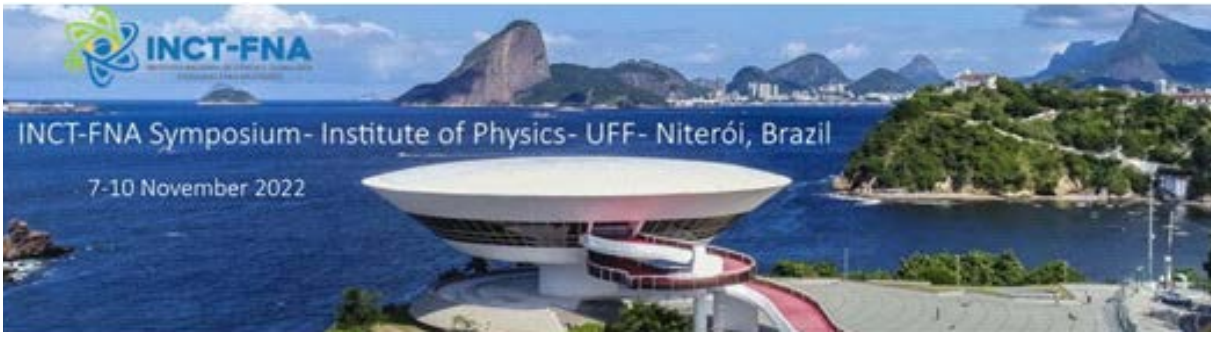

Book of Abstracts

Posters

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES
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CAPES

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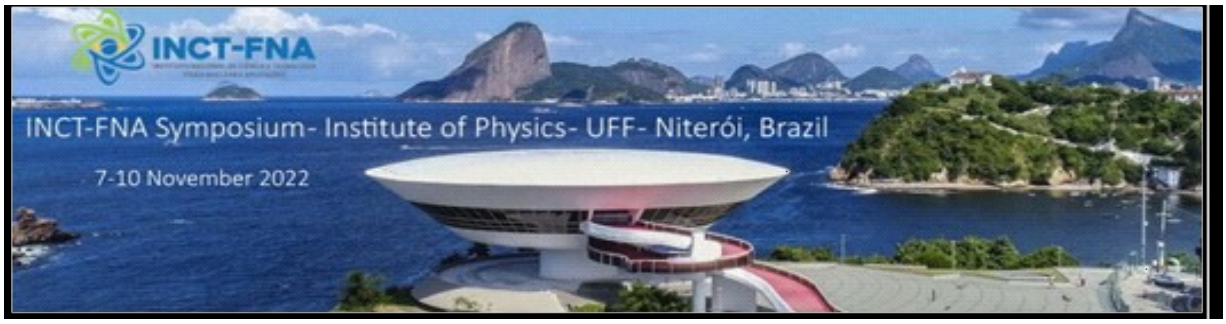


Poster FA01 - Electrical Characterization of Power Transistors of the type Trench by TID

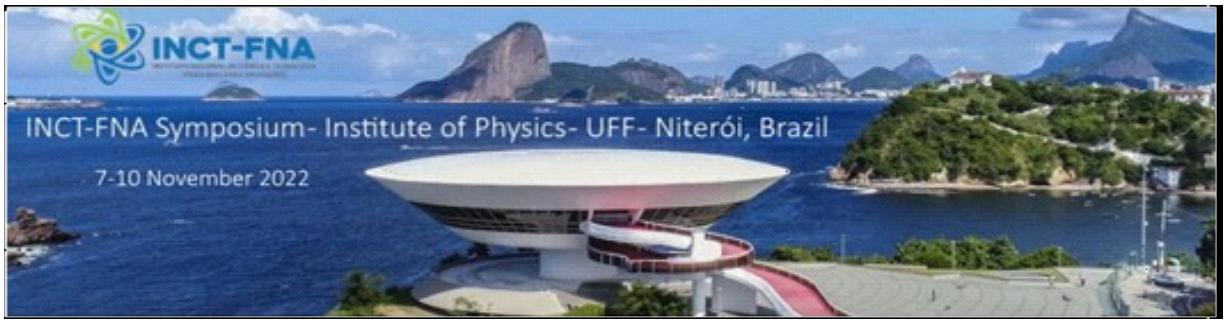
Ana Laura Q. Guidi, Paulo R. Garcia Junior, Alexis C.V. Bôas, Thomas H. Pschera, Marcilei A. Guazzelli*

Centro Universitário FEI, SBC, SP, Brazil

In recent decades, there has been a growing interest in power devices, such as TRENCH transistors, which have the same working principle as a conventional MOSFET (metal-oxide-semiconductor field effect transistor), but with a difference in their structure, in which the gate terminal is positioned vertically, providing it with smaller area and ultra-low channel resistance and high current carrying capacity. These characteristics make it possible for these transistors to operate at a higher current with great performance [1, 2, 3].

