Student lecture abstracts

International Conference for Physics Students

Copenhagen, Denmark

2021

Student Lectures

In this document you will find abstracts for all student lectures to be held during the conference. The lectures will take place in three different sessions to ensure that everybody gets a chance to attend.

Go to the next page for an overview of all lectures or deep-dive into a specific field and read all abstracts in the following pages. Each lecture will be 12 minutes long with 3 minutes for questions afterwards.

As we are in a lot of different time zones, we have included a few to help you convert it to your own time! Please be aware that the dates are referring to Central Eastern Time (GMT+2) and might not apply to the time zone you are in.

Lecture Location

Student Lectures are held in the lecture spaces on Gather, where you should find your avatar in a comfy seat! Lecturers will speak from a podium and their camera and mic will broadcast to everyone within the Lecture space. If after the talk you have a question or comment, line up in the queue by the moderator and await your turn. You'll find more information on Gather in the main booklet.

We can't wait to hear all of these great contributions!

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Photo courtesy of Visit Copenhagen

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Abstracts

Particle Physics

George Chanturia
No title

Session 2, August 6th
10:00 AM EST | 4:00 PM CET | 10:00 PM PHT

The Pion Vector Form-Factor (VFF) plays a central role in hadron scattering. To model this quantity, often sums of Breit-Wigners or the K-matrix formalism are used. The former violates unitarity, while the latter is not in general analytic. To understand the experimental data, a formalism is needed which respects both unitarity and analyticity of the scattering matrix. In this work, we model the VFF of pions using a dispersion-theoretical approach. The model is by construction unitary, analytic, and describes various non-elastic channels that couple to a two-pion system. The model is fitted to the relevant scattering data of hadrons.

Alexandra-Gabriela Serban
No title

Session 2, August 6th
10:20 AM EST | 4:20 PM CET | 10:20 PM PHT

The formal equivalence between the quartetting picture and the symmetry restored BCS picture is established for the ground state correlations induced by the general isovector-isoscalar pairing interaction. Multiple ground state structures compatible with the particle number and isospin symmetries are evaluated. The competition of isovector and isoscalar correlations is discussed for the N = Z nuclei above 100Sn.

Michał Suchorowski
No title

Session 2, August 6th
10:40 AM EST | 4:40 PM CET | 10:40 PM PHT

Since Bose-Einstein condensation had been first observed in a gas of chromium, dysprosium and erbium, physicists have been extensively studying ultracold highly magnetic atoms with a large magnetic dipole moment and anisotropic long-range interactions. Quantum phase transitions of the extended Bose-Hubbard model, the quantum chaos, the existence of the roton mode or the emergence of the self-bound droplets were discovered in experiments with these ultracold atoms. Such exciting applications make these systems a fascinating field also for theoretical investigation. We theoretically investigate the properties and dynamics of two ultracold highly magnetic atoms in a one-dimensional harmonic trap in the external magnetic field by means of exact diagonalization. Atoms interact via magnetic dipole-dipole interaction,

which in one-dimensional limit can be approximated by effective contact spin-spin interaction. We show how interactions and magnetic field impact the properties of the system and observe its dynamic after a sudden change of these parameters. We look at ground-state magnetization which can act as a guide into potential magnetic properties of a many-body system. Our research gives new insights into the possible application of highly magnetic atoms trapped in optical tweezers or optical lattice for simulations of quantum many-body systems. Investigation of various few-body systems shows that researching the dynamic of two highly magnetic atoms trapped in a one-dimensional optic trap could lead to discovering interesting properties in the interplay between spin-spin interaction and external magnetic field.

Andrea Gurgone
Physics beyond the Standard Mule

Session 2, August 6th
11:00 AM EST | 5:00 PM CET | 11:00 PM PHT

I will present my contributions to McMule, a novel Monte Carlo framework for the computation of high-order radiative corrections to low-energy scattering and decay processes involving leptons. In particular, I will discuss how it can be used in the search for signals beyond the Standard Model.

Tymoteusz Ciesielski and Pawel Drabczyk
No title

Session 2, August 6th
11:20 AM EST | 5:20 PM CET | 11:20 PM PHT

Detector calibration is an indispensable part of detector physics because as every electronic device, detectors suffer from electric noise. In VELO (VErtex LOcator), the amplitude and standard deviation of the noise are measured on the idle detector, received result can be then used to evaluate the performance of the detector. However, the number of dimensions in calibration data is far too big to plot the results reasonably. Therefore we performed dimension reduction for the calibration data using autoencoders neural networks and the PCA method. The dimensional output of the reduction is 2, which was the goal of our project and can be easily used to monitor the stability of the detector's work.

Adrian Domingo
No title

Session 2, August 6th
11:40 AM EST | 5:40 PM CET | 11:40 PM PHT

I'm studying a master in nuclear physics and one of the most interesting researchs in particule physics right now is about violation of lepton universality (LU), which is conservated in the Standard Model. In the last weeks g-2 experiment in Fermilab has increased the statistical

confidence in the experimental value of abnormal magnetic moment of the muon, a hint of new physics beyond SM that show us that, maybe, LU-violation is the window that will allow us a better understanding of fundamental physics. I'd like to make a small conference explaining the basics of anomal magnetic moment of the muon, how it is calculated within SM, how and where are the experiments for this mesure (Fermilab & LHCb) and some proposals of new physics that could explain this anomaly.

Weronika Stanek

Session 3, August 7th
2:00 AM EST | 8:00 AM CET | 2:00 PM PHT

Particle density fluctuations and correlations in low energy Cosmic-Ray showers simulated with CORSIKA

The current studies of cosmic rays are focused on most energetic particles entering the atmosphere and producing a single Extensive Air Shower (EAS). There are, however, models predicting that interactions of high energy particles may result in Cosmic-Ray Ensembles (CRE) created far from the Earth. They could be observed as some number of correlated air showers of relatively low energies spread over a large area. The objective of the Cosmic Ray Extremely Distributed Observatory (CREDO) is to search for CRE using all available data from different detectors and observatories including even small but numerous detectors spread over large areas.
Interpretation of such measurements require precise information on properties of EAS in a very wide energy spectrum. Low energy EAS are analysed using events from CORSIKA, the program performing air shower simulations. The primary cosmic ray particle energy range extends from 1 TeV up to 4 000 TeV. The secondary particles at the ground level are studied, their density fluctuations and correlations in location and time. Although the fluctuations observed in multiplicity distributions are consistent with random the more detailed analysis reveals that near a selected particle the density of other particles is enhanced over that expected in the absence of correlations. The results of the analysis may be useful in further calculations, for example to obtain probability of detection of an EAS without special simulations.

