Livro de Resumos

Teresina - 2018

Schedule

Time	Thursday November 22 - 2018	Time	Friday November 23 - 2018
08:00-09:00 h	Opening	09:00-10:00 h	T10 – Jérôme Depeyrot (UnB)
09:00-09:20 h	Plenary – Piauí Physics	10:00-10:40 h	T11 – Paulo Renato Carvalho (UFPI)
09:20-10:20 h	T01 – Robert Ducharme (L3 Techn.)	10:40-11:20 h	T12 – Aldilene Saraiva-Souza (UFPI)
10:20-11:20 h	T02 – Raimundo Rocha(UFRJ)	11:20-12:00 h	T13 – Bartolomeu Cruz Viana (UFPI)
11:20-12:00 h	T03 – Helder Alexandre Santos (UFPI)	12:00-14:00 h	*Almoço*
12:00-14:00 h	*Almoço*	14:00-15:00 h	T14 – Manoel Messias Ferreira (UFMA)
14:00-15:00 h	T04 – Diego Alves (UFMS)	15:00-15:40 h	T15 – Francisco Welington (UFPI)
15:00-16:00 h	T05-T09 – PGFIS Students (UFPI)	15:40-16:10 h	*Coffee Break*
16:00-16:30 h	*Coffee Break*	16:10-16:50 h	T16 – Anupama Ghosh (UFPI)
16:30-17:30 h	Poster Session	16:50-17:30 h	Closing Cerimony

Remarks:

Invited Speakers

UFPI Speakers

PGFIS-UFPI Students oral presentations

Abstracts identifications

T01 a **T16**: Research Talks

P01 a **P25**: Posters

T01 - Building Bots Using an Expert System and Machine Learning / Gouy Phase and FOAM in Electron Beam

Robert Jason Ducharme
L3 Technologies

Bots are autonomous processes. Communication between humans and bots is, usually, through natural language forms such as chat or speech. Here an open source based approach to building bots will be described that uses machine learning (ML) to interpret natural language and an expert system to comprehend and act upon the information. We shall also compare and contrast this to the slow / fast brain model of Daniel Kahnerman where the slow brain system represents consciousness and the fast brain carries out all the processes that do not require significant conscious effort.

Natural language interpretation (NLI) is the process of taking human utterances in text form and parsing them into a structured form that consists of an intent with all supporting data summarized as a list of name-value pairs. It has become popular to use ML for NLI applications. In relation to the Kahnerman model, NLI can be categorized as a fast brain skill since natural language is processed quickly and only requires significant conscious effort if comprehension is needed.

Expert systems arose historically as a model of conscious human thought. The purpose of expert systems is to execute conditional logic in the form of rules. Rules differ from functions in procedural code in the detail that functions need to be called whereas rules do not. In a good expert system, rules can do anything functions can do but they also have the advantage of being independent of each other and always awake. Overall, the intent is therefore to use the expert system in a chat bot as an analog of human slow brain system as machine learning approximates the human fast brain function.

In the past decade, there has been considerable progress towards solving the Dirac equation (DE) for the purpose of calculating detailed properties of electron beams. The earliest of this work modeled Bessel beams as a linear superposition of plane waves solutions to the DE. This led to an elucidation of the nature of fractional orbital angular momentum (FOAM) in Bessel beams including a clear understanding of FOAM in terms of Berry phase. More recently, the attention of some investigators has turned to Laguerre-Gaussian beams as a means to better understand relativistic vortex formation. The intention here is to present a Bateman-Hillion solution to the Dirac equation for a Gaussian electron beam taking explicit account of the 4-position of the beam waist. This solution has a pure Gaussian form in the paraxial limit but beyond it contains higher order Laguerre-Gaussian components attributable to the tighter focusing. Our results for these properties aligns with earlier work on Bessel beams in so far as the expectation values for spin and orbital angular momentum are fractional and can be parameterized in terms of a Berry phase. However, Gaussian beams also contain Gouy phase that Bessel beams do not. We show that Gouy phase shift from far field to far field in a Gaussian beam can also be parameterized in terms of Berry phase indicating that these two fundamental phases are unexpectedly related to each other. We also give give a formula for the energy in the beam that takes into account both the transverse and longitudinal momentum of the electron.

T02 - Mott phase in the dipolar extended Hubbard model on a square optical lattice

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The ability to cool bosonic and fermionic atoms down to ultra cold temperatures in optical lattices has enabled the experimental emulation of model Hamiltonians for strongly correlated systems. Unlike in Condensed Matter systems, one has control over the model parameters such as interaction strength, hopping amplitude, and population imbalance. A recent experimental development in cold gases is the ability to create quantum degenerate bosonic and fermionic gases of magnetic atoms, leading to the study of magnetic dipolar interactions. The extended Bose-Hubbard model was recently emulated with 168Er atoms in an optical lattice. The study of fermionic systems with anisotropic interactions beyond on-site is clearly in order. Here we use the Lanczos method to explore the ground state phase diagram of the dipolar extended Fermi-Hubbard Model at half-filling and two-dimensions. The anisotropic character of the dipole-dipole interaction, nearest-neighbour as well as next-nearest-neighbour interactions are taken into account. We observe quantum phase transitions between a Mott phase and different Charge-Density-Wave phases.

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T03 - Single-particle interference as a witnesses of Unruh effect

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The Unruh effect, which establishes that an observer with constant acceleration perceives the quantum vacuum as thermal radiation , is one of the most significant outcomes of the quantum field theory incorporating general relativity. In parallel to the theoretical investigations, there is great interest in the possibility of an experimental observation of the Unruh effect. In order to find evidence of this effect, we propose a simple device that detects the Unruh effect via interference pattern of a single quantum probe. This quantum network allows the use of visibility measure to study the degradation of quantum entanglement in noninertial frames.

T04 - A luz que vemos e a luz que não vemos

Diego Carvalho Barbosa Alves
Universidade Federal do Mato Grosso do Sul

Atualmente, estamos rodeados por milhares de dispositivos emissores e receptores de luz. A grande maioria dos animais, por exemplo, são equipados com sensores biológicos capazes de captar e interpretar as ondas eletromagnéticas. Este seminário versará sobre a percepção que temos sobre a luz no dia-a-dia e alguns dispositivos para converter energia luminosa em energia elétrica.

Nowadays, we are surrounded by several emitting devices and light receivers. A lot of animals, for example, are supplied with biological sensors capable of capturing and interpreting the electromagnetic waves. This seminar is about our perception of light in daily and some devices to convert light energy into electrical energy.

T05 - Electronic Properties of 2D and 1D Carbon Allotropes with Non-Hexagonal Rings

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Carbon is one of the most abundant elements in nature. The different hybridizations allowed for carbon enable it to form distinct materials with a variety of dimensions, which is a feature strongly related to the electronic properties of the carbon atom [1]. Since the atomic structures of these carbon-based materials are directly related to their properties, it is needed a deep understanding of the relationship between these two features. Therefore, it has motivated the investigation of many two-dimensional materials [2] (besides graphene, which is a zero gap semiconductor), such as graphenylene [3,4], phagraphene [5], Haecklites [6,7] etc. Considering the idea of sp2 carbon systems with a structural unit different from that of graphene, such as graphenylene, we propose in this work a hypothetical 2D-system where the structural unit is a naphthyl group. According to the way these naphthyl units are arranged in the structure, we can have two different 2D networks. We named the first one as naphthylene-α, and the second one as naphthylene-β . The way the naphthyl units are arranged in naphthylene-α structure is similar to the cyclic-naphthylene presented by Balaban and Vollhardt in [8]. Besides that, we also investigated the electronic properties of possible nanoribbons that can be constructed from these 2D-systems.