In this work the commercial TrenchT3 HiperFET Power MOSFET IXFA220N06T3 device was exposed to the X-ray beam of 10 keV, with a dose rate of 100 krad(Si)/h, accumulating a total dose of 300 krad(Si) . The analyzed devices were characterized before, during and after the irradiation process. The device characteristic curve, current versus voltage (IDSxVGS) was acquired and the threshold voltage (VTH) and maximum transconductance (gm) were extracted from it. The devices were characterized in on state, (VGS=5V and VDS=0V), and off state, (VGS=VDS=0V).

The results obtained so far indicate that the TrenchT3 transistors analyzed on the effects of the total ionizing dose (TID) are quite sensitive to the accumulation of doses up to 300 krad (Si), and their recovery is minimal after annealing at room temperature, mainly when it is polarized [4]. Thus, it is possible to affirm that this device, despite occupying a smaller area in an electronic system, is a component that should be avoided for use in environments with high levels of radiation, such as in aerospace commerce, particle accelerators and nuclear reactors.

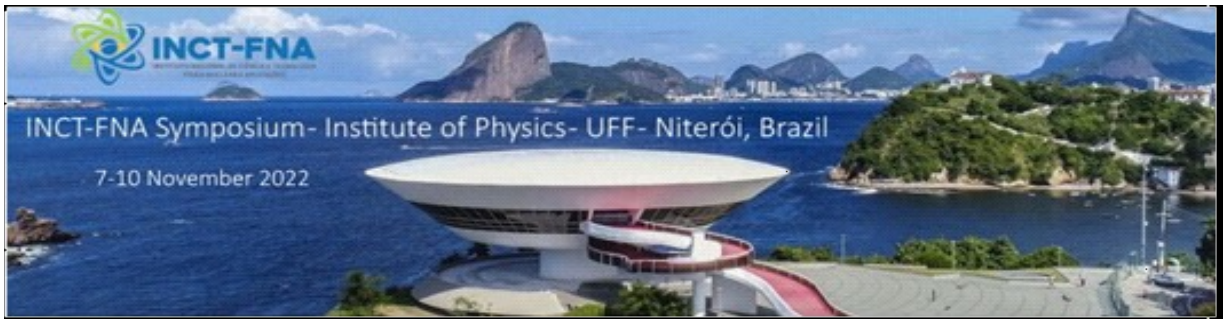


Poster FA02 - Evaluation of radiocarbon ages obtained for planktonic foraminfera and the impact on paleoceanographic reconstructions

Bruna Mota Netto, Kita D Macario, Maria A Pivel, Stewart Fallon, Fabricio Ferreira, Alberto Figueiredo Jr*

Laboratório de Radiocarbono, Instituto de Física, Universidade Federal Fluminense

Records of past environmental conditions, as temperature, salinity and sea level variation, represent an important tool to understand ocean dynamics. In this context, one of the most used group of microfossils is foraminifera, recovered in ocean cores. Their presence and characterization can be associated to past environmental conditions and allow the reconstruction of the palaeoenvionment. Thus, radiocarbon dating technique proved to be indispensable in analyses of these fossils on studies up to 50ky. Nonetheless, there are some obstacles, as reduced size and mass of these organism (each individual weighing ca micrograms and measuring 0,02 to 44 mm) and the fact that different species reflect different microhabitats conditions. To better understand these differences and allow more accurate chronologies, we compared radiocarbon signatures of different types of planktonic foraminifera samples (Globorotalia menardii and Orbulina universa, as monospecifics, and bulk) in different sample amounts (30 mg,15 mg and 5 mg), from Campos Basin. Samples were prepared at Radiocarbon Laboratory (UFF) and measured at Australian National University. Results until the moment show an effective difference between distinct species and distinct amounts, when considered the same species, indicating the necessity to investigate the reasons why isotopic ratios are not the same for all species, beyond to search developing methodology used to favor dating of these microfossils, allowing accurate results and helping paleoceanographic reconstructions.