Jacek Gębala

Session 3, August 7th
2:20 AM EST | 8:20 AM CET | 2:20 PM PHT

Cold interactions and collisions of the He_2^+ molecular ion in excited electronic states

Cold hybrid ion-atom systems recently emerged as a new area for fundamental research in quantum physics and chemistry. In my work, I investigate the dynamics of helium ions immersed in ultracold metastable helium atoms. We calculate accurate potential energy curves

for a ground state He+ ion interacting with He atom in the lowest-energy metastable ^3S state. We enploy the full configuration interaction method, equivalent to exact diagonalization, with large single-particle Gaussian basis sets extrapolated to the complete basis set limit. We include the leading adiabatic and relativistic corrections and use the potential energy curves to predict the scattering lengths for atom-ion collisions. We also investigate the spectroscopic properties of the system, namely we calculate the rovibrational levels and spectroscopic constants of the molecular ion in excited states for three stable isotopologues.

Balázs Endre Szigeti

Nuclear Liquid-Vapour Transition in Parity Doublet Chiral Nuclear-Meson Mode

Session 3, August 7th
2:40 AM EST | 8:40 AM CET | 2:40 PM PHT

Particle density fluctuations and correlations in low energy Cosmic-Ray showers simulated with CORSIKA: The current studies of cosmic rays are focused on most energetic particles entering the atmosphere and producing a single Extensive Air Shower (EAS). There are, however, models predicting that interactions of high energy particles may result in Cosmic-Ray Ensembles (CRE) created far from the Earth. They could be observed as some number of correlated air showers of relatively low energies spread over a large area. The objective of the Cosmic Ray Extremely Distributed Observatory (CREDO) is to search for CRE using all available data from different detectors and observatories including even small but numerous detectors spread over large areas.

Biophysics

Nicoleta Sandu
Facts and myths about particulate matter

Session 3, August 7th
2:00 AM EST | 8:00 AM CET | 2:00 PM PHT

Bovine serum albumin (BSA) acts as a carrier for many compounds, such as flavonoids, ions, vitamins and thyroid hormones. Current studies have shown that some flavonoids can decrease the cell proliferation of thyroid cancer cells and accelerate the apoptosis process. It has also been proven that rutin is a flavonoid that seems to be able to increase the expression of sodium-iodide symporter (NIS) in vivo. Given this research, we considered the study of the BSA-LT4 and BSA-LT4-rutin complexes have significant pharmacological importance. To analyze the intercation that take place between BSA-LT4 and BSA-LT4-rutin a number of experimental and computational methods have been used such as UV-Vis spectroscopy, Fourier-transform infrared spectroscopy (FT-IR), fluorescence and molecular docking.

Zurabi Ugulava
No title

Session 3, August 7th
2:20 AM EST | 8:20 AM CET | 2:20 PM PHT

In this work we investigate viral load propagation due to liquid droplets expelled during respiratory actions. We describe a mechanism of the transmission of such evaporating system and analyze dependence on several ambient parameters for different respiratory processes, such as sneezing, coughing and speaking. Our study has found that a significant amount of viral load and droplets from the respiratory fluid might transfer beyond the customary 2 m distance, understanding of which might give us a better insight about regulations and risks posed by an infected individual.

Randa Yerrou
No title

Session 3, August 7th
2:40 AM EST | 8:40 AM CET | 2:40 PM PHT

The aim of the work carried out in this paper is the implementation of the G4Linac_MT « Geant4 for Linac with Multi-Threading mode » platform in the modeling of linear accelerators used in radiotherapy. This code can quickly create whether the geometry of a Linac head or that of a phantom, it can also simulate dose deposits in a homogeneous or heterogeneous phantom by voxelizing it and calculating the absorbed doses in each voxel and make histograms of a set of physics quantities extracted from PhaseSpaceData and DosimetricData. Moreover it contains a tool for calculation of gamma index which is an indicator commonly used in external beam

radiation therapy to quantify the difference between an experimentally obtained dose distribution and a calculated one. In this work, we modeled a SATURN43 accelerator and calculated the dose distribution in a water phantom of 40 x 40 x 40 cm3 for different values of the average energy of the beam of incident electrons. All calculations are made for a 10x10cm2 square field at 100cm from the target. Different lists of physics implemented into the used code have been optimized to model the transport of charged particles and photons for radiotherapy applications. The results validation of the simulation was made using both experimental values and the MCNP code; Our findings were acceptable and very close to the existing results. We conclude that the installation and use of the code G4Linac_MT have been mastered; it has been well used to describe the Linac medical accelerator, in order to accurately predict the dose in small volumes which is crucial to planning radiotherapy treatment.

Zakaria rguibi

Deep Learning in Medical Imaging: Applications, Algorithms and Hardware's Perspectives

Session 3, August 7th
3:00 AM EST | 9:00 AM CET | 3:00 PM PHT

Deep learning aims to simulate human cognitive functions. It provides a paradigm shift in the field of medical imaging, thanks to the expanding availability of medical imaging data and to the rapidly advancing deep learning techniques. In effect, deep learning algorithms have become the approach of choice for medical imaging, from image acquisition to image retrieval, from segmentation to disease prediction. In this paper, we present a review that focuses on exploring the application of deep learning in medical imaging from different perspectives.

Mariam Arustashvili

Monte-Carlo methods for systems with high degrees of freedom.

Session 3, August 7th
3:20 AM EST | 9:20 AM CET | 3:20 PM PHT

Monte Carlo simulations are methods for simulating statistical systems. The aim is to generate a representative ensemble of configurations to access thermodynamical quantities without the need to solve the system analytically or to perform an exact enumeration. An Ising model is introduced and used to investigate the properties of a two dimensional ferromagnet with respect to its magnetization and energy at varying temperatures. The observables are calculated and a phase transition at a critical temperature is also illustrated and evaluated. Lastly Curie temperature is calculated and The results obtained from the simulation are compared to exact calculations to endorse the validity of this numerical process.

Maamar BOUKABCHA

Session 3, August 7th
3:40 AM EST | 9:40 AM CET | 3:40 PM PHT

The role of skin cancer cell biophysics in studying the effects of sunlight on human skin cells

The exposure of human skin cells to the sun for different time periods produce in risks that lead to the emergence of diseases. The sunlight and especially ultraviolet radiation of the type B (UVRB) may collide with the human skin cells for different time periods and doses. Within the last decade, the effects of UVRB appear prominent on the human skin and in different forms and areas, characteristics and features. The Skin cancer is one of the negative effects of public health. The surveys conducted with more than 200 Skin cancer patients diagnosed across the Chlef region in Algeria showed that the main risk factor and the major cause of skin cancer patients is the radiations and especially UVRB. But there are positive effects of sunlight on the human body, so we are advised not to be exposed to sunlight for long time periods and to use sunscreens, especially during high air temperatures in the worldwide. Ultimately, early detection of skin cancer patients may facilitate definitive treatment by professionals, but Prevention is still better than cure.