References

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T06 – Generalized Ellipsometry

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Spectroscopic Ellipsometry (SE) is a technique that characterizesthe optical properties of solids and liquids materials by studying the polarization state change afterlight reflection or transmition(AZZAM, 1977). Wherever, in general, SE is used mainly to study materials with axial symmetry, since the studies of non-axial samples, or with high geometrical complexity, are quite restricted in the amount of data and qualitative analyzes (TOMPKINS, 2005). In this case two studies will be shown: one conducted on samples with axial symmetry, and for this, we demonstrate that they are in fact axial. The properties of light reflection of these materials are represented by a diagonal Jones matrix, with the off-diagonal elements exactly null. In this case, we will see the properties of films of ZnO growth by spray and spin-coat.In this case films were modeled using Drude/Tanguy/Lorentz model. Todescribe theZnO, a Drudeband is used in the infrared region (conductivity, resistivity), Tanguy near the band gap, that describes high densityof excitons, bounded and unbounded. Finally, the Lorentz model represents the ultraviolet absorption. As a second option, we will see that the optical properties of non-axial materials are subject to changes with the orientation of the sample and the polarization of the light so that they are described by means of a dielectric tensor. This fact makes the Jones matrix, which represents the reflection of the material, a non-diagonal matrix (FUJIWARA, 2003). The measurement of the Jones matrix of non-axial materials is done through the use of Generalized Ellipsometry. The possibility of measuring these materials opens up different experimental options, such as determining Optical Hall Effect (Optical Hall mobility), determination of refractive indexes in anisotropic crystals and determining the orientational distribution of molecules in thin films. At this moment, the measurements are in progress and as an application of the developed technique; we will show the results of the generalized ellipsometry in a silicon oxide film deposited by plasma.

Keywords: Spectroscopic Ellipsometry, Jones Matrix, Optical Hall Effect

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T07 - Energetic and structural properties of phagraphene nanotubes

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Carbon nanostructures have received a lot of attention from scientific community with the expansion of research on graphene and carbon nanotubes. Their interesting mechanical, electrical and thermal properties have increased efforts in research and development of technology by scientists in recent decades. A new type of two-dimensional carbon structure, also composed of carbon and called phagrafene, emerges in the scenario as an alternative and potential competitor of the 2D network of the graphene. The name of phagraphene is due to its structure with pentagons (p) and heptagon (h), in addition to hexagons. In this work, we presented some results of the structural and energetic properties of phagrafene nanotubes using computational calculation based on Molecular Dynamics and Density Functional Theory (DFT). From the energetic point of view, the phagraphene nanotubes were found to be dependent on the form of rolling the former sheet (chirality). Such phenomena are not observed in conventional graphene. Phagraphene nanotubes were also submitted to extreme tensions along their length and they were found to be as stable as conventional CNTs. We obtained stress-strain curves at 0K, 300K and 900K, which can be used to calculate Young's modulus, which characterizes the rigidity the such nanomaterial.

Keywords: phagraphene, Molecular Dynamics, DFT, stress-strain, Young’s modulus.

T08 - Minimum position momentum correlations as an indicator of the maximum number of interference fringes

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In order to propose a successful interference experiment is important to choose a set of parameters values that can produce a maximum number of fringes. Thus, understanding alternatives that enable us to obtain such values of parameters can be experimentally helpful. In this paper we find a relation between the minimum of position- momentum correlations and the maximum number of fringes for the double-slit experiment. The minimum of position-momentum correlations is obtained by modeling the double-slit experiment initially by the Gaussian correlated wave-packet. Position-momentum correlations are quantum correlations that indicate dependence between the position and the momentum of a single particle. In the case of simple Gaussian or minimum- uncertainty wavepacket solution for the Schrödinger equation for a free particle, the position-momentum correlations at are zero but they appear in later times [1]. The matter waves quantum interference is a subject of intense research given its importance to the foundations of quantum mechanics. The initial mystery of quantum mechanics illustrated by the double-slit experiment have reveled interesting results that let us learn a lot about quantum mechanics. Today we know that under different circumstances, the same physical system can exhibit either a particle-like or a wave-like behavior, otherwise known as wave-particle duality. Experiments reveling wave-particle duality in the double-slit were performed by Zeilinger et al. for neutrons [2] and Zeilinger et al. for macromolecules [3]. We study the effect of initial position-momentum correlations in the interference pattern, wave-like and particle-like properties in the double-slit experiment with matter waves. Thus, before reaching the double-slit setup we consider that the particle is represented by a Gaussian wavepacket initially correlated in position and momentum. These initial correlations are measured by a parameter . After the double-slit apparatus, the particle is represented by a linear combination of two identical Gaussian wavepackets coming from the two slits which are affected by the initial correlations. The behaviour of these correlations enable us to extract some information about the interference pattern and intensity, visibility and predictability. They are analyzed in terms of the maximum and minimum of the position-momentum correlations.

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T09 - Ferromagnetism in the disordered Hubbard model in the Lieb lattice

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The analysis of strongly correlated electron systems is interesting because they present a variety of phenomena that arise precisely due to such interactions, such as superconductivity and magnetism. Another important question about these phenomena is the presence of impurities in the material, which may or may not favor the display of such properties. Based on this information and knowing that some lattices tend to present localized magnetic moments, which favor the occurrence of such phases, we decided to study magnetism in the presence of impurities. In this work, we study the competition between disorder (degree of impurity) and magnetism as the objective of analyzing the impurity content that the material can withstand before losing such property. The study was made for a type of bipartite lattice, the Lieb lattice or CuO_2 lattice, under the half-filled band regime. Due to the occurrence of electron interactions between the electrons, a model that is feasible for this study is the Hubbard model. We used the repulsive Hubbard and model the impurities by making a γ fraction of sites in different lattice sizes have the value of the electronic interaction U zero, thus disadvantaging the electronic correlations. By means of quantum Monte Carlo simulations, the magnetic behavior of the system was analyzed through the local moment, which was shown to be much larger for the p (oxygen) sites in relation to the d (copper) sites, indicating that the largest contribution to the magnetism came from the p sites. We also calculated the magnetic structure factor in order to detect long-range orders and by means of the finite-size scaling technique, we extrapolated the results to the thermodynamic limit. The analysis of the electronic correlations showed a magnetic ordering, which diminished as the degree of disorder in the system increased. The system sustained the magnetic phase $\gamma = 0.60$; for higher values, the phase of the system was totally suppressed.

T10 - Research and innovation on ferrofluids: from core/shell bimagnetic nanonoparticles to colloidal glass

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Core/shell Bimagnetic Nanoparticles (NPs) associate different physical and chemical properties in a unique object and may contribute to the improvement of the whole of their performances in catalysis, pollutant removal from wastewater and biomedical applications. As an example, in magnetic hyperthermia assays, the design of core/shell NPs with a high contrast of magnetic anisotropy between shell and core provides a remarkable enhancement of the power loss efficiency. It could be due to the interfacial exchange coupling between magnetically soft and hard phases. As the magnetic anisotropy and the NPs magnetization are structure dependent for both the core and the shell, an insight on the local structure of these nanocrystals is of primary interest. We are currently working on the synthesis of core shell ferrite nanoparticles by a soft chemistry route and on their dispersion in acidic and neutral media or in more complex systems like clays or liquid crystals. In aqueous dispersions, the interactions between particles can be readily tuned and the global balance of interactions is related to the colloidal state by using small angle X-ray and/or neutron scatterings. We can therefore explore the entire phase diagram, from a gas of individual particles, to a well structured fluid and a glassy system. In this context, the purpose of this talk is to discuss how a better understanding of intrinsic and collective properties would enlighten the design of new nanopharmaceuticals.