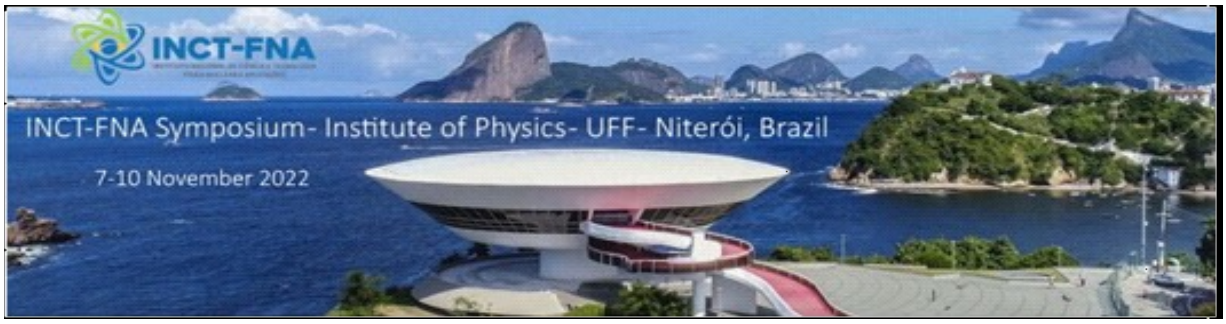


Poster FA3 - PIXESim: self consistent analyses of RBS and PIXE data in MultiSIMNRA

Cleber L. Rodrigues, Tiago F. Silva, Thiago B. Saramela, Manfredo H. Tabacniks*

Instituto de Física da Universidade de São Paulo

The complete integration between PIXE and RBS is long desired in the field of ion beam analysis. Since its release in 2016, the most requested feature among the MultiSIMNRA users is to include PIXE data in a joint analysis with the remaining IBA techniques calculated by SIMNRA. Many attempts have been made to include PIXE analysis, using for this the calculations done by software tools already available. Mainly because most of such codes do not follow a bottom-up calculation scheme, as required by the inverse induction approach of MultiSIMNRA, these attempts did not succeed. Thus, we developed a code that simulates PIXE spectra of a given target with smooth integration into a MultiSIMNRA analysis. Our code performs the calculation of all emission lines intensities for the elements present in the sample description. The detector response curves, including detection efficiency, resolution, fano factor, incomplete charge collection, and pile-up, are used to simulate the spectra as measured. It is also possible to consider the X-ray absorption in filters placed in front of the detector. Different databases are included to support the test of different approaches against the experimental data. For the x-ray absorption coefficient, FFAST and XCOM are available. For ionization cross-section, PWBA and ECPSSR theoretical models are available, together with semi-empirical approaches. Transition rates, fluorescence yield, and Koaster-Kronig probabilities are the same as adopted by the most recent software for x-ray fluorescence. The background estimation is driven by the data, using an improved version of the peak-clipping filter. Currently, we are performing tests and validation of the code. The results are promising, and we expect that it becomes available to the public soon. In this presentation, we report the development of the code and the results of the firsts validations.

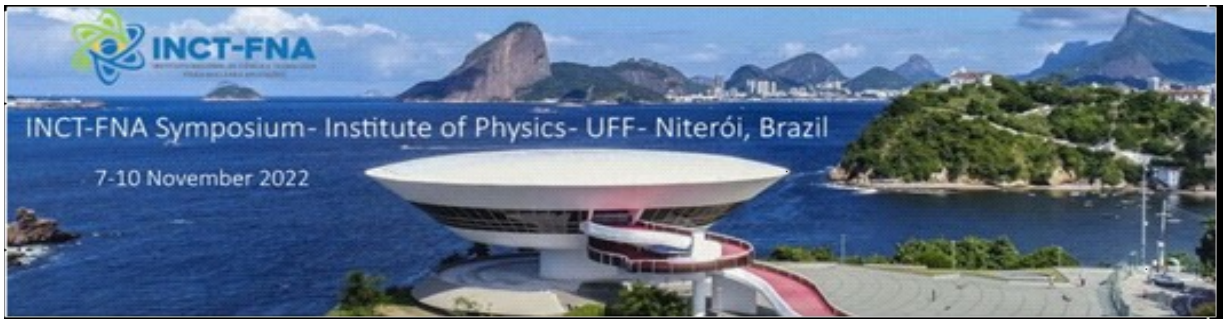


Poster FA04 - Data fusion of XRF and vis-NIR to predict soil exchangeable calcium in soil

Felipe Rodrigues dos Santos, José Francirlei de Oliveira, Graziela M. C. Barbosa and Fábio Luiz Melquiades*

Applied Nuclear Physics Laboratory, State University of Londrina (UEL), Londrina-PR, 86057-970.

