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Mathematics and Science.Physics.01

SanjivJha

East Central University

Vibrational Signatures of Carboxylated Graphene: A Computational Study

Raman and infrared (IR) spectroscopies are fast, efficient, and nondestructive techniques commonly used for structural characterization of carbon nanomaterials. Using computational methods based on density functional theory, we computed the vibrational Raman and IR absorption spectra of carboxylated graphene containing no surface defects, containing Stone-Wales defects, and containing divacancies. Our calculations demonstrated that the presence of point defects near the functionalization sites significantly altered the Raman and IR spectra of carboxylated graphene. In all cases, we observed the emergence of new Raman and IR absorption bands in the range of low and high frequencies. The calculated Raman and IR spectra showed clearly distinguishable spectroscopic signatures associated to different types of structural defects present in carboxylated graphene. The results of our study provide guidelines for the interpretation of Raman and IR spectra of chemically functionalized graphene.

Mathematics and Science.Physics.02

TrevorBerg

East Central University

Analysis of Newton's Rings Interference

A plano-convex combination lens produces an interference pattern of concentric circles known as Newton's rings. The objective was to measure unknown properties of the plano-convex lens by using characteristic relationships of Newton's Rings and thin lenses. Concentric fringes produced by the lens were visually counted, and the radius of the ensemble was measured. This data allowed the radius of curvature to be calculated. To verify this work, a different approach was taken. If the focal length was found using the thin lens equation, the radius of curvature could be calculated. However, the plano-convex lens was not easily focused. It was hypothesized this was due to an extreme focal length, and a two lens system could solve the problem instead. The system contained a lens with known properties and the plano-convex combination lens. It could be used to measure the unknown focal length of the plano-convex lens, and by extension find its radius of curvature. This method was also difficult due to the long focal length. Tiny changes in measured lengths resulted in huge percent differences and occasionally errors. Therefore, it was difficult make accurate comparisons for verification. Nevertheless, the research was valuable, and it was found in a publication that Ophthalmologists apply the same method of counting concentric Newton's rings to visually check for astigmatism and calibrate prescription lenses.

Mathematics and Science.Physics.03

LoganMurphy

East Central University

Gamma Spectral Analyses of Granite Samples

Samples of many different kinds of granite were obtained from a local vendor who has naturally occurring samples from all over the world. The samples were massed and the radioactive dose rates were measured for comparison. The gamma energy spectrum of each sample was obtained using a NaI Detector connected to a UCS-30 that was interfaced to a computer. Tables and literature were used to match the energies obtained to the major radioactive isotopes present in each sample. Health implications for large amounts of granite in public areas will be discussed.

Mathematics and Science.Physics.04

JonRisner, SusmitaHazra

Cameron University

Solar Activity Variation and Its Effect on Ionospheric Electron Density

As the Sun progresses through its solar cycle and its activity increases, more number of sunspots occur and solar fluxes become more intense. The change in solar activity is related to the change in electron density of the ionosphere. Studying this relation is very important in terms of space plasma studies and space weather predictions, which play a significant role in radio and satellite communication as well as GPS navigation. In this poster we are presenting the sunspot and solar flux data for solar cycle 24 (year 2008-2018). During solar minima, sunspot number varies from 0 to 20 and solar flux varies from 60 SFU (Solar Flux Unit) to 68 SFU. During solar maxima, sunspot number varies from 60 to 140 and solar flux varies from 90 SFU to 150 SFU. We are using CHAMP satellite data to understand the variation of electron densities of the upper atmosphere with solar cycle 24. We will be comparing this results with IRI (International Reference Ionosphere) model. This data set can be used as a framework for future advancement in empirical modelling of regional and global electron density of the ionosphere.

Mathematics and Science.Physics.05

She'KaylaLove, SusmitaHazra

Cameron University

Seasonal Variation of F2 Peak of Ionosphere

The environment in the top layer of the Earth's atmosphere which we call as ionosphere changes from hour to hour and from day to day due to its interaction with Sun. As a part of this research, we are studying the F2 peak of the ionosphere using ionosonde data. We are using the data for King Salmon (latitude 58.4 degree, longitude 203.6 degree) station. During winter time of solar minima (year 2008) F2 peak varies around ~1.6 MHz to ~2 MHz and during summer time it varies between ~3.1 MHz to ~4 MHz The height of the F2 peak varies between ~180 km to ~370 km. The results of this research project will be important in terms of space plasma studies and space weather predictions, which play a significant role in radio and satellite communication as well as GPS navigation.