Key words: Sun; Ultraviolet radiation; human Skin cells; Skin Cancer; Patients.

Astrophysics

Clàudia Soriano Guerrero

Compact relic seeds: the fossil record of the most turbulent epoch of a galaxy's life

Session 2, August 6th
10:00 AM EST | 4:00 PM CET | 10:00 PM PHT

We present new data for PGC 012519 compact elliptical (cE) galaxy, the first ever proposed candidate relic seed using spectroscopy from the Gran Telescopio de Canarias, particularly the MEGARA instrument. We successfully reduce the raw data with the MEGARA DRP. After, we apply pPXF, using the single stellar populations E-MILES models, in order to reconstruct our galaxy spectrum and find the best fit possible to derive the kinematic and stellar population properties for different apertures and rings. From the kinematic study we observe there is a mild rotation of the galaxy, with an increasing gradient of 15 km/s, and a mild decreasing gradient (20-25 km/s) for the velocity dispersion. These are both compatible with the gradients seen in other literature cEs that have an intrinsic origin. Moreover from the stellar populations and SFHs results high values for the total metallicity ([Z/H] 0.15-0.3 dex), very old ages (12.5-13.6 Gyr) and very quick formation timescales (T50<1.5 Gyr) at very early times are obtained. Indeed, all these results are compatible with the possibility that PGC 012519 is a relic compact seed. However, further studies are proposed to produce spatially-resolved maps which would fully confirm its relic nature.

Enrico Catalano

No title

Session 2, August 6th
10:20 AM EST | 4:00 PM CET | 10:20 PM PHT

Astrobiology is one of the fields on the rise concerned with the study of life, namely its origin, evolution, distribution, and future on Earth and elsewhere in the Universe. Astrobiology is a broad research domain that encompasses wide areas of the scientific landscape. Astrobiology is a very interdisciplinary field that traverses a very wide spectrum of spatial and temporal scales: from prebiotic chemistry to geomicrobiology, atmospheric sciences, and astronomy. This maturing field cuts across many scientific concepts ranging from the molecular level to ecosystems and planetary systems, at scales ranging from Earth's (sub)surface to planetary objects detected thousands of light years away. Several hypotheses have been proposed to explain life in the cosmic context throughout all the human history, but only now, science&technology has allowed many of them to be tested. Astrobiotechnology can be intended as the evolution of astrobiology and exobiology for understanding the origins of life to its future evolution and destiny on Earth and exoplanets. It could be a nascent field aimed at

applying tools of modern biology to advance our goals in space exploration and discover extraterrestrial life forms. The big challenge in the search for life on other planets is identifying features that are known to be uniquely associated with life and the emergence of life. Features attributed to past and present life on Earth are often used as indicators for previous or extant extraterrestrial life.

Francesco Costa
No title

Session 2, August 6th
10:40 AM EST | 4:40 PM CET | 10:40 PM PHT

Dark matter is one of the big mysteries of our century. The standard paradigm of the WIMP miracle is being challenged by the numerous experimental observation that failed to detect any new particle. New production mechanisms to generate Dark Matter have been proposed and more exotic particles that could not be necessarily stable are being studied in the context of Freeze-in. This is a complementary production mechanism to the standard WIMP freeze-out one with some very promising Dark Matter candidates.

Tiziano Schiavone
An inconstant Hubble constant?

Session 2, August 6th
11:00 AM EST | 5:00 PM CET | 11:00 PM PHT

The Hubble constant tension between local cosmological probes and Planck measurements ranges from 4 to 6 σ. To investigate this tension, we perform a binned analysis in redshift space of the Pantheon sample, the largest compilation of Type Ia supernovae (SNe Ia), and we estimate the Hubble constant for each bin in different cosmological models. Then, fitting the extracted values with a function of redshift, we find that the Hubble constant evolves with redshift unexpectedly, showing a slowly decreasing trend from 1.2 to 2.0 σ. Interestingly, extrapolating the fit function to the redshift of the last scattering surface, z=1100, we obtain values of the Hubble constant compatible in 1σ with Planck measurements. The possible intrinsic evolutionary behavior of the Hubble constantcould be due to astrophysical selection effects or to modified gravity theories. This talk is based on the paper by Dainotti et al. (2021) ApJ 912, 150 (arXiv: 2103.02117). Speaker: Tiziano Schiavone. Authors: M. G. Dainotti, B. De Simone, T. Schiavone, G. Montani, E. Rinaldi, G. Lambiase.

Amine Akka
No title

Session 2, August 6th
11:20 AM EST | 5:20 PM CET | 11:20 PM PHT

When it comes to nanosatellites, a newly emerging miniaturized form of conventional satellites

and the most sought-after forms of them, it is always known that they feature the smaller envelope size, the lower cost, with the shorter development time. Yet still that, they cope with different issues namely high thermal gradients or different thermal loads negotiated by different solar radiation and the planetary infrared emissions. The prediction of thermal behavior is almost conducted by the way of simulation. That last should be well performed in order to obtain reliable results taking into consideration all the parameters that govern the outer space environment namely vacuum and radiation in high-energy sources. For that purpose, this paper aims to describe the different types of heat radiation that the nanosatellite incurs, and then accurately simulate them with consideration or not of the nanosatellite heat dissipation. The impact on the entire spacecraft appears clearly along the way that some parameters change such as emissivity and absorptivity that are describing the optical coatings of the materials.

Edoardo Altamura

No title

Session 2, August 6th
11:40 AM EST | 5:40 PM CET | 11:40 PM PHT

In recent years, research on the kinetic Sunyaev-Zel'dovich (kSZ) effect has enabled observers with tools to study the kinematics of the hot gas in the inter-galactic medium on cosmological (>10 Mpc) scales and in virialised structures, i.e. groups and clusters. Due to its relation to the gas dynamics, the kSZ signal contains a signature from to the bulk rotation of structures, referred to as rotational kSZ effect (Chluba & Mannheim 2002; Cooray & Chen 2002). With an amplitude typically 10^4 times smaller than the thermal SZ spectral distortion, observing the rotational kSZ effect is extremely challenging and, to date, has only been achieved by aligning and stacking Planck SZ maps (Baxter et al. 2019). In order to explore the gas kinematics using the rotational kSZ as a probe, hydrodynamic cosmological simulations offer some of the most comprehensive datasets for this study. Numerical models can be used to validate assumptions made in observational strategies, as well as providing useful predictions for future kSZ measurements from NIKA-2, Simons Observatory or other facilities. The rich halo statistics from the BAHAMAS sample, integrated with information from the most rare and massive MACSIS clusters, constitutes a unique simulations suite for making such predictions. In our work, we combine the BAHAMAS and MACSIS datasets to investigate the rotational kSZ effect across a wide range of group and cluster masses. Based on these models, we also test the the stacking approach and estimate the amplitude of the stacked signal with varying mass, redshift and map-alignment geometry.

