localized wave packets), and the generation of harmonics. The stability of the superposition is determined by the balance between the non-linear effects and dispersive effects, which can either stabilize or destabilize the wave pattern. In addition, the behavior of non-linear waves in space is influenced by external factors such as boundaries, dissipation, and external forcing.

In this paper, we study the behavior and characteristics of waves when they interact with each other. Superposition refers to the phenomenon where multiple waves combine to form a resultant wave. In the case of linear waves, this superposition occurs according to the principles of linear superposition, which states that the displacement or amplitude at any point is the algebraic sum of the displacements or amplitudes of the individual waves. Understanding the superposition of linear waves in space has various applications in fields such as physics, engineering, acoustics, optics, and signal processing. By studying how waves interact and combine, researchers can gain insights into wave propagation, interference patterns, wave reflections, diffraction, and other phenomena that occur when waves meet.

Research Article

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[Environmental Effects on the Norbornadiene-quadricyclane Photoswitch for Molecular Solar Thermal Energy Storage](#)

Today's need for renewable energy combined with modern societies' reliability on on-demand power leads us to find solutions that can store excess or produce directly to storage for later use. A MOlecular Solar Thermal (MOST) based on norbornadiene/quadricyclane(NBD/QC) does the latter with an isomeric photoswitching molecule pair. The theoretical studies of molecular solar thermals (MOST) provide a needed understanding of potential synthetic candidates. We have investigated an array of more complex solvation models for the norbornadiene/quadricycle (NBD/QC) photoswitch and the impacts of the models on the first absorption energy. Our results have been obtained with various density functional theoretical methods and basis sets.

Research Article

Published Date:-2023-12-08 14:31:39

[Adjusted Hardy-Rogers-Type Result Generalization](#)

The adjusted Hardy-Rogers result generalization for the fixed point is demonstrated in this study, validating our results utilizing an application.

Research Article

Published Date:-2023-11-07 12:32:58

[Study the Influence of Laser Energy on the Surface Morphology of Copper Nanoparticles Prepared by Pulsed Laser Extirpation Method in Liquid](#)

A study reports a novel synthesis of pure copper and the effect of laser energy on optical properties and the particle size of colloidal copper nanoparticles prepared by pulsed laser ablation in liquid (PLAL). Different laser energies (600,700,800 mJ) of pulsed laser (Nd: YAG) were used to prepare colloidal copper nanoparticles size of about (40.4 nm - 91.3 nm) which were measured using Field Emission Scanning Electron Microscopy (FESEM). The presence of Copper NPs in distilled water, respectively, with nanostructure in the shape of a spherical construction and size of about 50 nm were measured using Transmission Electron Microscopy (TEM). The absorption spectrum and Surface Plasmon Resonance (SPR) were measured to study the optical properties of the prepared copper nucleus, and the results showed that the SPR and high optical density were found in the 320 wavelengths at the laser energy of (600 mJ), present at wavelength 333 to the laser energy (700 mJ) and shifted to a lower wavelength (blue shift) with a higher optical density, a wavelength of 341 at the laser energy of (800 mJ).

Research Article

Published Date:-2023-10-30 12:43:32

[Design and Development of a Dual-Volume Ionization Chamber for an Accident Monitor to Detect Gamma Radiation During Emergency Conditions in a Nuclear Reactor](#)

A Gamma Ionization Chamber was developed for the purpose of high gamma radiation detection during accident conditions in a Light Water reactor. The pre-eminence of the detector is that it was designed and developed to monitor gamma exposure rates in the wide range of 100 mR/hr to 107 R/hr. The detector has an overall diameter of 90 mm with a length of 400 mm. The response of the detector is accurate and the sensitivity is within $\pm 6\%$ over gamma energies ranging from 660 KeV to 1.25 MeV.

The detector operates with a DC voltage of 500V. The V0.9 voltage is about 250V for 107 R/hr. The estimated operation life of the detector is about 20 years.

Mini Review

Published Date:-2023-10-11 15:31:49

[Development of Gamma Flaw Detectors for Non-Destructive Testing](#)

The radiographic method of control is implemented by a set of control tools in the form of gamma flaw detectors, which are distinguished by: mobility, reliability, radiation safety, adaptability to a wide climatic range, ease of operation, and the ability to control products with small and large radiation thicknesses. The paper describes portable gamma flaw detectors manufactured by JSC NIITFA: Gammarid 2010R, UNIGAM R, Stapel-5 Se75 Ir192, Stapel-5 Se75W, gamma flaw detector ?-RID-75/80R and stationary gamma flaw detectors RID K-100 and RID K-400. Also paper describes a brief technology for the production of ionizing radiation sources Ir-192 with activity of 120 Curie, a technology for rolling the source holder with Ir-192 source and completing the Ir-192 source with a portable gamma flaw detector Gammarid-192/120M in the INP AS.