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T11 - 10 years of Quantum Field Theory research at Federal University of Piauí

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Departamento de Física, Universidade Federal do Piauí

In this talk we will present the research activities of the Quantum Field Theory group of the Federal University of Piauí in the last 10 years.

T12 - Electronic Transport in Molecular Junctions by DFT Methods

Aldilene Saraiva-Souza
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The ability to control the electron- and spin- transport properties of a molecule bridging conducting electrodes is of paramount importance to molecular spintronics. Quantum interference (QI) can play an important role in allowing or forbidding electrons from passing through a system. This great transport property might be explored via nonequilibrium Green's function calculations performed within the density functional theory framework (NEGF-DFT). The key quantity of interest is the transmission coefficient T(E), which yields the electrical conductance, current–voltage relations and the thermoelectric figure of merit ZT of single-molecule devices. Since T(E) is strongly affected by QI, it is very difficult to pinpoint the position of the antiresonance dip relative to the Fermi energy and even more difficult to control it. This is usually related to the position of the frontier molecular orbitals relative to the Fermi energy of the electrodes when the junction is formed, which can also be dependent upon the dipole moment at the surface of the electrode (which is metal in most cases). This presentation will address the challenges facing the development of new molecular devices that are capable to control the antiresonance in the transmission coefficient.

T13 - Raman spectroscopy applied to nanoscience

Bartolomeu Cruz Viana Neto
Departamento de Física, Universidade Federal do Piauí

Raman spectroscopy is a technique that analyzes the vibrational modes existing in any structure or material formed by two or more chemical elements, whether solid, liquid or gaseous. This quantized vibration (phonon) is correlated with other properties of the material (electronic, optical, magnetic, thermal, etc ...) and this technique is able to give us different information about diverse properties of a material. Nanocrystalline systems are objects of intense investigation, because they have marked changes in their properties when compared with those of their bulk. The phenomena induced by the nanometric size are quite interesting and open opportunities for the use of these properties in new applications and in the improvement of the current technology. When the material is nanometric, the existing size confinement generates effects that influence the characteristics of the quantized vibrations and other correlated properties already mentioned, that through Raman spectroscopy we can investigate and infer about. Therefore, in the world of nanoscience is an excellent opportunity to use this tool as a platform of work that can give precious information in basic science. In this talk we report the facilities allowed by the Raman spectroscopy technique in the study of nanocrystalline materials.

T14 - Physics of magnetic dipole moment and electric dipole moment: an accuracy physics program

Manoel Messias Ferreira Júnior
Departamento de Física, Universidade Federal do Maranhão

The magnetic dipole moment (MDM) of the electron is one of the physical quantities best known in nature. The electron anomalous magnetic moment, the gyromagnetic factor deviation from the value predicted by the pure Dirac equation, due to radioactive corrections, is known with precison best than 1 part in 10^{12}. Such experimental precision can be, obviously, used to constrain new theoretical models that yield MDM corrections. The electric dipole moment (EDM) of elementary particles is a tiny quantity compatible with parity-odd and time reversal-odd interactions. In a nonrelativistic formulation, the EDM interaction has the form $d(\sigma \cdot E)$, in which E is the electric field, σ, the spin operator and d, the EDM modulus. The EDM magnitude d, according to the Standard Model (SM), is $\approx 10^{-38} e \cdot m$, while the experimental measurements have reached the level $\approx 10^{-31} e \cdot m$ very recently, having a large space for new physics, beyond the Standard Model, to play a relevant role. The electron EDM, actually measured at the level $\approx 8 \times 10^{-31} e \cdot m$, also provides a strong tool to constrain theoretical models that correct the electron EDM. Concerning the EDM of atoms, it holds the Schiff theorem (1963), stating that for an atom with a point-like nucleus and nonrelativistic electrons that interact electrostatically only, the nuclear EDM is completely screened at first order by the atom's electrons, causing no Stark spectrum shift. For a finite-sized nucleus, however, the first order screening is no longer complete, there appearing the nuclear Schiff moment, whose interaction with the electrons generates atomic EDM. In this talk, we introduce some elements of the physics of MDM, EDM, Schiff theorem and Schiff moment, discussing how new physics can impact on the these issues and be constrained by the related experimental data.

T15 - Evolution of tag-based cooperation with emotion on complex networks

Francisco Welington Sousa Lima
Departamento de Física, Universidade Federal do Piauí

We study the evolution of the four strategies: Ethnocentric, altruistic, egoistic and cosmopolitan in one community of individuals through Monte Carlo simulations. Interactions and reproduction among computational agents are simulated on undirected Barabási-Albert (UBA) networks and Erdös-Rènyi random graphs (ER).We study the Hammond-Axelrod model on both UBA networks and ER random graphs for the asexual reproduction case. We use a modified version of the traditional Hammond-Axelrod model and we also allow the agents' decisions about one of the strategies to take into account the emotion among their equals. Our simulations showed that egoism and altuism wins, differently from other results found in the literature where ethnocentric strategy is common.

T16 - Synthesis, characterization and applications of different carbon nanostructures derived from local biomass, babassu coconut

Anupama Ghosh
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Worldwide, biomass is a renewable and sustainable choice of precursor for synthesis of functional carbon nanostructures. Babassu palm is a regional (north and north-east Brazil), abundant biomass with extreme importance in local economy. Its coconut has four different parts: epicarp, mesocarp, endocarp and kernel with variable composition. Although it had been used as cheap and sulfur-free substitute of coke in Brazilian steel industries long back [1], the exploration of the possibility in using it as a carbon nanostructure precursor has started pretty recently [2]. In this work, different carbon nanostructures have been synthesized starting from different parts of babassu coconut following different synthetic routes, characterized and submitted to few environmental and energy applications. The starch-rich part, mesocarp and the oil-extracted kernel residue have been carbonized hydrothermally to obtain hydrochar with improved combustible properties owing to the enrichment in carbon and hydrogen content compared to oxygen content. Pyrolysis of mesocarp and endocarp can be another way to generate solid fuel, depending on the relative mass loss and energy gain [3]. Due to abundance of surface oxygen functionality, hydrothermal carbon, derived from mesocarp can be decorated with silver nanoparticle and this composite material had shown improved electrochemical reduction of CO_2, which is a green house gas [4]. These hydrochars and pyrochars can be further activated chemically with KOH in order to generate activated carbon (AC) with high surface area, elevated surface functionality and enhanced porosity, which can be used in environmental applications, such as sensing and adsorption. AC synthesized from mesocarp has been used as a sensor of CO_2, a principal component of automobile exhaust, and the detection has been accomplished by a non-invasive method called in-situ Raman spectroscopy [5]. AC, having negative surface potential, formed by the presence of oxygenated functional groups, has shown impressive uptake of cationic carcinogenic dye methylene blue due to the strong Coulombic interaction. Although high specific surface area and microporosity of AC favors its supercapacitor properties, its amorphous nature hinders the ion conduction. As thermal annealing brings in substantial amount of graphitization, careful choice of the treatment temperature can lead to the betterment in the crystallinity with retention of surface area and porosity, therefore partially graphitized AC can be used as in supercapacitor. All these carbonaceous materials have been thoroughly characterized by elemental analysis, IR and Raman spectroscopy, scanning and electron microscopy, thermogravimetric analysis and N_2 adsorption-desorption at low temperature and other surface analysis.