Geophysics

Beate Stevens
Facts and myths about particulate matter

Session 2, August 6th
10:00 AM EST | 4:00 PM CET | 10:00 PM PHT

Air quality has been a hot topic last year, but not all the outsourced information was scientifically proven. During this talk we are going to deep dive into the information shared by the media for the society, to see what the facts and myths are.

Helena Ciechowska
No title

Session 2, August 6th
10:20 AM EST | 4:20 PM CET | 10:20 PM PHT

Co-author: Dr. Małgorzata Kozłowska (will not present). Gamma radiation present in sedimentary clastic rocks is caused by the presence of radioactive isotopes of Potassium, Thorium, and Uranium. Performing gamma ray spectrometric research, and measuring the amount of radiation in the rock, shall allow to define its mineral composition. Gamma ray spectrometry provides data that later can be used for the calculation of Th/K ratio, which allows for preliminary recognition of minerals, such as feldspar, micas, clayey minerals, and some of heavy minerals, responsible for increased gamma radiation. On the basis of measurements of Th and K contents the Th/K ratio is calculated for recognition of clayey minerals in the matrix that the rock consists of and defining what mineral is most likely to be a main source of gamma radiation. This method is effective only for rocks such as sandstones, conglomerates and heterolithic beds and broadly used especially in geochemical well-logging. This research was carried out in the Borehole and Geological Samples Archive of National Geological Archive in Piaseczno, Poland. It allowed for the recognition of main radioactive mineral present in Carboniferous and Lower Devonian sandy sedimentary rocks of Wilga IG-1, Białobrzegi IG-1, Lublin IG-1 core-sections, and Holocene sands of Jastrzębia Góra. Gathered data included 166 points of measurements (with 3 minute intervals of measurement each), most of which were performed on core-sections with a step of approximately 25 cm. Data obtained with gamma ray spectrometry survey performed with the use of Gamma Ray Spectrometer (BGO) produced by GF Instruments s.r.o. showed that sandstones and heteroliths of Carboniferous Lublin Formation (=Lublin Fm) are rich in clay minerals as well as smectite. Similar results were obtained for Lower Devonian Zwoleń Formation (=Zwoleń Fm) and sandstones and heterolithic beds of Carboniferous Dęblin Formation (=Dęblin Fm) in Białobrzegi IG-1 core-section . For heteroliths and sandstones of Zwoleń Fm in Lublin IG-1 core-section, the Th/K ratio was

characteristic for illite, which also seems present in clastic rocks of Lower Devonian Czarnolas Formation in Wilga IG-1. These results are present as a cloud of points that are difficult to petrographic interpretation. Interesting results were obtained for Holocene sands of Jastrzębia Góra, where Th/K ratio is characteristic for heavy minerals such as garnets, monazites, and zircons, which were documented by Łoziński and Masicka (1962), in glacial deposits of Kępa Swarzewska. The results obtained for the measured sample show the high amount of Th present in it. However, the results allow for conclusions that the method is not suitable for small samples and seems to only give results fitting the model when the sample is measured in the field or directly in the borehole. In case of small volume samples, the influence of background radiation is very high and makes it very hard to fit the measured values with the model, making it probably impossible to distinguish between subtle changes in actual Th/K ratio of the investigated samples.

Joanna Szulc

The automatization of All-Sky cloud detection system for Alomar Observatory in Norway

Session 2, August 6th
10:40 AM EST | 4:40 PM CET | 10:40 PM PHT

The goal of the project was the modernization and automatization of a previously existing cloud detection system in Alomar Observatory. The original system was set up in 1995 under the name All-Sky and consisted of a fish-eye lens, camera, and supporting optics and electronics.

The project involved the maintenance work on every level - from adjusting the optics, through diagnostics of the electronics to writing new software for the automatic detection of the clouds from the taken pictures. Part of the project involved a review of both classical and machine learning approaches to automatic recognition of clouds on photos which will be presented during the talk.

The system works as a supporting system for LIDAR measurements of the arctic mid-atmosphere above Alomar Observatory.

Antti Mikkonen
No title

Session 2, August 6th
11:00 AM EST | 5:00 PM CET | 11:00 PM PHT

Global greenhouse gas measurements are necessary for monitoring emission quotas and accurate climate modeling. Currently the only way to obtain global data is by using satellite-based spectrometers. In this talk I will present the basic theory of greenhouse gas remote sensing and its recent developments in the context of my research.

Mariam Mchedlidze
Nonmodal evolution of Internal Gravity Waves in Kinematically Complex Flows

Session 2, August 6th
11:20 AM EST | 5:20 PM CET | 11:20 PM PHT

In this presentation we consider the evolution of internal gravity waves (IGW) in kinematically complex shear flows. We derive equations governing the dynamics of these waves and consider different interesting cases. We analyze in detail how the flow with complex velocity inhomogeneity patterns influences the evolution of IGW.

Quantum Physics

Manab Mukherjee
No title

Session 3, August 7th
3:40 AM EST | 9:40 AM CET | 3:40 PM PHT

The talk will be about "Quantum Mechanics and our reality". It will cover both philosophical and physical interpretations of objective reality. Different interpretations about quantum mechanics and how they affect whole research in physics. Since, It all started with the Copenhagen interpretation, What will be the best place to discuss it again, even if virtually!?

Achal Vinod
Ermakov-Pinney equation for time-varying mass system

Session 1, August 6th
11:20 PM EST | 5:20 AM CET | 11:20 AM PHT

We extend Fring-Tenney approach of constructing invariants of constant mass time-dependent system to the case of a time-dependent mass particle. From a coupled set of equations described in terms of guiding parameter functions, we track down a modified Ermakov-Pinney equation involving a time-dependent mass function. As a concrete example, we focus on an exponential choice of the mass function.

Luka Dvaladze
Quantum eraser

Session 1, August 6th
11:00 PM EST | 5:00 AM CET | 11:00 AM PHT

In this work we will try to reveal a fundamental weirdness in the way the world works with a really simple experiment. Atoms and other particles travel around like well-behaved billiard balls but sometimes they behave like waves, becoming dispersed over a region and capable of crisscrossing to form interference patterns. Quantum effects are most evident when tiny systems are involved. Creating an environment for such an experiment is not easy, but a quantum erasure experiment will give us an opportunity to get a firsthand glimpse of the bizarre quantum world. This effect involves one of the oddest features of quantum mechanics—the ability to take actions that change our basic interpretation of what happened in past events. As a result, we will see that particles behave as a wave when unobserved and as billiard balls when observed but information about observation can be deleted.