X-ray fluorescence (XRF) and visible and near-infrared (vis-NIR) have proven to be capable of predicting soil properties. Both techniques allow fast soil analysis with minimal or no sample preparation, providing inferences about different soil constituents. Recent studies have demonstrated that XRF and vis-NIR data fusion can improve the quality of predictive models for soil attributes (Javadi and Mouazen 2021; Tavares et al. 2021; Teixeira et al. 2022). Although promising results have been related, there is still no established data fusion approach for soil fertility prediction. Moreover, few studies assess the synergism among different techniques and how their complementarities/differences may improve the knowledge about the sample. For this purpose, p-ComDim analysis was used as data fusion approach to predict exchangeable calcium in a soil toposequence derived from basalt. P-ComDim provides the common sources of information shared by each technique assessing which information in the different techniques is relevant for the prediction of an attribute (El Ghaziri et al. 2016). A relative improvement of 30% and 33% was observed comparing p-ComDim with vis-NIR and XRF individual models, respectively. Moreover, p-ComDim result was better when compared with the two approaches most used in literature for soil fertility prediction. In addition to predictive improvement, p-ComDim analysis allowed us to verify that samples with the highest contents of exchangeable calcium are associated with total contents of K, Mn, Ca, Ti, Mn, Zn, and P (determined by XRF) as well as the visible region from 400 to 440 nm and NIR bands at 1900, 2210 nm. Therefore, this study demonstrated the potential of p-ComDim for vis-NIR and XRF data fusion to predict exchangeable calcium in soil. Furthermore, p-ComDim method reveals the complementarity and differences between vis-NIR and XRF techniques, assessing the importance of each technique for exchangeable calcium prediction in soil.

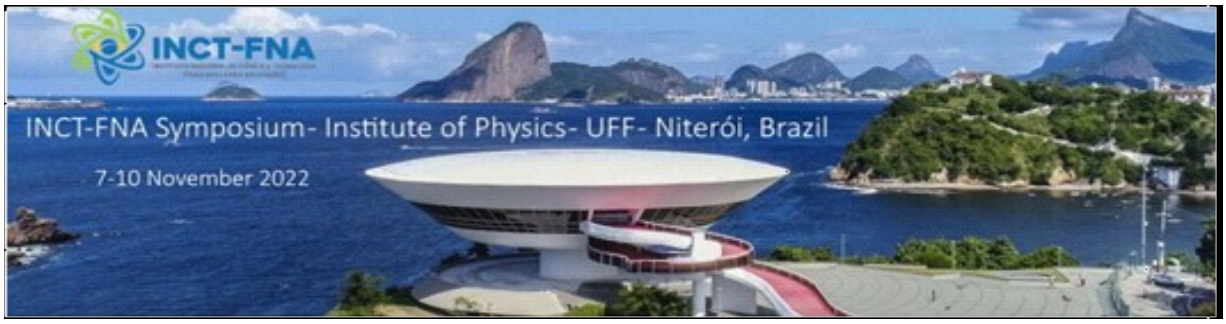


Poster FA05 - Quantification of metals in e-cigarette refill liquids using Total Reflection X-Ray Fluorescence (TXRF) and Principal Component Analysis

Gabriel Minto Faria, Paulo Sergio Parreira, Tiago Dutra Galvão and Fabio Luiz Melquiades*

Applied Nuclear Physics Laboratory, Universidade Estadual de Londrina, Rodovia Celso Garcia Cid, PR-445, Km 380 - Campus Universitário, Londrina - PR, 86057-970