Keywords: Babassu coconut, carbon nanostructures, graphitization, environmental application

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P01 - COMPUTATIONAL STUDY OF THE EFFECT OF THE COMPRESSOR MEDIUM IN CARBON NANOTUBES BY MOLECULAR DYNAMICS.

Antonio Lívio de Sousa Cruz, Acrísio Lins de Aguiar
Departament of Fisics, Universidade de Federal do Piauí

Discovered in 1991 by S. Iijima, carbon nanotubes are currently one of the hot topics in nanoscience and nanotechnology, thus overcoming the barriers of physics. Since its discovery, its thermal, optical, mechanical and electrical properties have been studied so that the vast possibilities of use they possess, according to their characteristics, are known. Thus, these nanostructures can be used in different types of materials, such as concrete, fibers, polymers, electromechanical sensors, among others. Computational simulations are important because they can reproduce difficult scenarios, or even impossible to be reproduced by common experiments.

The calculation of the force that is obtained by the derivative of the potential between the particles of the system. We can thus define the kinetic energy and temperature of the system from simple equations that are implemented for the programming language. The periodic boundary conditions and minimum image convention are defined using loops and intrinsic functions so the program understands that the particles must not exceed the limits of the box. In order to simulate the compression of nanotubes of different sizes, the Brenner's code, with which we compressed the CNTs of each size in its circular and collapsed phase, was used to compute its collapse pressure from the enthalpy, bulk modulus, and order to obtain the desired graphs.

After concluding the simulation of the box we are able to gather important information such as the evolution of the temperature of the system over time, using different speeds for the particles, so that this can tell us if the simulated system conforms to a real system. The kinetic energy of the same and acceleration of each particle. Based on the Lennard-jones Potential.

When we made the simulations, we first made a compression process on each nanotube, from (10.0) to (20.0) we used a subroutine that has the function of calculating the volume and generating data files of the pressure and enthalpy of each nanotube. Thus, with which we can generate graphs in order to find the collapse pressure and the Bulk module of each structure. Thus, we can finally see that the collapse pressure and the Bulk modulus of the nanotube increase according to the reduction of its diameter, that is, the smaller its size, the greater its resistance to collapse.

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P02 - Study of Orbital Angular Momentum of Light

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The solutions of the Helmholtz paraxial equation may be expressed as combinations of the Hermite-Gaussian modes (whose amplitude profiles are separated into x and y using Cartesian coordinates) or similarly as combinations of Laguerre-Gaussian modes (whose amplitude profiles are separated in r φ using cylindrical coordinates). At any point along the z axis, these modes include the same Gaussian factor as the fundamental Gaussian mode by multiplying the additional geometric factors for the particular mode. Beams having circular geometry, such as the LG beam, have an azimuthal phase of the ilφ type, ie this phase modulates the wavefront in order to assume a helical wavefront. As will be seen, the l in the phase represents the orbital angular momentum.[1]

The simplest solution, but one of the most important of the Helmholtz paraxial equations, is the Gaussian beam, which we obtained through the Fresnel approximation, which is to approximate a spherical wave in a paraboloidal wave, made in such a way as to confine the beam around the z-axis[3]. This beam is commonly used in lasers. Another solution addressed in this work forms the HG modes, which were obtained from an "An sartz". These modes form a complete set of solutions for the Helmholtz paraxial equation in Cartesian coordinates.

Changing our equation (Helmholtz paraxial equation) from Cartesian coordinates to cylindrical coordinates, and applying another "An sartz", we have obtained a new class of solutions that are the LG modes these modes also form a complete set of solutions with these modes it was possible to analyze the existence of singularity of faze and orbital angular momentum, so we observed that the Gaussian beam has no phase singularity[2].

In this way we obtain the main solutions of the Helmholtz paraxial equation, in cartesian and cylindrical coordinates, which are the HG and LH modes. These solutions are general, that is, they are two complete solutions spaces for the paraxial equation. As can be seen, the LG modes have orbital angular momentum and faze singularity when they are non-Gaussian bundles, in the case of the Gaussian beam, it has no phase singularity and also does not have orbital angular momentum.

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P03 - Study of harmonic chains via Laplace transform and continued fractions

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The study of oscillations is a fundamental subject in physics. There are many works in literature about classical harmonic chains. This is because the solutions of these systems lead to powerful knowledge in mathematics and can provide fundamental to comprehension about the structure of matter. In this work we solve some types of classical harmonic chains with different geometries and properties. We determined the dispersion relations, density of normal modes and analytic functions for the displacement of individual sites. Furthermore we determined the density of states of a tight binding chain.

In the solution of classical harmonic chains the main methods used were the Fourier transform, Laplace transform, continued fractions and numeric solutions.

In the cyclical chains with 1,2 and 5 masses per period we determined its dispersion relations. In these systems we can notice that the appearing of gaps between the bands of frequencies is due to the coupling of different masses per period. We observe also that the number of frequency bands is equal to the number of masses per period.

In closed chains we determined time dependent analytic expressions to the displacement of individual sites of chains with infinite and semi-infinite geometries. In this cases we considered uniform masses and elastic constants. Furthermore, we determined the density of normal modes of theses chains, of chains with impurities and the density of states of a tight binding chain.

The study of classical harmonic chains leads to the comprehension of many important concepts. For example, the study of the harmonic chains with periodic boundary conditions, in this system the dispersion relation found is equal to the dispersion of phonons in an elastic media. Furthermore the mathematical tools utilized in the solution of linear harmonic chains are easily adapted to solution of problems involving second quantization in many-body theory.

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P04 - Three-loop field renormalization for scalar field theory with Lorentz violation

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In high energy physics the main aspects of many physical effects involving particles and fields such as pair anihilation, Compton effect can be understood by lowest-ordwer pertubative calculation. On the other hand, the many-body behavior of some physical systems is satisfactorily described only if higher-order approximations are used for studying them. As ferromagnetic system present large thermal fluctuations near critical point, any higher-loop correction, is highly relevant for an accurate determination of the value of a critical exponent. All these physical phenomena are described by theories satisfying certain symmetry principles, one of them is Lorentz invariance. However some of these phenomena are been studied in the limit in wich this symmetry is violated. These theories were proposed as natural extensions of their Lorentz-invariant thoeories. This work was made applying the counterterm method in minimal subtraction scheme to calculate the three-loop quantum correction to field anomalous dimension γ in a Lorentz-violating O(N) scalar field theory. The Feynman diagram was calculated using dimensional regularization and ε-expansion techniques.

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P05 - Study of Ising model and Ising model in transverse field

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In nature, there are several phenomena that exhibit behavior resulting from the interaction of many bodies. In his article entitled More Is Different, P.W. Anderson emphasizes that the behavior of an aggregate of elementary particles could not be understood in terms of the properties of a system of few particles[1]. An example of this is the superconductivity exhibit by some materials at sufficiently low temperature. This collective effect can be studied through models such as Ising and Ising with transverse field since they exhibit phase transition.

In this work we obtained the behavior of magnitudes such as magnetization and susceptibility as a function of temperature for the classical Ising model in a square network using the Monte Carlo method. We have also solved the Ising model with transverse field in a chain using the Word-Line Quantum Monte Carlo method determining magnetization and susceptibility and Binder cumulant as a function of the field. We characterize the phase transition in both models. In the classical Ising two-dimensional model, we show that the system exhibits phase transition to a critical temperature region equal to 2.30 kBT / J using the Monte Carlo method.

In the Ising model with a Tranverse Field in one dimension we use the fact that a quantum system in a dimension d can be mapped in a classical system in a dimension d+1. To take advantage of this fact we use the World Line Quantum Monte Carlo method and and then we simulate different sizes of networks. The simulations showed a critical region for the system close to 1.0 in units of magnetic field (mfu). This agrees with the analytical value equal to 1.0 mfu[3].