Nicolò Antolini
No title

Session 3, August 7th
2:00 AM EST | 8:00 AM CET | 2:00 PM PHT

The supersolid is a counterintuitive state of matter where atoms, arranged in a periodic crystal-like structure, can still flow coherently as they do in a superfluid. The supersolid has been recently observed in trapped quantum gases of strongly dipolar atoms, emerging from the crystallization of a superfluid Bose-Einstein condensate. In this work we study for the first time the nature of the quantum phase transition associated with the formation of the supersolid both experimentally and theoretically. Although our supersolids are formed by a single row of density clusters arranged in a periodic structure, we observe two different types of transitions that are reminiscent of the first- and second-order phase transitions expected to occur at a thermodynamic level in 2D and 1D, respectively. We find a continuous crossover between the two regimes that can be controlled by changing the atom number and the trap confinement, and we characterize its scaling properties. The two types of phase transitions give rise to supersolids with different structures and dynamical properties.

Jordan Cohen
An Infinity of Soft Charges

Session 3, August 7th
2:20 AM EST | 8:20 AM CET | 2:20 PM PHT

Recent results on the infrared structure of gravity and electro-magnetism have suggested that the deep infrared is much richer than previously appreciated. This talk presents an extension of several of these findings to nonabelian gauge theories, taking a number of important insights from the infrared triangles of both gravity and abelian gauge theories along the way. As a warm up, we describe the emergence of an infinity of soft (i.e. zero-energy) electric and magnetic charges in the absence of sources. We then show that an infinity of analogous charges arise in the nonabelian theory. In light of the concomitant conservation laws associated to the soft charges, we revisit the black hole information paradox and argue that a generic black hole must carry an infinite amount of gravitational, electromagnetic, and chromodynamic soft hair.

Friedrich Hübner
No title

Session 3, August 7th
2:40 AM EST | 8:40 AM CET | 2:40 PM PHT

During the last two decades experiments with cold atoms trapped in optical lattices were able to simulate the behaviour of quantum systems. One prominent way of manipulating cold atom systems is to apply external time-periodic fields. In order to achieve the desired outcome one of course needs to understand how quantum systems behave under such oscillating perturbations. Floquet theory is a powerful theoretical toolbox to tackle such problems by mapping the time-dependent system onto a static effective Hamiltonian describing the same physics.
In this talk I would like to give an introduction into Floquet theory in the cold atom setting. I will cover three points: the main ideas behind Floquet theory, how it is applied in cold atoms and finally outline some of my own work considering scattering of bound pairs in a Fermi-Hubbard chain at a driven barrier.

Matteo Vismara
No title

Session 3, August 7th
3:00 AM EST | 9:00 AM CET | 3:00 PM PHT

In our work we consider single particle quantum walks on graphs and study the estimation of the shift parameters on a generic pure state. We look for the optimal measurement to estimate the shift parameter without any a priori information and also seek for the optimal preparation of the walker in order to minimize the overall cost of the estimation strategy.

Chaibata Seida
No title

Session 3, August 7th
3.20 AM EST | 9:20 AM CET | 3:20 PM PHT

Bidirectional quantum teleportation (BQT) enables two legitimate partners to exchange their states simultaneously. In this contribution, we discuss a BQT protocol (published in Modern Physics Letters A, 35(33), 2050272.) and show how to enhance the BQT of information using initial state parameters.

Condensed/Solid Matter Physics

Trung Ha Quang
No title

Session 1, August 6th
11:00 PM EST | 5:00 AM CET | 11:00 AM PHT

The fractional quantum Hall effect (FQHE) provides a platform for many exotic physical phenomena that arise from the interplay between strong correlation, geometry, and topology. One such phenomenon is the formation of "anyons" – quasiparticles with fractional charges and fractional statistics that follows neither Bose-Einstein nor Fermi-Dirac distributions. The challenge in understanding these phenomena is to find ways to resolve the strong electronic interaction while retaining the important features (such as topological indices) of the systems. In this talk, I will introduce some of these approaches, including a new perspective that, interestingly, results in further fractionalisation of these anyons and an anyon-mediated phase transition within the same topological index (arXiV: 2009.14214 and references therein).

Sayed Mohammad Ali Najafi & Amirhossein Payandeh
No title

Session 1, August 6th
11:20 PM EST | 5:00 AM CET | 11:20 AM PHT

In general, this research has introduced the history and importance of light-emitting diodes in light industry. Experimental activities and data analysis is based on design and manufacture of organic light emitting diodes with capability green light emission. So in chapter one is provided a comprehensive definition of organic light-emitting diode with Benefits of polymers and small molecule organic matter and the physical processes governing them include injection, transmission and emission of light. In chapter two and three is expressed, the work done in recent years includes materials changes, layers thickness changes, the addition of different layers, in order to improvement the performance of the diode, their flexibility, transparency and quality of the output light and method of coating and required devices respectively. In the fourth chapter, is described introducing the three-layer transparent conductive structure and its properties, Experimental structure of inverted organic light emitting diode based on green emission material Alq_3 and transparent three-layer anode and its electroluminescence specification has been analyzed. In this study, the effect of a change in the thickness of the middle layer of silver in an anode of three layers V2O5/Ag/V2O5 is investigated on the amount of luminance, current efficiency and power efficiency organic light emitting diode structure. The results show that in this light emitting diode, thickness 17(nm) silver had maximum luminance 85% that it is due to an increase in the injection of the hole and the greater balance of the

carriers in the active diode area. Investigations show that at high voltages, on the other hand use from the injection and cavity transfer improvement layer (WO3) has been investigated. Also comparing the performance of Diodes with WO3 layer and VAV anode and ITO anode is indicated the use of three-layer conductive structures as anode in diodes will improve the performance of the diode and these structures can be a suitable substitute for conventional anodes in the structure of organic light emitting diodes.

Lamborghini Sotelo
No title

Session 1, August 6th
11:40 PM EST | 5:40 AM CET | 11:40 AM PHT

Laser-Induced Periodic Surface Structures (LIPSS) are utilized to prepare surfaces of titanium and steel implants which inhibit bacterial growth and promote bone coupling with the implant. This research is of great interest since it reduces the cost and time of implant preparation and extends its life within the body, reducing the need for post-surgery.