E-cigarettes are electronic devices that simulate conventional tobacco. Due to its recent creation (2000s), the risks to human health are uncertain, and its effectiveness in addict cessation divides opinion in the scientific community. They operate by vaporizing an e-liquid composed of vegetable glycerin, propylene glycol, flavorings, and nicotine. An important subject is determining if toxic metals are present in e-liquids. The most applied technique in this analysis is the ICP-MS, but as related in the literature, the complex sample preparation and matrix interferences appear to be its major drawbacks. As an alternative, TXRF reaches similar quantification limits (ppb) and has great advantages, the sample preparation is simple and the grazing incident angle of the X-Ray beam almost extinguishes the interferences by matrix effect. In this study, 38 e-liquids were analyzed by TXRF and the concentration of 5 toxic metals (Br, Cr, Cu, Ni, Pb) was determined and confronted to the resources of potable water established by Anvisa. Furthermore, the principal component analysis (PCA) was applied to investigate correlations between samples. Sterilized quartz polished discs were used to sample preparation, with Gallium (200ppb) internal standard and a benchtop TXRF equipment was employed in the analysis. After the spectrum acquisition and elemental quantification, ten samples presented metals surpassing the potable water limits for toxic metals. In two samples these concentrations were highly surpassed, reaching 6 times the limit for Ni and 7 and 14 times the limit for Pb. The PCA could separate these two e-liquids as outliers, indicating that these high levels of metals are anomalous in relation to the other samples. TXRF presented several advantages to the common techniques and the PCA could help to investigate relations between samples. This methodology could be easily reproduced and could contribute to quality control of the electronic cigarette refill liquids.

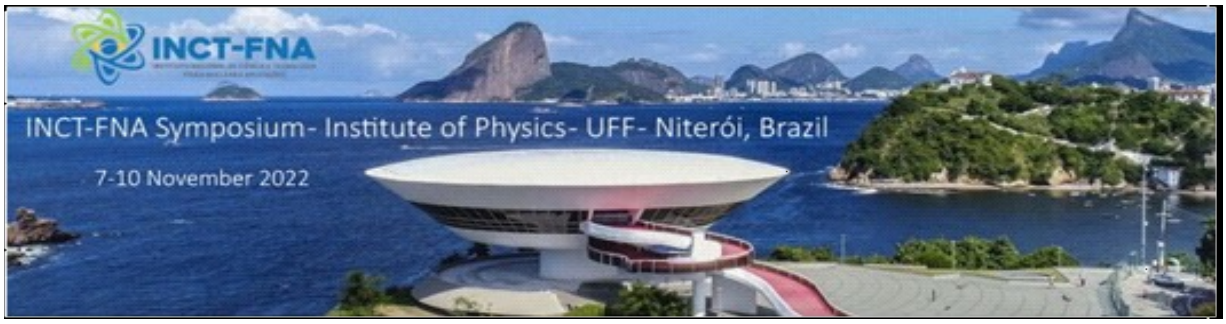


Poster FA06 - Mean transit time of carbon estimated through 14CO2 measurements in a vertical profile in the central Amazon

Ingrid Chanca, Ingeborg Levin, Carlos Sierra, Samuel Hammer, Susan Trumbore, Kita Macario, Jost Lavric and Alessandro Araújo*

Max Planck Institute for Biogeochemistry

The Amazon rainforest is important in the global carbon balance, but there is still a lack of information regarding the time scales of carbon cycling in these forests. One useful timescale metric is the transit time of carbon (TT), defined as the age of carbon exiting the ecosystem, mostly as respiration (ER). To estimate the mean transit time of ecosystem respiration, we took advantage of the large variations in CO_2 in the atmosphere below the forest canopy to estimate the radiocarbon signature of mean ER using the Miller-Tans model. We collected samples of air in a vertical profile in 2019 during the dry season at the ATTO (Amazon Tall Tower Observatory) site, in the central Amazon, ca. 150km NE of Manaus, Brazil. Air samples were collected in a diurnal cycle from two heights below the canopy (4m and 24m) and, for the background, above the canopy at 79m. The Miller-Tans model estimated Δ14CER = 32.0 ± 7.4‰. An estimate of the mean transit time is derived from comparing this value with the atmospheric Δ14CO2 records that show values of 32 - 34‰ in the years 2012 - 2013. Therefore, the mean TT for the ATTO site is estimated in 6 to 7 years with an uncertainty of 2 years. This result is consistent with other TT estimations obtained through simulations and compartmental models of tropical forest.