Mathematics and Science.Physics.06

AlbanyBlackburn, ShayneJohnston

Oklahoma School of Science and Mathematics

Self-Excitation, Parametric Forcing, and Chaos in the Dynamics of Dust-Grain Charge in Dusty Plasmas

The Van der Pol equation describing self-excited oscillations, and the Mathieu equation exhibiting parametric excitation, are each well-studied and have numerous applications in physics, engineering, and biology. A combined Van der Pol-Mathieu equation has been shown to arise from a simple model for the dynamical behavior of charged dust grains in dusty plasmas (Momeni et al., 2005). A systematic numerical study of this combined equation reveals a rich variety of nonlinear behavior including widespread chaos. An improved derivation of the equation leading to quasiperiodic parametric forcing, as well as the inclusion of external forcing and Duffing nonlinearity have also been studied.

Mathematics and Science.Physics.07

ChristopherFickess, AlyxPerkins

University of Central Oklahoma

Cosmic Radiation Detection Utilizing Muon Particle Detectors to Distinguish Rates of Muon Interactions Compared with Elevation

The purpose of researching muon particle interactions is to confirm whether elevation effects the rate of particle interactions occurring based on the elevation in which the detectors are positioned. Muons exist for 2.2 microseconds and pass through everything except for extremely dense materials or elements. Utilizing Galilean Relativity, the probability of muons existing at sea level is impossible, but it is known that they can travel to this elevation. Employing the Theory of Special Relativity, the probability of these particles existing at sea level is realistic. Throughout the project, muon particle detectors will be taken to multiple locations to document various readings of muon particle interactions compared with elevation. These elevations will range from mountain altitudes to sea level and attempt to determine an accurate trend line for the cosmic radiation occurring based on the muon particles being detected. By stacking the detectors, the number of vertical trajectory muons will be found, and the horizontal trajectory muons will be neglected. Using the data collected during the last few months, the goal is to determine if the amount of muons detected is affected by the elevation.

Mathematics and Science.Physics.08

WayneTrail

Southwestern Oklahoma State University

Building and Using Lehman Seismometers

Seismometers are used to detect vibrations in the earth. They can be made extremely sensitive even with very simple and inexpensive parts. The most basic seismometers behave like horizontal pendulums, which are caused to swing when the earth undergoes small movements. The swinging motion is made to produce a tiny current, which we detect and record using a micro-controller. A few seismometers separated geographically allow one to triangulate to the location of the earthquake. We have built a few Lehman seismometers which we are currently testing and calibrating. We can now detect earthquakes as low as 2.5 on the Richter scale anywhere in Oklahoma.

Mathematics and Science.Physics.09

WayneTrail

Southwestern Oklahoma State University

The Dobsonian Telescope: An Outreach Exploration II

We are reclaiming optical equipment from some of our older, unusable telescopes, to incorporate into new portable Dobsonian telescopes, which we are building and hope to use for viewing sessions in more distant communities, and on trips. SWOSU has several old non-working telescopes that either broke (irretrievably), or were donated and unusable, but which have good to excellent optics and can be rescued from obsolescence with careful construction. We have begun with some of the smaller optical systems (6 inch diameter mirrors), but we will be making telescopes out of 10 inch, 12 inch, and 16 inch mirrors in the future. Considerable care has to be taken to make sure the telescopes move extremely smoothly and can be pointed very precisely; this is the challenge in building a usable (great) Dobsonian telescope. In addition to using them for on-campus observing sessions, we hope to use these telescopes as part of Physics Club community outreach by taking them to other towns.

Mathematics and Science.Physics.10

WayneTrail

Southwestern Oklahoma State University

Automating the SWOSU Observatory

Recent, low-cost, high-quality astronomical cameras have made it possible for us to use SWOSU's 16 inch Ritchey-Cretien telescope to take very high quality images of faint astronomical objects like distant galaxies and nebulae. One challenge we have faced in this astrophotography is that these images often require long exposure times, as much as several hours. During this time the Earth is rotating so the telescope has to track its target across the sky over the course of the night. The SWOSU Observatory, which houses our telescope, consists of a 15-foot diameter dome with a closable slot the telescope looks through. So as the telescope tracks a target across the sky, the slot must be regularly adjusted (usually every several minutes) to keep the telescope looking through the slot. This part of the process is very tedious, particularly in the wee hours of the morning. In this work we use microcontrollers to allow the software that controls the direction the telescope is aimed to also correctly position the dome so that the astronomer doesn't have to.

Mathematics and Science.Physics.11

DouglasBryhan

East Central University

A Comparison of Artificial and Natural Lighting Spectra and Intensities

Recently concerns have been raised about the spectra from various new artificial lighting and display technologies representing potential long term harm to human eyesight. Spectra from various lighting and electronic displays will be experimentally compiled and compared to spectra of ordinary sunlight as a reference to assist in the assessment of potential hazards.