Tatiana Aurelia Uaman Svetikova
No title

Session 2, August 6th
10:00 AM EST | 4:00 PM CET | 10:00 PM PHT

Scientists have been studying HgCdTe (MCT) solid solutions for a long time. Thanks to the development of technologies for structure growth, it became possible to create terahertz optoelectronic devices. You can hear about the different applications of MCT in human life (medical, anti-terrorist and space), and research carried out in our scientific laboratory on oral presentation. My research is related to the vacancy of mercury - the major defect in MCT. The important results now are the identification of photoconductive bonds at various temperatures (spoiler - it's PTIS), revealing the influence of potential fluctuations.

Alaa Mohammed Idris Bakhit
No title

Session 2, August 6th
10:20 AM EST | 4:20 PM CET | 10:20 PM PHT

We performed ab-initio calculations of the vibrational frequencies of diamond along the crystal direction [001]. We observed the pressure dependence on the Raman shift of diamond. Due to the non-hydrostatic stress, we observed splitting of the triply degenerate first-order Raman mode into doublet ωD and singlet ωS. Furthermore, the theory was found to be inconsistent with the observed splitting of the first-order Raman mode. The radial σr and axial σz stress components were varied at different constant volumes. We obtained a simple polynomial approximation for the dependence of ωD and ωS on σr and σz. In addition, for experimentally

measured vibrational frequencies the shear stress (τ = σz - σr) was computed. The shear stress points out the non- hydrostatic contribution to the measured sample pressures. Thus, the stress state was obtained for pressures between 200 and 400 GPa which shows the stress state of the diamond anvil cell at multimegabar pressures.

Ilia Nikolaev
No title

Session 2, August 6th
10:40 AM EST | 4:40 PM CET | 10:40 PM PHT

Photoconductivity spectra in a HgTe/CdHgTe double quantum well with a normal band structure have been studied. Photosensitivity bands associated with the ionization of a mercury vacancy, which is a doubly charged acceptor, have been detected in photoconductivity spectra. The transformation of photoconductivity spectra when the Fermi level moves from the edge of the valence band through the band gap to the conduction band has been revealed using the residual photoconductivity effect. It has been shown that the observed absorption bands are due to the ionization of doubly charged acceptors rather than individual different singly charged states.

Katarzyna Sadecka
Excitonic properties of low dimensional transition metal dichalcogenides

Session 2, August 6th
11:00 AM EST | 5:00 PM CET | 11:00 PM PHT

Single layers of transition metal dichalcogenides (TMD's) MX2 (M = Mo, W, X = S, Se, Te) are novel semiconductor research platforms enabling exploration of many fundamental physical phenomena. These include low energy massive Dirac fermion model and related valley degree of freedom which allow for selective excitation with circularly polarized light. Moreover, strong electron-electron interactions lead to excitons with binding energy ~500 meV [1], roboust charged exciton states [2,3] and broken symmetry valley- and spin-polarized phases [4]. TMD's are also the basic "blocks" to the construction of so called van der Waals heterostructures [5]. Such systems, built from atomically thin layers of MX2 crystals, enable the formation of excitons from electrons and "holes" in distinct layers producing long-lived interlayer excitons with very strong binding energies [6,7] and interlayer many body complexes [8]. Furthermore, it is also possible to manipulate properties of TMD's van der Waals heterostructures by mutual twisting of layers [9].
In the following work various TMD's heterostructures will be studied from the point of view of their electronic and excitonic properties. For both mono- and bilayers of MX2 semiconductor

crystals, we study exciton fine structure with particular attention to topological effects manifested in the exciton spectrum. Combination of density functional theory, tight-binding approximation, k×p methods and Bethe-Salpeter theory will be used.

Manuel Längle
No title

Session 2, August 6th
11:20 AM EST | 5:20 PM CET | 11:20 PM PHT

Noble gas clusters trapped between two or more graphene layers form two-dimensional noble gas crystallites that are directly observable in an atomically resolved scanning transmission electron microscope (STEM). These otherwise inert atoms appear in both solid- and liquid-like phases, and in our experiments the clusters exhibit size-dependent, electron-beam driven dynamics that include, for instance, ""jumps"" over distances greater than the dimensions of the crystallites. Atomistic simulations confirm the stability of small clusters and shed light on the observed dynamics.

Giorgi Gogaberishvili
*Synchrotron emission from a nearby zone of SgrA**

Session 2, August 6th
11:40 AM EST | 5:40 PM CET | 11:40 PM PHT

I will talk about Quasi-linear diffusion (QLD), driven by the cyclotron instability, which is proposed as a mechanism for the possible generation of synchrotron emission in the nearby zone of SgrA∗ . For physically reasonable parameters, the QLD, by causing non-zero pitch angle scattering lets electrons with the relativistic factors of the order of 10^8 emit synchrotron radiation in the hard X-ray spectral band ∼ 120 keV.

Material Physics

Mahdi Vazvani Hassanabadi & Amirhossein Payandeh
No title

Session 1, August 6th
11:00 PM EST | 5:00 AM CET | 11:00 AM PHT

Here we used a new PEROVSKITE solar cell for optical communication and data transmission. This detector meets the requirements for a sensor based on thin-film semiconductor physics, and also meets its dual use for clean energy generation and optical telecommunications applications. The detection of this optical sensor is in a range comparable to commercial models, and its wide bandwidth provides the ability to transmit broadband information.

Kora Lu Rojas Baldivia
No title

Session 1, August 6th
11:20 PM EST | 5:20 AM CET | 11:20 AM PHT

The primary goal of this work is to produce a red phosphor emission applications in white light lamps based on LED's. In particular, a material with wavelength at 617 nm excited under long wave UV light and based on Eu3+, Tb3+- activated molybdates Li3Ba2(La1-x-yEuxTby)(MoO4)8 with $0 \leq x \leq 1$ and $0 \leq y \leq 1$. A series of powder samples were synthesized by combustion method and annealed at 800°C in air. The phase formation of the samples was investigated by X-ray diffraction which revealed the monoclinic C2/c (15) space group with Z=2, in agreement with the JCPDS 01-077-0830 database reports. The characterization by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) revealed a similar morphology in all samples: rather large (1-7 μm) agglomerate particles with irregular shape and surrounded by smaller (~50 nm) particles. Cathodoluminescence measurements indicated that the composition is optimal for Eu3+:Tb3+ doping ratios of 80:0, 90:0 and 20:80. While the samples with 80:0 and 60:40 doping ratios showed the highest intensity in a detailed photoluminescence analysis. The luminescent material per the composition Li3Ba2La3(MoO4)8:(Eu3+, Tb3+) is a promising candidate for its application as a red emitting component in lighting systems based on solid-state devices, in particular, light-emitting diodes.