Thesis

Published Date:-2023-10-04 14:24:02

[Pre-equilibrium Effects on Alpha Particle Induced Reactions on Niobium Isotope from Threshold upto 100MeV using the Computer Code COMPLET](#)

Excitation functions (EF) for four reactions of the type $^{93}\text{Nb}(\alpha, xn)$; $x = 1-4$ were studied. This study provides current evidences about the dominance of pre-equilibrium processes at high energies followed by compound nucleus equilibration at low energies. The main objective of the work is to look pre-equilibrium emission induced by alpha particle energies up to 100 MeV on Niobium through describing, analyzing and interpreting the theoretical results of cross sections obtained from computer code COMPLET by comparing with experimental data obtained from EXFOR library. COMPLET code has been used for the analysis using the initial exciton number $n_0 = 4(4p+0h)$ and level density parameter $ACN/10$. A general agreement was found for all reactions.

Research Article

Published Date:-2023-09-29 00:00:00

[Fundamental Forces are not Fundamental as our 3-d Universe is Driven by an External Energy Source](#)

Atom has been considered as a space of perfect vacuum and no energy loss takes place inside the atom. The purpose of the current research work is to prove that even fundamental particles receive energy from external sources for their motion. In order to prove this, the model of the solar system and its planets is selected. According to this proposed theory, even the gravitational attraction between planets and stars is due to external energy received through the hypothesized O- Dimension. O-dimension is a time-independent totally symmetric dimension filled with potential energy and it encircles every object from atom to galaxy as well as the whole Universe and imparts energy to the whole Universe. The gravitational force between two objects is a result of the energy shadow cast by them on each other. Mathematical model developed and applied to the Sun and planets in our solar system as well as Earth and moon and it fits with the values obtained by Newtonian theory, confirming the validity of the hypothesis.

Opinion **Published Date:-2023-09-15 14:38:56**

[Black Holes and Time: Opinion](#)

This opinion essay is about how singularities may exist in a different dimension than we are, and on black holes and their time correlations. It also briefly mentions another way the universe may have been created.

Research Article **Published Date:-2023-09-14 00:00:00**

[Determination of the Effect of Zinc Acetate as a Doped Substance on the Properties of Cadmium Sulfide Nanomaterials by using a Hydrothermal Interaction Technique](#)

In the current work, cadmium sulfide nanoparticles (CdS) NPs were synthesized via the hydrothermal interaction technique. Especially, the deviation in zinc Acetate $Zn(CH_3CO_2)_2$ with 0.5%, 1.5%, and 2.25% was examined for its part in nanoparticles size. The nanoparticle size seems to reduce from 149.7 nm to 116.3 nm by enhancing the zinc acetate $Zn(CH_3CO_2)_2$. With increasing zinc acetate $Zn(CH_3CO_2)_2$ in CdS (Cadmium Sulfide) small lattice phase changes appeared due to angle peaks of diffraction shifting toward higher angle. The standard crystallite size and lattice parameters were analyzed through X-ray diffraction (XRD) characterization. The average crystallite size and volume unit cell were found to increment with increasing Zinc acetate $Zn(CH_3CO_2)_2$ concentrations. Absorption peaks in the UV visible spectra corresponding to zinc acetate $Zn(CH_3CO_2)_2$ of CdS (Cadmium Sulfide) were analyzed at various wavelengths of 368 nm and 369 and 371nm. These findings show the tuning ability of structural, and optical characteristics of cadmium sulfide (CdS) NPs.

Research Article **Published Date:-2023-08-18 09:52:05**

[Unsteady and Incompressible Magneto-Hydrodynamics Blood Flow in an Inclined Cylindrical Channel](#)

In the current study, the blood flow through an inclined cylindrical tube subjected to an external magnetic field is evaluated. The blood flow has been considered under the consequence of a transverse magnetic field. Previously the mathematical model was solved by using Caputo-Fabrizio (CF) fractional order derivative with a non-singular kernel which has the limitations like it fails to satisfy the fundamental theorem of fractional calculus. Whereas, in the present study Adomian Decomposition Method (ADM) which is suitable for all types of linear and non-linear differential equations is used. The flow of magnetized blood in an inclined cylindrical tube has been studied by using the ADM. An external magnetic field and an oscillating pressure gradient drove the blood flow. ADM algorithm has been developed and used to find the Adomian solution. Computer software MATHEMATICA has been used to visualize the influence of various flow characteristics such as Hartmann number (Ha), different radial locations and angle of inclination on the Adomian velocity. Due to the Lorentz effect and central radial location, the results show that the magnetic field diminishes the velocities of blood. Meanwhile, progressive inclination angle enhanced the blood flow.