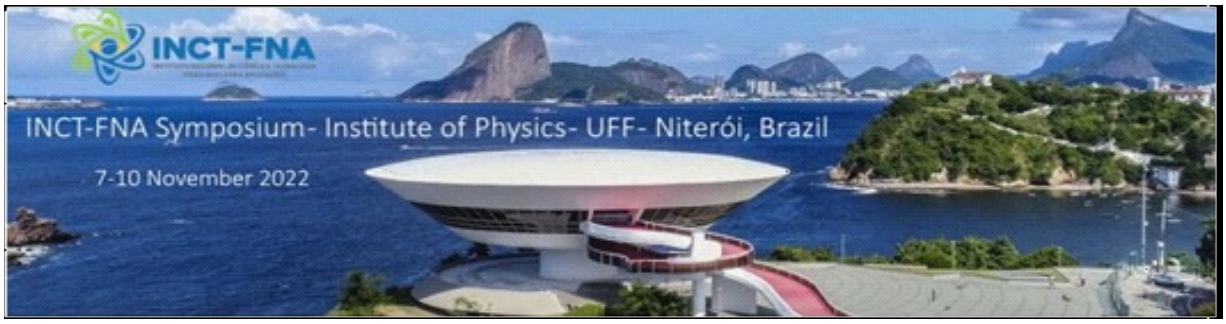


Poster FA07 - Elemental analysis of saliva samples affected by peri-implant diseases using X-ray fluorescence

João Marcos Fávaro Lopes, Avacir Casanova Andrello and Ítalo José Vitorino Netto*

Applied Nuclear Physics Laboratory, State University of Londrina, 86057-970, Londrina, PR, Brazil

The study of biological fluids is important to understand how a organism behaves in the presence of a disease and to evaluate the effectiveness of medical treatments. Therefore, studying these kinds of samples with different techniques has become common nowadays. Among these fluids, saliva can be studied to find the correlation between it's components and disorders with the human body. This work uses total reflection X-ray fluorescence (TXRF) to analyze saliva samples collected from 10 patients suffering from peri-implantitis divided into three groups according to their sampling sites and verify: (i) which elements can be associated with peri-implantitis; (ii) how the disease acts upon the implants; and (iii) how the corroded titanium from the implants behaves in the oral cavity. The analysis showed that the elements Fe, Cl and Zn can be associated with the body's response to the infection, while S is a product of the bacteria acting upon the implants. The principal component analysis showed a tendency of grouping the peri-implantitis samples in function of Fe, S and Cl. It was also possible to identify that the Ti corroded from the implants is absorbed by the gum tissue. This work showed that TXRF can be used to study diseases behaviours and which elements can be associated with it, the authors suggest that it is posible to extend this kind of study to other diseases that may act upon the human body.

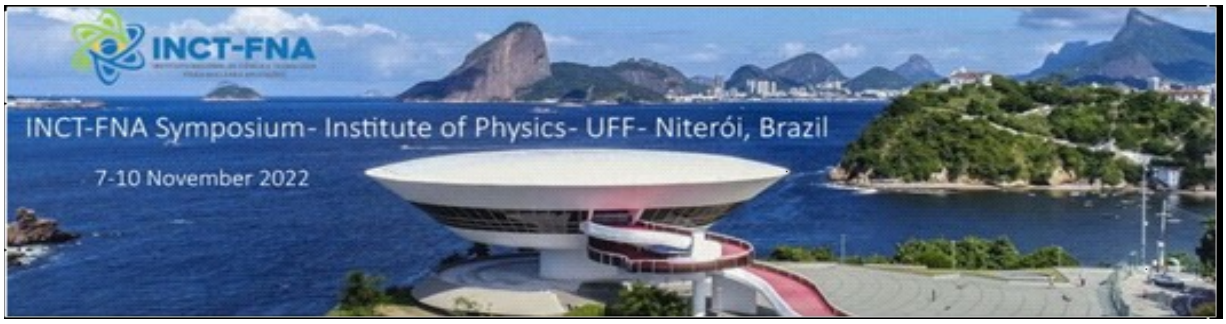


Poster FA08 - pXRF spectral data combined with PLSR to determine SOC, CEC, and SB of soil

José Vinícius Ribeiro, Felipe Rodrigues dos Santos, José Francirlei de Oliveira, Graziela M.C. Barbosa, Fábio Luiz Melquiades*

