Mar 6th, 12:00 AM

14. Physics

Southwestern Oklahoma State University

Ground Verification of the NASA/JAXA Global Precipitation Measurement Project Using CoCoRaHS Precipitation Data

Karen Williams

Abstract

Precipitation data has been measured at my location and stored online by CoCoRaHS for over a decade. The Global Precipitation Measurement Project (GPM) precipitation predictions from multiple satellites for my coordinates during this interval was downloaded from NASA using Giovanni software. Ground verification from many entities are working on the accuracy of GPM data and members of CoCoRaHS were invited to participate. The GPM data was compared to the measured precipitation at my location to determine the accuracy of the GPM data. The precipitation for a month will be examined to determine if GPM is consistently predictions are too high or too low for a particular month or season. Preliminary comparisons from 2016 yielded a correlation of 0.8526 while the correlation was much smaller for 2018 at 0.7022. Total predictions of precipitation for these two years both showed only slightly over an 11% error. Additional data will be examined in this study.

Investigating the Relationship Between Attenuation Coefficients of Light and Sound in a Sunflower Oil Medium

Dylan Barber

Abstract

There exist similarities between the equations used to calculate the attenuation coefficients of electromagnetic and acoustic (or ultrasonic waves). Those similarities prompted our research question. We sought in our study to better understand the relationship between the attenuation coefficients of light and sound in an effort to build upon the tools used in diagnostic imaging and radiation therapy treatment planning. This research examined the ultrasound attenuation via the slope method utilizing Bouguer's Law. The optical attenuations were calculated using Beer's Law. Samples were tested at 3 different temperatures 15, 20, 25 degrees Celsius and sound frequencies 1, 2, 4 MHz. Future work would include further investigation of the attenuations and temperature or other complicating variables.

Variability Study of RR Lyrae Star TV Lyn

She'Kayla Love

Abstract

In this research, we are presenting the light curve of RR Lyrae type variable star. The name of our star is TV Lyn. This star is observed in the northern hemisphere and its coordinates are 113.38262, 47.80280. RR Lyrae type stars are the brightest representative of the variable stars. They are typically low mass and found within an instability strip with a temperature ranging from 6000 K to 7250 K. These stars are only located in solar systems that contain a stellar component older than 10 Giga-years. Therefore, study of these stars can provide us information on the distance and properties of a specific solar system. We
are using the data from Las Cumbres Observatory (LCO) which consists of a worldwide network of robotic telescopes. Photometric measurements were conducted using the 0.4 meter SBIG telescope. We have used advanced photometric techniques developed by Dr. Michael Fitzgerald & his team as a part of solar sibling project. Depending on the color of a star, luminosity changes in different color filters. Our data consists of four filters, B (Blue), V
(visual), I (Infrared), and Z (PAN-STARRS). Results show that this star has a variability period of 0.2409±0.003 days. Further analysis of our data can provide us information on intrinsic and extrinsic variables of this star.

Photometric Analysis of RR Lyrae SS For

Jonathan Risner & Susmita Hazra

Abstract

In this paper, we are presenting photometric analysis of a RR Lyrae type of variable star. These stars have low metallicity with mass and size like the Sun. They have a relatively low period about 0.2-1 day, makes them one of the most useful stars for exploring groups of stars that are similar to each other in terms of age and chemical composition. We are studying the RR Lyrae star "SS For" located in the global cluster M3 in the southern hemisphere with coordinates (31.96664, -26.8661). We are using the data from Las Cumbres Observatory (LCO) which has network of robotic telescopes located across different parts of the world. The data we are using are from SBIG (0.4 m) telescopes which has four different filters, B (blue), V (visual), I (infrared), and Z (PAN-STARRS). We have used advanced photometric techniques developed by Dr. Michael Fitzgerald & his team as a part of solar sibling project to study the light curves of SS For star. Results shows that this star has a variability period of 0.98909±0.00028 days using the standard deviation method. Further analysis of our data can provide us information on intrinsic and extrinsic variables of this star.

A Study of Reflectivity of Failed Optical Storage Media

Douglas Bryhan

Abstract

One of the most common optical storage media used today is the DVD. In this technology, a laser is reflected off a layer of a laminated disc and depending on the patterns of pressed “dots” on one layer of the disc the beam will either be reflected back or diffused. However, failure of the reflective layer can result in discs that “go bad” even if they are not otherwise abused (surface scratching, etc). Oxidation of the reflective layer due to a failure of the glue seal on the edges of the discs that holds the laminations together is commonly blamed.

This is an introductory look at the reflectivity changes in discs that have failed using an Ocean Optics Spectrograph with the goal to better understand the mode and rate of degradation as a function of time in prerecorded media. Other discs that go back to the early days of the media in the mid ‘90’s will be compared in an effort to establish longevity guidelines for optical media.