Tobias Messer
No title

Session 2, August 6th
10:00 AM EST | 4:00 PM CET | 10:00 PM PHT

3D laser lithography is among the most versatile techniques in 3D additive manufacturing - especially on the micro- and nanoscale. It exploits the mechanism of two-photon absorption (2PA), which allows for the creation of nearly arbitrary three-dimensional structures with

sub-micrometer resolution. The talk will explain the underlying mechanism as well as it will show recent results in merging additive and subtractive manufacturing.

Said Bouzit
No title

Session 2, August 6th
10:20 AM EST | 4:20 PM CET | 10:20 PM PHT

In order to reduce the heat loss from envelopes and to ensure energy saving in building refurbishment, polystyrene balls are added to Moroccan natural gypsum plaster. A complete characterization of the mechanical, thermal, and acoustic properties of the samples is carried out, taking into account different contents and diameters of the polystyrene balls. Increasing balls size, flexural strength peak value occurred with a lower polystyrene percentage. Thermal properties were measured by means of Small Hot Box apparatus. The values of conductivity were 0.191 and 0.116 W/mK for 10% and 30% addition of the smallest polystyrene balls, respectively. The acoustic properties were measured by means of a Kundt's Tube, in terms of absorption coefficient and sound insulation. The absorption coefficients were slightly higher than the ones of standard plasters. Concerning insulation properties, a worse performance was expected, due to the lower density of the samples with the balls, according to the Mass Low. Anyway the transmission loss values were up to 45 dB, with a reduction of only 2–3 dB with respect to the samples without balls, showing a good performance for the proposed composites. Finally, dynamic energy simulations for a case study showed that polystyrene plaster with smaller balls applied on the wall surfaces of a residential building involved benefits both for heating and cooling energy demand. A small thickness (3 cm) of insulating material could be a suitable solution in order to enhance the thermal and acoustic performance and to reduce environmental impact of the construction systems.

Tudor Şuteu and Ştefan Galin
Nitrogen-containing carbon nanostructures as anode modifier in microbial fuel cells

Session 2, August 6th
10:40 AM EST | 4:40 PM CET | 10:40 PM PHT

The recovery of energy from wastewaters using microbial fuel cells (MFCs), where microorganisms oxidize wastewater constituents and convert their chemical energy into electricity with simultaneous wastewater purification presents an opportunity to make a major contribution to the EU energy requirements. The anode material is one of deciding factors that affects the performance of MFCs. Among different materials used for anode modification, nitrogen-containing carbon nanostructures (NCNS) have drawn much attention due to their excellent electro catalytic activities as well as low cost, good durability, and environmental

friendliness. In the present work nitrogen-containing carbon nanostructures (NCNS), obtained via carbonization of conducting polymers, were investigated as anode modifiers in microbial fuel cells. NCNS were obtained via carbonization of polypyrrole and polyaniline at 900 0C under nitrogen flow. Both polymers and NCNS were characterized using X-ray diffraction and Scanning Electron Microscopy. Dual chambered MFC reactors under the fed-batch mode condition were used to analyze the performance of MFCs with NCNS modified anode.

Oufakir Abdelhamid

No title

Session 2, August 6th
11:00 AM EST | 5:00 PM CET | 11:00 PM PHT

The effect of dispersion on the morphology and the surface properties of the silica SiO2 compounds are investigated. The analysis of the as prepared silica nanofibers by Variable Pressure Scanning Electron Microscope (VP-SEM) shows typically, fibrous texture on the surface of SiO2. FTIR spectroscopy reveals the presence of the bridging oxygen stretching vibration Si–O–Si as well as the increase in the intensity ratio between Si-OH band and Si-O-Si. Furthermore, X-ray diffraction (DRX) validates the conservation of the SiO2 lattice when it goes through the KOH attack for both dispersed and non-dispersed aggregates. The shift of the DRX main peak (101) is in good agreement with the FTIR results showing the shift of Si-O-Si peak and the increase in the intensity ratio of Si-OH / Si-O-Si. The dispersed SiO2 aggregate exhibits a promising functionalized surface with satisfactory results in terms of silica nanofibers crystallinity and chemical composition. High Resolution Transmission Electron Microscopy HR-TEM data corroborate the claim of the presence of SiO2 nanofibers on the sample surface.

Youssef Ouldhnini

No title

Session 2, August 6th
11:20 AM EST | 5:20 PM CET | 11:20 PM PHT

Bioactive glasses have applications in restorative bone medicine, in view of their bioactivity, these materials are able to react with the body environment. 45S5 bioactive glass from Soda-lime phosphosilicate glasses represent a model system which started to take off commercially. Regardless of their importance as bioactive materials, the relationship between the structure features, density, and cooling process has not been studied in detail. In this investigation, we used molecular dynamics simulations to study the elastic and structural properties of densified 45S5 bioactive glass through a range of densities. A systematic analysis of the structure-density relationship was performed, correlating the change in the bioactive glass properties with the structural change to perform its mechanical properties while preserving their bioactive

behavior. The findings show a repolymerization in the glass network structure, by increased network connectivity and a tetrahedral to octahedral polyhedral transition. We were able to tailor the elastic properties while keeping the bioactivity of the glass.

Alicja Kawala

No title

Session 2, August 6th
11:40 AM EST | 5:40 PM CET | 11:40 PM PHT

In 2014, the superconductivity was discovered in the new type of materials - High Entropy Alloys (HEA), the alloys that are formed by mixing relatively large proportions of five or more elements. Since then, the superconductivity was found experimentally in many HEAs. However, the theoretical research concerning the electronic structure and the mechanism behind forming of the superconducting state is scant. HEAs are of high interest from material science point of view due to their unique properties such as high fracture toughness, ductillity and yield strength in extreme temperatures as well as resistance to corrosion and oxidation. The superconductivity of Sc-Zr-Nb-Rh-Pd alloy was experimentally confirmed in 2018 and reported in [1]. This research investigates electronic structure of the Sc-Zr-Nb-Rh-Pd HEA by employing the Korringa-Kohn-Rostoker Coherent Potential Approximation method (KKR-CPA) and Density Functional Theory. The main purpose of this work was to analyze how well the KKR-CPA method can describe the electronic properties of HEAs. Similar computations were carried out in [2] for Ta-Nb-Hf-Zr-Ti HEA superconductor. The results obtained in this work concern the McMillan-Hopfield coefficients, the density of electronic states around Fermi Energy and dispersion relations for different concentrations of the components in Sc-Zr-Nb-Rh-Pd HEA for which the formation of the superconducting state was observed. The computations also showed that the CsCl structure should be observed in this type of alloy, and the experimental data in [1] shows that this is indeed the case. Additionally, strong smearing of the electronic bands shows the significance of the chemical disorder in the properties of the alloy.