The Monte Carlo and World-Line Quantum Monte Carlo methods are efficient in the solution of the Ising and Ising model with transverse field, respectively, allowing the analysis of the behavior of quantities under the influence of thermal and quantum fluctuations. These methods are widely applied in the study of phase transition phenomena in both classical and quantum systems.

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P06 - Master equation for two coupled quantum harmonic oscillators interacting with a specific thermal reservoir

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The solution of closed quantum systems, where the system does not interact with the environment, basically consists of finding the wave function Ψ(x, t), from the Schrödinger equation, which describes the temporal evolution of the system. Closed systems correspond to an idealized situation, because the environment will always be present and interact with the system. In this case we have the Open Quantum Systems (OQS) and evolution is no longer governed by the Schrödinger equation giving rise to a master equation. In OQS we must take into account the effects of decoherence due to the dynamic interaction of the quantum system with the environment. In this work we study the mathematical tooling necessary to deal with open quantum systems, such as the density operator, matrix density and master equations. We find the master equation that describes the evolution of a quantum harmonic oscillator interacting with a reservoir as well as the density operator for the thermal equilibrium situation. We performed the study of two classical and quantum oscillators linearly coupled in the free situation (without environment), in order to establish a connection with the open case. We find the master equation for the two coupled oscillators and interacting with the thermal bath considering that there should only be bilinear terms in $\hat{a}$ and $\hat{a}^{\dagger}$. However, we did not conclude the calculation of the coefficients of this equation to make a more careful analysis of it. So we will have this as one of the study's goals in future work.

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P07 - Improvising the activated carbon synthesis from mesocarp of babassu coconut in order to produce a better adsorbent of cationic dye from aquous solution

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Activated carbon with high surface area and porosity was synthesized from mesocarp of babassu coconut, fruit of a locally abundant palm tree using a KOH-activation route [1]. The method and the temperature of the pre-treatment and pyrolysis, as well as the KOH-starting material ratio were varied in order to better the physical and chemical properties as well as the yield [2]. The samples were characterized by elemental analysis, infrared and spectroscopy, thermogravimetry, X-ray diffraction, scanning and transmission electron microscopy to understand the structure and morphology, whereas various surface characterizations, such as N 2 adsorption-desorption, point of zero charge and zeta potential measurements were carried out to understand the surface properties better. All those materials were found to be fairly oxygen-rich, non-crystalline and microporous with an elevated surface area with negative charge. These properties made them an exceptional candidate for cationic dye adsorption and thorough adsorption testes were carried out using cationic dye methylene blue, varying time, initial pH and dosage. These materials show a very fast and efficient uptake of this dye with its adsorption kinetics following pseudo second order rate law [3]. These materials have a potential use in treating wastewater of textile industries after being taken care of few facts like regeneration of the adsorbent and large scale application, which are planned to resolve in near future.

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P08 - Oxidation than ferrytic stainless steel, aisi 439, in argonium atmosphere and high temperatures in tubular oven

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Stainless steels are the ideal materials for numerous aplications because they offer excellent resistance to corrosion, good mechanical resistance, and ductility and toughness elevated. [1]. AISI 439 steel is a relatively new steel on the market and competes with AISI 304 in high temperatures applications. The absence of nickel in AISI 439, AISI 430A and AISI 430E steels makes these steels a lower cost product compared to austenitic steels [2]. When a stainless steel is subjected to an oxidizing atmosphere, it forms on its surface a thin layer of complex oxide, depending on the boundary conditions of the research, this layer may be protective or not [3]. The objective of the present study is to analyze the oxidation behavior, microstructure and chemical composition of the oxide film formed on the AISI 439 ferritic stainless steel subjected to high temperatures, between 850 ° C and 950 ° C, oxidized for 2h, 4h, 16h, 32h, and 50h in tubular furnace in Argon atmosphere with 1ppm of oxygen. The oxidation kinetics were determined by measuring the mass gain per unit area versus oxidation time. The microstructure and the chemical composition of the oxides were analyzed by scanning electron microscopy (SEM) and EDS dispersive energy spectroscopy. Chemical analysis by ESD describes that the films formed on the steel were composed of the following elements: Cr, Mn, Fe, Ti and Si. When comparing the oxidation rates, it was verified that AISI 439 steel gained mass according to the temperature increase, it was also observed that the oxidation of this steel follows a parabolic behavior, producing a lower oxidation rate at 850 ° C and a higher oxidation rate at 950 ° C.

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P09 - Crystallization, characterization and studies of transitions of phase of acetylsalicylic acid crystals

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The AAS (acetylsalicylic acid), object of study of this work, has its synthesis made today as 100 years ago, by acetylation of salicylic acid. It is acetylation consists of the esterification of the phenol function of salicylic acid with acetic anhydride in the presence of sulfuric acid droplets as the catalyst, and techniques such as vacuum filtration and recrystallization may also be employed.

The present work aims to study the polymorphism and thermal stability of AAS, when subjected to high temperatures using Raman spectroscopy.

The Raman spectroscopy experiments were performed in the spectral region between 50 to 3100 cm^{-1} and in the temperature range between 40°C and 110°C. The method used consisted of starting from room temperature and increasing the temperature until reaching the desired values. For each temperature value, a time of 5 minutes was wasted in order that the sample reached the thermal equilibrium.

From the analysis of the spectra and the morphology of the crystals, it is possible to notice the disappearance and enlargement of some bands. From the modifications of the spectra we can infer that the AAS crystal remains stable for the studied temperature range (20°C to 110°C) and that the observed changes are only associated to the energy increase effect of the studied system.

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P10 - Instrumentation impedance spectroscopy using an oscilloscope and an amplifier lock-in

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Impedance spectroscopy is one of the main technics used in the laboratories of physics to study electronic properties of materials and devices. This technique consists in applying a small electrical perturbation in the form of a alternating voltage with a certain frequency in a material between two electrodes and observe the resulting current. The impedance is then calculated through the amplitudes of the voltage and current and the phase difference between the two signals. The goal of this work was to setup the instrumentation of the technique of spectroscopy. We used an oscilloscope Tektronix model MD03034 for the application of the stimulating ac voltage with a controlled frequency and an lock-in amplifier Signal Recovery model 7265 for measuring current and phase difference between the signals in the device. The control of instruments and acquisition of data to perform the calculation of the real part and imaginary of impedance as a complex function of frequency was made using the Python programming language via the communication protocol GPIB (General Purpose Interface Bus). The graphics of the real and the imaginary part of the impedance as function of the frequency make up the spectrum of impedance for the device between the electrodes. The spectrum of the impedance using the instrumentation described above was obtained successfully in the frequency range of 75Hz to 10kHz when compared with the measurements of a commercial impedanceometer from Solatron model SI 1260 coupled to an dielectric interface Solatron model 1296 available in the laboratory.

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P11 - Synthesis and characterization of cobalt-doped molybdenum trioxide

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After the discovery of the scanning tunneling microscope (STM) by Binning et al. in 1982, the study of nanometric scale systems underwent a great advance in their development, due to the creation of new methods for the preparation and characterization of nanometric materials. The development of this study promoted the emergence of a new area of knowledge, nanotechnology, which aims to develop new products and processes based on the increasing modern technological ability to see and manipulate atoms and molecules [1]. Nanotechnology encompasses several areas of research such as; medicine, electronics, computer science, physics, chemistry, biology and materials engineering. Thus, the development of new semiconductor materials with optical properties is increasingly studied by scientists because of their great technological applicability [2]. Molybdates, in particular, have several technological applications, and are widely used in heterogeneous photocatalytic processes for the photodegradation of dyes. And due to the good quality of the photocatalytic and photoluminescence properties of the molybdates, they have received a lot of attention from the researchers [2]. Due to the low cost, ease of preparation and obtaining of large amounts of the material compared to other methods, the synthesis of this material was given by the solid state reaction technique. Raman spectroscopy technique was used to characterize the material. This technique is used to determine the vibrational energies of the material bonds [1].