Boron Doped Carbon: A Tunable Morphology

Aaron Austin & David McIlroy

Abstract

Our group has successfully synthesized a new mesoscopic material via Chemical Vapor Deposition (CVD) technique in an attempt to dope boron on a form of Pseudo-Graphite known as GUITAR. By adding a boron precursor into the solution we discovered new mesoscopic structures that have formed with varying tubular morphologies. We call these novel structures BOD (Boron Orthocarborane Doped) Carbon and intend to explore their growth characteristics and possible applications. Some of these applications include hydrogen storage and improved battery technologies.

A CVD technique is used to grow this material. Through this method we flow nitrogen into a flask that is heated on a hotplate. The vapor is then carried through a tube furnace at 900 °C where the structures are then grown for various times. We have found that by manipulating time of the reaction and amount of boron in our mixture as well as cooling rate we can create different morphologies.

Due to the nature of the material growth we hypothesize that it is possible to tune the structures to vary in their application. For instance, an important aspect of improving Li-Ion batteries is surface area of the electrode material. Naturally, BOD Carbon has a high surface area due to the tubular structure increasing the storage capacity and performance of Li-Ion batteries.

The Dobsonian Telescope: An Outreach Exploration III

Cameron Cinnamon & Daniel Gassen

Abstract

We have reclaimed optical equipment from some of our older, unusable telescopes, which has been incorporated into new portable Dobsonian telescopes. These portable telescopes are ideal for use in viewing sessions in more distant communities, and on trips. We started by building a new Dobsonian base for a broken telescope. This took several attempts before we had a smoothly functioning piece of equipment, and we learned through trial and error how to be extremely precise with our measurements. Next, we built a telescope from scratch around a 6-inch diameter mirror. Considerable care was required to ensure the telescopes move extremely smoothly and can be pointed very precisely- this is the challenge in building a usable (great) Dobsonian telescope. We mastered this level of precision in our smaller telescope builds. Now we are in the process of building a telescope from scratch around a 16-inch diameter mirror which was donated to the SWOSU Physics Department many years ago. We are well underway with the design and construction process. Every aspect of the 16-telescope, affectionately named "tiny," is significantly more challenging and demanding than what we have experienced in the previous builds. The 16-inch telescope, when completed, will rival the automated telescope in the SWOSU observatory. In addition to using it for on-campus observing sessions, we hope to use this telescope as part of Physics Club community outreach by taking it to other towns.

Analysis of Algorithms for Analyzing Cochlear Mechanics

Petral Abong & Scott Mattison

Abstract

Optical coherence tomography (OCT) is a noninvasive diagnostic technique capable of providing structural information millimeters deep in tissue. The goal of this research project is to analyze various algorithms for utilizing Optical Coherence Tomography to quantify vibrational motions in layered tissue structures. Currently, a technique known as optical coherence vibrometry serves as a powerful tool for extracting vibrational motion parallel to the imaging axis. We hypothesize that we may develop an algorithm for extracting bulk vibrational motion of tissue structures by monitoring changes in signal speckle patterns over time. To test this hypothesis, we utilized a piezoelectric chip and quantified its vibrational motion at various angles relative to the imaging axis. We then compared the results of the measured vibration using both an existing optical coherence vibrometry technique and our new speckle algorithm.

Interactions among Graphene, Carbon Nanotubes, and Polymer: A Density Functional Theory Study

Sanjiv Jha

Abstract

Carbon nanomaterials, such as graphene and carbon nanotubes (CNTs) are used to enhance the mechanical properties of polymers. In this work, we performed a computational study based on density functional theory to investigate the interfacial interactions among graphene, CNTs, and Nylon 6. The role of Stone-Wales (SW) defects on the interaction energies were also examined. The results of our study show that CNTs and graphene form stable complexes, and the presence of SW-defects on CNTs weakens the CNT-graphene interactions. Our result that the CNT-graphene interaction is much stronger than CNT-CNT interaction suggests that graphene could be able to promote the dispersion of CNTs in the polymer matrix, resulting in an enhancement in mechanical properties of nanocomposites containing CNT-graphene nanocarbons.

Analyzing SN 2012fr Spectra through SYNOW

London Willson

Abstract

Type 1a supernovae (SNe 1a) are exciting and important to study because they are probes for dark energy and were the main component in the research
that led to the discovery of dark energy and the 2011 Nobel Prize. Their explosions are some of the brightest in the universe and by using spectral synthesis we gain clues that bring us closer to understanding the details of the explosion. Supernova 2012fr (SN2012fr) is of particular interest due to its slight irregularity from a standard type 1a.