Other

Nachiket Jhala
No title

Session 1, August 6th
11:00 PM EST | 5:00 AM CET | 11:00 AM PHT

Tathvardhigam Sutra, a scientific text in Jainism, happens to be closely related to the field of Modern Physics, namely Particle Physics. It also talks about the world in terms of particles and their interaction with nature. This resemblance needs to be studied further to get a better picture of what the enlightened beings, known as kevalgyanis in Jainism, described this universe, far beyond the reach of human in the current time.

Yash Gurbani
No title

Session 1, August 6th
11:20 PM EST | 5:20 AM CET | 11:20 AM PHT

Learning and associative memory are understood as emergent phenomena resulting from interactions between a complex network of neurons. It is well known that the structure of such a neural network heavily influences its function. Biological networks (e.g. neuronal network of the worm Caenorhabditis elegans) have been shown to exhibit small-world characteristics. To investigate the structure-function relationship in small-world networks, we simulate the Hopfield model of associative memory on a regular and Watts-Strogatz network. We obtain estimates of memory capacity on a regular and a WS network through numerical simulations. Further, we study how changing the probability of rewiring and local connectivity in a WS network affects the performance of associative memory. We find that the performance on small-world networks is as robust as that on random networks despite using only a fraction of connections, making the former biologically favorable. Our simulations are in agreement with experimental evidence found in the existing literature on small-world characteristics in biological networks and give deeper insights into this phenomenon.

Soe Gon Yee Thant
No title

Session 3, August 7th
3:20 AM EST | 9:20 AM CET | 3:20 PM PHT

The 20-centuries old Balinese Ancient Rice Terraces is a social system involving farmers who share the water while facing the threat of local pest infestations. Game theoretic model has been used to optimize the harvest based on main considerations of the global water stress and the local pest stress. In order to analyse this social system in the physics context, we propose a 1D Hamiltonian representing the short range communications between neighbouring farmers to minimise local pest stress and long range interactions involving the sharing of water, with entropy analogous to farmers' independent decisions. Using Monte Carlo simulations, the

preliminary results suggest a possible phase of the system which satisfies both minimizing the local pest stress and equal sharing of the water at zero entropy. With these initial results and the physical intuition of the system, a more in-depth analytical and numerical analysis can be done to determine the possible phases and explore the phase diagram of the Subak model as a social system.

Lazare Osmanov
No title

Session 3, August 7th
2:00 AM EST | 8:00 AM CET | 2:00 PM PHT

We analyze and investigate the existence of chaos in coupled fallen pendulums, which is different from all the other mechanical oscillators because it's oscillation doesn't last forever and the reason of it isn't drag force or energy loss. We use different tools to analyze motion, such as Poincare's section for quasi-periodic and chaotic cases, calculation of Lyapunov's characteristic exponent by two different methods. As it is impossible to make normal bifurcation diagram for the system, Strange bifurcation diagram is constructed for this extraordinary system. our calculations shows that Lyapunov's exponent is positive as LLCE(largest Lyapunov's characteristic exponent)=0.235 on the predicted range where chaos could take place. All these work confirms the existence of chaos in a different way in the system after the parameters reaches the certain values.

Andrii Shytikov
No title

Session 3, August 7th
2:20 AM EST | 8:20 AM CET | 2:20 PM PHT

A model of a thermonuclear reactor (such as TOKAMAK and Farnsworth/Hirsch Fusor) was developed and implemented (based on the Python and C++ languages). The input parameters are the type of fuel (which nuclei are involved in the reaction), the initial temperature of the plasma, the dimensions of the reactor, the magnitude of the magnetic field in TOKAMAK or the electric field in Fusor, the initial number of nuclei of each of the elements, the simulation time and the accuracy of calculating the velocities and coordinates of the nuclei at each moment of time. Modeling enables you to calculate: 1) Number of reacted nuclei 2) Energy yield of the reaction 3) Heating of reactor walls 4) Average energy of particles in contact with walls 5) Reaction stability (the number of synthesis reactions versus time).

Graphical visualization is implemented in Python, firstly, it makes it possible to visually verify the correctness of the program, and secondly, it qualitatively demonstrates the course of the reaction. Numerical processing is implemented in C++, this language has an order of

magnitude better performance but lacks the convenience of working with graphics.
This program was developed with the aim of qualitatively checking the presence of reactions in the Farnsworth-Hirsch Fusor, before collecting it and conducting an experiment with the given: geometry, power supply parameters, fuel concentration and experiment time.
But in addition to this goal, this model can be configured to perform any other tasks related to complex nuclear and molecular dynamics. Video of the program can be found at this link.

David Ohse
No title

Session 3, August 7th
2:40 AM EST | 8:40 AM CET | 2:40 PM PHT

We present a physics show musical first put on stage at the University of Bonn, March, 24th, 2019. The "Phyusical" tells the story of a couple, Life and Death, nicknames Vita and Mortis, who want to buy a planet at the store Planetamos, run by Luna Callisto and Jupi Mercury. In the store they learn about all the possible features the associated star and their planet may have. To harbor living ecosystems, a delicate balance of all planetary parameters is required. The show involves 16 live physics experiments. The four actors sing 7 songs, which are to well-known tunes with new german lyrics, accompanied by a small live orchestra. The show was developed by the University of Bonn physics students, who have all been very active in the Bonn Physics Show (Bonn Physikshow). We combined a story line, songs mostly on physics, as well as live demonstration experiments. We are not aware of any other group combining all these show elements, but would love to hear of any related activities. The point of this presentation is to discuss the evolution and further perspectives of this physical project.

Ketevan Arabuli
Anomalous skin effect

Session 3, August 7th
3:00 AM EST | 9:00 AM CET | 3:00 PM PHT

A pulsar is a highly magnetized rotating compact star that emits beams of electromagnetic radiation out of its magnetic poles. Observation of this radiation is quite a challenge for modern astrophysics. The main reason is that, pulsar is not in a vacuum. The region enclosed inside the light cylinder is entirely filled with plasma. Electromagnetic radiation penetrates through plasma if and only if, it's own frequency is more than plasma oscillation frequency. Low frequency radiation only covers a short distance and is being reflected.

I want to discuss the penetration of magnetic-dipole radiation of pulsars in plasma and then observe an anomalous skin effect. According to the latter, transverse waves penetrate through plasma over greater distances than is expected according to skin effect. This, on the other hand, greatly increases our chances of studying pulsars.

Elizabeth Kelauridze

No title

Session 3, August 7th
3:20 AM EST | 9:20 AM CET | 3:20 PM PHT

The S-matrix or scattering matrix relates the initial state and the final state of a physical system undergoing a scattering process. The main aim of the thesis is to develop a method that could be generalized for calculation of S-matrix. We analyze the method for mechanical systems. The define dynamics of the zero modes of integrable field theories. In the presentation we consider the Liouville theory and apply this method for the Liouville particle

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