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P12 - SYNTHESIS, IONIC EXCHANGE AND STUDY OF PROPERTIES OF TITANATE NANOTUBES DOPED WITH GALLIUM

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Titanate nanotubes (TiNT) synthesized by the hydrothermal method have received great attention from the scientific community due to their unique physicochemical properties, such as the nanotubular structure, multilayers, high surface area and, in particular, ion exchange capacity. In the present work, we submitted titanate nanotubes of sodium (NaTiNT) synthesized by the alkaline hydrothermal method to ion exchange reactions of Na^{+} interlamellar ions by Ga^{3+} ions from gallium nitrate in aqueous solution. The samples were characterized by XRD, Raman Spectroscopy, EDX and SEM, where the ion exchange with Ga^{3+} ions (GaTiNT) and the preservation of the titanate nanotube were confirmed. The study indicated the formation of nanocrystals of gallium hydroxide on the nanotubes surface. This study intends to make possible the biological applications of titanate nanotubes with gallium.

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P13 - Physical properties of carbon systems with mixed hybridization $sp^2 – sp^3$

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Several carbon allotropes were recently proposed and studied [1-2]. This is due to the diverse varieties of hybridizations that this chemical element can form, implying in several stable systems, with innumerable properties and some with promising characteristics, such as, modulating energy gap, dynamic stability and transport properties. These systems have a great potential to replace silicon in the constant race for miniaturization of electronic devices, for example. In this sense, the present work determined the electronic properties and the dynamic stability, through computational simulations, of a new two – dimensional carbon allotrope, Tetragrafene, and of hybrid systems, based on graphene and this allotrope. The calculations were based on the DFT method, implemented in the SIESTA computational package [4]. We observed that the Tetragrafhene-2-ODD system presented a semiconductor characteristic with a modulable gap, through small modifications in its atomic structure. The calculation of phonons showed that this system is dynamically stable. Other systems presented a metallic characteristic, with a crossing of the valence bands and conduction in the Fermi level in different points of the Brillouin zone. A hybrid system presented an indirect gap and the other hybrid systems maintained the metallic characteristics strongly influenced by the graphite sectors present in the structures.

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P14 - Study of interference in the double slit and the Wigner function for partially coherent matter waves

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In this work, we study the interference with macromolecules through a double slit that interacts with the environment. Considering this, we consider the propagation of a Gaussian beam that has been spread by air molecules. Due to the interaction of the system with the environment, the system has a decrease in the visibility of interference that occurs through entanglement in the total system due to the effects of decoherence, which is nothing more that the partial or complete loss of quantum characteristics, and finally the appearance of classical effects. Because it is a configuration in which there may or may not arise more than one wave function representing the whole (coupled system) and besides facilitating the studies by condensing the notations of the theoretical aspects more, we substitute the use of the wave function by the use of density matrix. Given this, we theoretically analyzed the experimente of double slit with the effects of decoherence due to the interaction of the studied system with a specific environment, that from the initial density matrix , we evolve the same time through the proposed propagator in [1], in fact implementing coupling factor Λ of the environment (decoherence effect) that leads to parameters, such as reservoir temperature and density of molecules. The propagator which includes such effects has the following form:

$$K = \frac{m}{2\pi\tau\hbar}.\exp\left\{\frac{im}{2\tau\hbar}[(x-x_0)^2-(x'-x'_0)^2]-\frac{(x_0-x'_0)}{2l^2}\right\}\times$$
$$\times\exp\left\{-\frac{\Lambda\tau}{3}\left[(x-x')^2+(x-x')(x_0-x'_0)\right]\right\}, \quad (1)$$

where l is the coherence length. In possession of the density matrix for the double slit, we can thus calculate the shape of the Wigner function for the coupled double slit in a reservoir. Since the negative part of the graph of the Wigner function represents the non-classicality of the system for closed systems, then by including the effects of environment on it, a decrease in that negative part was observed as much as increasing Λ, until complete disappearance, giving us a view of the classical and quantum transition.

The above work, which was developed by Lucas Soares Marinho and collaborators, resulted in a publication in EPL (EUROPHYSICS LETTERS) in the year 2018 [2].

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P15 - Development of hybrid nanomaterials (bimetallic nanotubs of auag) and catalytic and spectroscopic study of oxidative reactions of glycerol.

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The chemical, morphological and electronic properties of metallic nanoparticles directly affect their catalytic activity, making the systematic investigation of these properties and their effects on the activity of new catalysts one of the research targets of significant interest.

Bimetallic nanotubes has advantage of combine catalytic and plasmon properties, they have a dual function: intensify the Raman signal of adsorbed molecules (allowing the detailed analysis of the surface processes involved in the chemical reaction) and also the function of catalyzing the chemical reaction of interest, systematic spectroscopic studies of the interaction processes between the substrate and the surface of the catalyst by surface enhanced Raman spectroscopy (SERS). Bimetallic systems, combinations of Au-Ag, are of particular interest for the preparation of SERS substrates, since both metals provide a significant increase in terms of enhancement of the SERS signal.

The objective of this work is to develop and characterize new hybrid catalysts (AuAg nanotubes) that exhibit high activity and catalytic selectivity for glycerol oxidation reactions. We did in this work was the synthesis of the nanocatalysts, then the reaction of oxidation using glycerol and finally the monitoring by SERS in order to detect the byproducts generated by the reaction, confirmed by gas chromatography.

In view of the oxidation reaction of glycerol we obtained three by-products generated in which we can infer by means of the Raman Spectra of the standard samples and prove their presence from Gas Chromatography. The alterations of the species adsorbed in the reaction, provided a new methodology to detect and identify intermediates of the reaction. In terms of the reaction mechanism, changes in the SERS spectrum of the adsorbed species on the surface of the catalyst suggest that the products are generated from glycerol.

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P16 - Functional Integration for scalar field. Field Quantisation

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The objective of this work, was to study the path integral formulation of quantum mechanics in order to find a gerating functional for a scalar field theory in the presence of a source. With this result, we can get an diagramatic expansion of gerating funcional of φ^4 theory.

In the usual formulation of quantum mechanics, the quantities q and p are replaced by operatores which obey Heisenberg commutation relations. The path-integral formulation of quantum mechanics, is based directly on the motion of a propagator $K(q_f t_f; q_i t_i)$.

Used the formalism of path-integral, we meet the expression for transition amplitude, and we did the diagrammatic expansion getting the Green Function for generating functional.

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P17 - Synthesis and characterization of tungsten nanostructures

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The objective of the work is the synthesis of nanostructures based on pure Tungsten (W) and doped with Bismuth (Bi) by the hydrothermal method, and the analysis of the vibrational properties by Raman and Infrared spectroscopy technique.

The synthesis occurred through the hydrothermal method, the characterization of the materials were through Raman and Infrared spectroscopy, made in the materials physics laboratory (FISMAT) of the Department of Physics of the UFPI.