Research Article **Published Date:-2023-08-17 09:44:15**

[Investigating Thermal Conductivity of Ferrofluids](#)

Heat transfer is one of the most important aspects of large-scale industries and machines, linking importantly to the efficiency associated with different mechanisms while also emphasizing the importance of sustainable, low-cost methods of heat transfer. One such method is the use of ferrofluids. Through this paper, it is clearly explained that the conductivity of ferrofluids has vast applications across industries and using its magnetic and thermal properties, it can be a cost-effective solution as well. Previously researched works in this field ferrofluids are also acknowledged and furthered as per experimental data.

Research Article

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[Studies of dose distribution to Lung and Stomach and Estimation of Second Cancer Risk due to Outfield Dose in Radiotherapy with 60Co Teletherapy Beam](#)

A critical component of the radiation regimen for treating cancer patients is the precise dose delivery to the treatment organ while minimizing the dose to the healthy tissue. This study aims to evaluate in-field organ dose and dose distribution outside the target organs to estimate the excess lifetime risk of second cancer. The study was carried out with a male Alderson Rando Phantom. 20 sets of thermoluminescence dosimeters (MTS-100) were used in this study. The in-field organs absorbed dose was measured by inserting TLDs at different geometrical depths of the left lung, right lung, and stomach, and for peripheral organs skin dose TLDs were placed at the surface of the corresponding organs. Target organs were irradiated at 100 cGy and 200 cGy by a 60Co teletherapy unit, and irradiated TLDs were read out by a RE-2000 TLD reader. For precise dose delivery to the cancerous organs by 60Co teletherapy, the depth dose correction factor for lung cancer treatment is 0.8667 ± 0.01 , and for the stomach is 0.7856 ± 0.017 . In the case of the treatment for the lung and stomach, the closest organs received significant doses compared to the other distant organs. Thus, the risk of second cancer due to the peripheral dose is obtained. The stomach is at the highest risk when the lung is the target and the liver is at the highest risk when the stomach is the targeted organ.

Research Article

Published Date:-2023-07-25 16:27:32

[Magnets, Gradients, and RF Coils of MR Scanners](#)

The topic of this paper is the parts of modern MR devices, which contain magnet coils. MR scanner magnets are made of four types of electromagnetic coils: 1) Main magnet, made of superconducting material. The main magnet of an MR (Magnetic Resonance Imaging) scanner creates a strong and uniform magnetic field around the patient being scanned. This magnetic field is typically in the range of 0.5 to 3 Tesla and is used to align the magnetic moments of the hydrogen atoms in the patient's body. The superconductors, which create the main magnetic field, should be cooled with liquid helium and liquid nitrogen. The main magnets made of superconductors should use a cryostat, with cooling vessels with liquid helium and liquid nitrogen, thermal insulation, and other protective elements of the magnet system. 2) The gradient magnetic field is made of three types of coils: x-coils, y-coils, and z-coils. The X coil, made of resistive material, creates a variable magnetic field, horizontally, from left to right, across the scanning tube; 3) The Y coil creates a variable magnetic field, vertically, from bottom to top; 4) The Z coil creates a variable magnetic field, longitudinally, from head to toe, inside the scanning tube. RF coils are used to generate RF pulses to excite the hydrogen protons (spins) in the patient's body and detect the signals emitted by the protons when they return to their equilibrium state after the RF excitation is turned off. The resulting interaction between the magnetic field and the aligned hydrogen atoms produces a signal that is used to generate the images seen in an MRI scan. The main magnetic field is what allows MR imaging to produce detailed anatomical and functional information non-invasively. The structure of the MR scanner magnet is complex. The resonant frequency changes at each point of the field in a controlled manner. Inside the copper core are embedded the windings of the main magnet made of superconducting material in the form of microfibers. A non-linear gradient field is created by coils of conductive material. It adds to the main magnetic field. Thus the resulting magnetic field is obtained. The types of magnets that exist in the basic configurations of MR scanners are analyzed. Scanners in the form of a closed cylindrical cavity generate their magnetic fields by passing current through a solenoid, which is maintained at the temperature of a superconductor. Exclusively used superconductors are niobium-titanium (NbTi), niobium-tin (Nb₃Sn), vanadium-gallium (V₃Ga), and magnesium-diboride (MgB₂). Only magnesium diboride is a high-temperature superconductor, with a critical temperature $T_c \approx 390\text{K}$. The three remaining superconductors are low temperatures. New high-temperature superconductors have been discovered, as well as superconductors at room temperature. Newly discovered superconducting materials are not used in MR scanners.