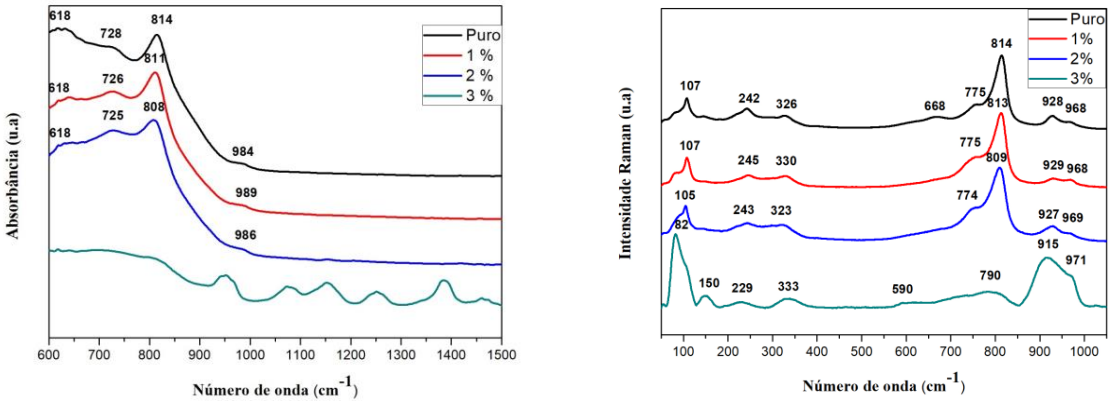

Figure: (left) Raman Spectrum WO 3 Doped with Bi; (right) Infrared Spectrum WO 3 Doped with Bi.

The spectra of the up to 2% doped nanostructures in figure 3 and 4 are in accordance with the literature, showing the success of the WO_3 synthesis and maintaining the same structure up to that doping percentage, with only one leftward shift in the network modes , this is expected since Tungsten was replaced by Bismuth and this being heavier, moving the spectra.

The spectra in Figure 4 have the low intensity peaks between 588 cm^{-1} and 657cm^{-1} can be attributed to the flexural vibration of W-O, the high intensity peaks around 814 can be attributed to the stretch vibration of W-O-O (JIAN et al., 2016). After 2% the material loses its crystallinity and thus ceases to be WO_3 and becomes another structure.

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P18 - Structural and electronic properties of nanotubes constructed from fragmented fullerenes

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2D fullerene-based carbon nanostructures have been recently proposed theoretically [1]. These are conceptually formed by the arrangement of fragments resulting from the unzipping of C_{60} cages [2]. Depending on the ordering these fragments, the structures exhibit either semiconducting or metallic behaviors [1]. In this scenario, we propose and
investigate the structural and electronic properties of achiral nanotubes by means of first-principles calculations [3]. We show that this new class of nanotubes are not only energetically stable, but also share many properties similar to those of their 2D counterparts. In addition, the semiconducting cases can exihibit either direct or indirect band gaps. We further show that the electronic properties can be modulated by the presence of a transverse electric field. We find that the electric field promotes a radial deformation that grows linearly with the strength of the electric field. In addition, the semiconducting tubes can undergo a semiconducting-metallic transition for a sufficiently large electric field. The study shows that these structures have potential for applications in the area of new nanodevices owing to their tunable band gap.

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P19 - Majority-vote Model on a Small – World Network.

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One of the social models that describes the dynamics of opinion among individuals of a social group is the majority-vote model, in which the choice of opinion that an individual has at a given moment depends on the choice that most of his neighbors have. This model is similar to the Ising model, since it associates to each network spin two values $\sigma_i = \pm 1$. If σ_i is equal to one, we can say that the individual at site i favors, for example, a candidate for mayor in a municipal election, and if $\sigma_i = -1$ means that the voter is unfavorable to this candidate. Thus, in this model we can study how an opinion, favorable or contrary to a certain theme, is accepted or not in a given social group.

In this sense, a study on this model was made through a computational simulation using the Fortran programming language, obtaining some physical quantities of interest as shown in Figure 1.

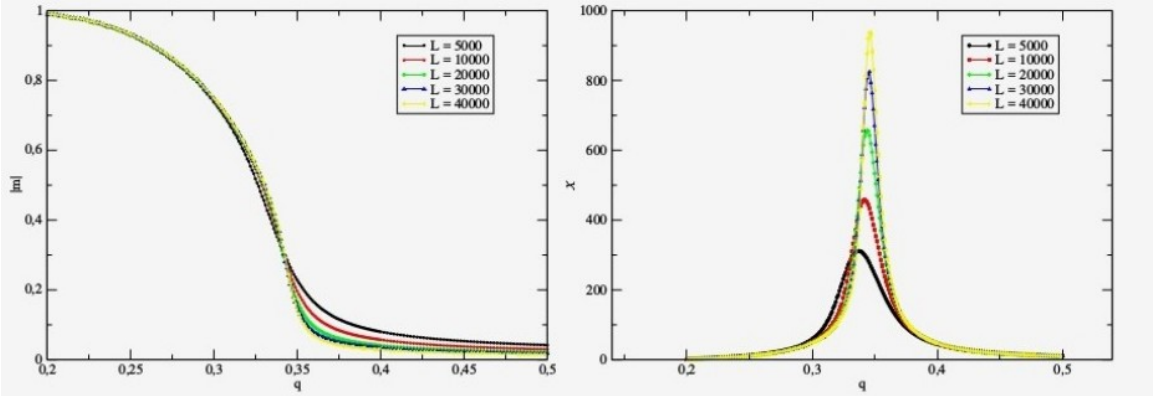

Figure 1

We have the graph of the magnetization (right) for each curve of L, thus suggesting that there is a phase transition, from ordered states to disordered states. In the graph on the left, we see how the susceptibility behaves and we can observe that the maximum value of χ is around the critical noise parameter q_c. These disordered states are reached as the noise parameter q_c is increased and the phase transition is reached at a well-defined critical noise parameter q_c. For future work we intend to find the critical exponents of both models and change the probability of spins binding in the small-world network, to further deepen the knowledge about these models.

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P20 - Vibrational Properties of Sodium Tellurite (Na_2TeO_3) and Silver Tellurite (Ag_2TeO_3) in Extreme Temperature Conditions

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In this work, the vibrational properties of sodium tellurite (Na_2TeO_3) and silver tellurite (Ag_2TeO_3) were studied in room Temperature and as a function of the Temperature. This material was characterized by X-ray diffraction (XRD), Infrared and Raman spectroscopy. Thus, the crystallographic structure of sodium tellurite was identified (by means of X-ray diffraction at room temperature) as monoclinic with spatial group C_{2h}^5 $P2_{1/C}$, Nº 14 and of silver tellurite was immeasurable due to the low intensity of the peaks related to the planes. However, when submitted thermal treatment, the Raman spectrum coincided with the monoclinic phase. The Raman spectra of the sodium and silver tellurites are shown and described in a Temperature range between 298 and 823 K. Was observed 23 active modes in Raman and four infrared modes for Na_2TeO_3 at room conditions. In the evolution of the Raman spectra with Temperature, three of the vibrational modes found disappeared: one mode in approximately 450 K (255 cm^{-1}) and the other two around 700 K (168 e 362 cm^{-1}). We also observed inversion of intensity between the first two peaks (peaks initially below 100 cm^{-1}). In the ω x T curves of the peaks as a function of Temperature, we observed modes discontinuities in ~ 700 K. Thus, we can suggest that o Na_2TeO_3 undergoes a conformational change in ~ 450 K and a phase transition in ~ 700 K during the heating process. For the Raman spectra of silver tellurite under ambient conditions, we found a total of 12 vibrational modes active in Raman and five in infrared. Analyzing the spectra collected during the heating of the sample, we noticed discontinuities in the bands for the Temperatures of 573 K and 700 K. In addition, we note the disappearance of one of the bands around 423 K (~ 702 cm^{-1}), as well as the disappearance (~ 638 cm^{-1}) and appearance of a band (~ 670 cm^{-1}) at 573 K. Therefore, we can suggest that Ag_2TeO_3 undergoes two phase transformations, one phase transformation at ~ 573 K and the other at ~ 700 K, during the heating process.

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P21 - Opinion formation in kinetic exchange model in solomon network

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We study the interaction between individuals through the opinion formation model in the Solomon network. The Ising and MVM model is useful to simulate the behavior of people where each person can be influenced by the neighbors or influences these neighbors. However, the neighbors at home differ from the neighbors in the workplace except when everybody works at home. Home neighborhood and workplace neighborhood can be approximated by using two SLs of N sites each, the home SL and the workplace SL. In the workplace SL, the people are numbered consecutively from i=1 to i=L2 with toroidal boundary conditions. The same people i also appear in the home SL but in di®erent order P(i), which is a random permutation of the order in the workplace SL. Thus, each person has exactly one place in the home SL, and each site in the home SL is occupied by exactly one person, just as the case for the workplace SL. The same person occupies two entirely different sites i and P(i) in the two SL of linear dimension L with N=2Lx L sites in total. Such a network of two lattices (in our case, two SLs) suggested by Sorin Solomon is called a Solomon network because each person is equally shared by two lattices, just as in the biblical story of King Solomon. We consider that the interactions are made in pairs, where each individual located in their site will interact with the other individuals of the network in their respective sites. In this work, our objective is to make simulations for one dimension (1D) and two (2D) dimensions. The first part of the research has already been concluded which is concerning to one dimension (1D). Then, in the first part of our work, we calculated the values of the critical exponents and verified if they agree with the values already existing in the literature. The second part of our work is still in the process of completion and we expect that the values of the critical exponents are in agreement with the values found in the literature for two dimensions.

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P22 - Gravitational Collapse of Stars

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From ancient times man has looked up to the sky and inquired about the various mysteries present in the fascinating universe, questions like: What is the origin of the Universe? What is the origin of life? and etc. Among the various phenomena present in the universe, there are stars, celestial bodies that have always fascinated the human mind and like any body that has matter, stars also die and surprise by the time of life. No matter if you live in urban or rural areas, if the weather is favorable, it is always wonderful to contemplate the beauty of these bright spots in the night sky, and it is worth mentioning that looking at the night sky is to visualize the past due to many of the stars are already dead, and also because the distances in the universe are astronomical, light takes millions of years to leave these celestial bodies towards our eyes, telescopes and space probes, which proves that most of the stars are already dead. The death of stars occurs in what is known by science as a gravitational collapse, that is, the star collapses on itself due to its own gravity, because it runs out of its fuel and thus ceases its source of life: nuclear fusion. And this is the theme of my work: GRAVITACIONAL COLLAPSE OF THE STARS, will be approached the types of stars, formation, life and death, highlighting that what will influence the life and death time of them, is their mass.

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P23 - Oscillations of Quantum Systems: Caldirola Oscillator - Kanai and Lane Emden.

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In this work have as objective is to analyze the solutions for the equation of moviment for the following oscillators of Lane Emden and Caldirola - Kanai, where mass is an analytical function $m(t) = t^{\alpha}$. The Lane Emden oscillators are the damped harmonic oscillations, which depend on a time-dependent damping constant. The great contribution of this work is to show the analytical expressions, solving by the power series method (Frobenius method), assigning values to some constants, and also discuss the physical meanings of expressions such as energy and Hamiltonian for these time dependent systems . Finally, we compared results of the Lane Emden track with the Caldrola Kanai oscillator, showing the difference and the common points, to choose the values of α.

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P24 - Analysis of light behavior in collagen with addtives

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Light is applied in medical therapies, in the extermination of pests, in the maturation of fruits, in the stimulus of metabolic reactions, etc. The present work seeks to analyze the behavior of light in collagen with additives. We will study the diffusion of light through the aqueous samples of hydrolyzed collagen, which is produced from the enzymatic degradation of collagen, with the addition of ZrO2 scattering nanoparticles and organic pigments (turmeric), which together seek to simulate a biological tissue and its degradation using the process of UV irradiation. After preparation, the samples were placed in an experimental arrangement to perform the irradiations; using a low intensity UV lamp. Then samples irradiated for 0, 30 and 60 minutes were placed in a mounted system to obtain images of light scattering. The images obtained in the system were analyzed with the imageJ program and with the obtained results we can observe the light behavior in our samples and compare them
with each other.

The results presented in this work were obtained from the analysis of the experimental images. With them we construct representative graphs in which they express how light behavior occurs in each sample. Assuming that the Lambert-Beer law implies the relation between the optical path traveled by light and the concentration of the medium, and that the variance of these factors can change the decay pattern of the light intensity.

We observed that the samples containing nanoparticles of ZrO2 present greater light scattering. However, the samples containing turmeric showed a sharper drop than the other samples, the collagen samples presented less light scattering. In the sample containing all the components, collagen, turmeric and nanoparticles of ZrO2, it is noted that the components interact in the one sample provoking effect in the other, the intensity increases and is absorbed. We also observed that the irradiations suffered by the samples were not sufficient to cause changes in their scattering or absorption. Due to this it would be necessary to carry out a new study, with greater exposure times to UV radiation, to better work the degradation of the biological tissue that we try to reproduce in this present work.

The objectives proposed by the work were partially obtained, with satisfactory results for the samples, except the degradation of the samples that required a longer irradiation time. However, the experimental apparatus constructed with the purpose of obtaining the images capable of characterizing the behavior of light, proved to be efficient. Good concentration conditions were identified for collagen, nanoparticles and pigment for obtaining samples capable of simulating an animal biological tissue.

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P25 - Minimum position momentum correlations as an indicator of the maximum number of interference fringes

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In order to propose a successful interference experiment is important to choose a set of parameters values that can produce a maximum number of fringes. Thus, understanding alternatives that enable us to obtain such values of parameters can be experimentally helpful. In this paper we find a relation between the minimum of position- momentum correlations and the maximum number of fringes for the double-slit experiment. The minimum of position-momentum correlations is obtained by modeling the double-slit experiment initially by the Gaussian correlated wave-packet. Position-momentum correlations are quantum correlations that indicate dependence between the position and the momentum of a single particle. In the case of simple Gaussian or minimum- uncertainty wavepacket solution for the Schrödinger equation for a free particle, the position-momentum correlations at are zero but they appear in later times [1]. The matter waves quantum interference is a subject of intense research given its importance to the foundations of quantum mechanics. The initial mystery of quantum mechanics illustrated by the double-slit experiment have reveled interesting results that let us learn a lot about quantum mechanics. Today we know that under different circumstances, the same physical system can exhibit either a particle-like or a wave-like behavior, otherwise known as wave-particle duality. Experiments reveling wave-particle duality in the double-slit were performed by Zeilinger et al. for neutrons [2] and Zeilinger et al. for macromolecules [3]. We study the effect of initial position-momentum correlations in the interference pattern, wave-like and particle-like properties in the double-slit experiment with matter waves. Thus, before reaching the double-slit setup we consider that the particle is represented by a Gaussian wavepacket initially correlated in position and momentum. These initial correlations are measured by a parameter . After the double-slit apparatus, the particle is represented by a linear combination of two identical Gaussian wavepackets coming from the two slits which are affected by the initial correlations. The behaviour of these correlations enable us to extract some information about the interference pattern and intensity, visibility and predictability. They are analyzed in terms of the maximum and minimum of the position-momentum correlations.

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