Applied Nuclear Physics Laboratory, State University of Londrina (UEL), 86057-970 Londrina, PR, Brazil

Soil nutrition is one of the main factors for agricultural production. For the conservation of nourished and productive soil, the periodic analysis of its fertility attributes is necessary. Among them, the quantification of the soil organic carbon (SOC), cation exchange capacity (CEC) and the sum of exchangeable bases (SB) is essential to estimate the physicochemical state of the soil. These parameters are indicators of chemical fertility and are traditionally evaluated in laboratories through acidic or basic extractions, using techniques that, although accurate, require sample preparation, are destructive, time-consuming, use reagents, and generate waste. As an alternative, the development of time- and cost-effective quantitative methods based in green chemistry for soil analysis has become a priority in recent years. In this study, soil samples were subjected to portable X-ray fluorescence (pXRF) and associated with multivariate analysis to quantify SOC, CEC, and SB. The models were developed using partial least squares regression (PLSR). Three spectral conditions (15, 30, and 50kV) and two preprocessing were tested (Poisson scaling + mean center and Pareto scaling). The best results for evaluated parameters were verified with Poisson Scaling + mean Ccnter pre-processing, with 15kV being the best condition for SOC and CEC while for SB was 30kV. The use of pXRF spectral data for SOC, CEC and SB prediction in this dataset proved to be feasible. The models were considered very good (2.5 > RPD > 2.0) and are recommended for quantitative prediction. The results contribute to the establishment of pXRF associated with multivariate analysis as an alternative methodology to conventional analyses, demonstrating its potential as an efficient, economic, and ecological procedure for the determination of SOC, CEC, and SB in soil.

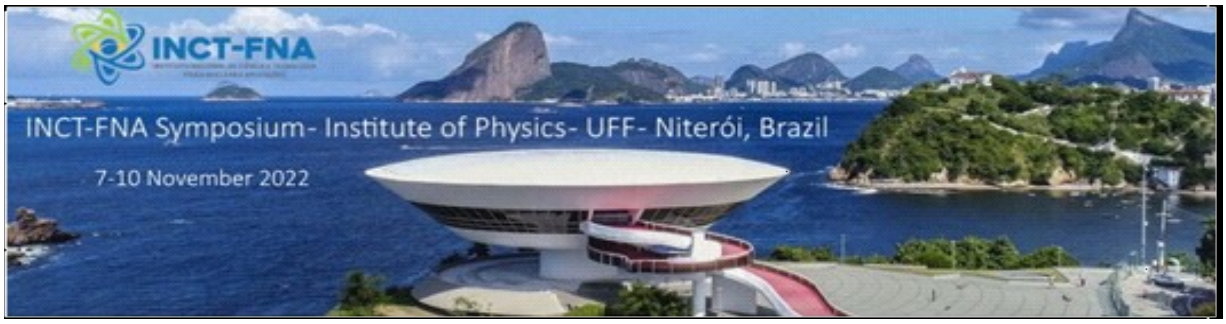


Poster FA09 - Radiocarbon dating as a forensic application in ivory samples

Karolayne Silva dos Santos and Kita Macario*

Universidade Federal Fluminense, Gragoatá, Niterói - RJ, 24210-346

The present work aims to fill a gap presented by the Brazilian Federal Police regarding the certification of art objects made from ivory. This application of the radiocarbon dating has been under development during the last decades. Through this technique, it is possible to estimate the date of death of the elephant, whose tusks were used, based upon the quantification of the 14C produced by nuclear bomb testing during the XX century. Therefore, in forensic cases, when samples of ivory are confiscated, it is possible to know if those samples entered in circulation before or after the prohibition of commercialization established by the Convention on International Trade of Endangered Species from Wild Flora and Fauna (CITES). This prohibition aimed to decrease the hunting of elephants, since ivory has high commercial value. Obstacles in the accurate determination of age in this case comprises the understanding of trunk growth, the provenance of the elephant and the sampling protocols. At the Radiocarbon Laboratory of Universidade Federal Fluminense (LAC UFF), ivory samples were analyzed by Accelerator Mass Spectrometry (AMS). This work presents the chronology of the dated samples and the aspects that can influence the results so that the technique can be a useful tool for forensic sciences in Brazil.

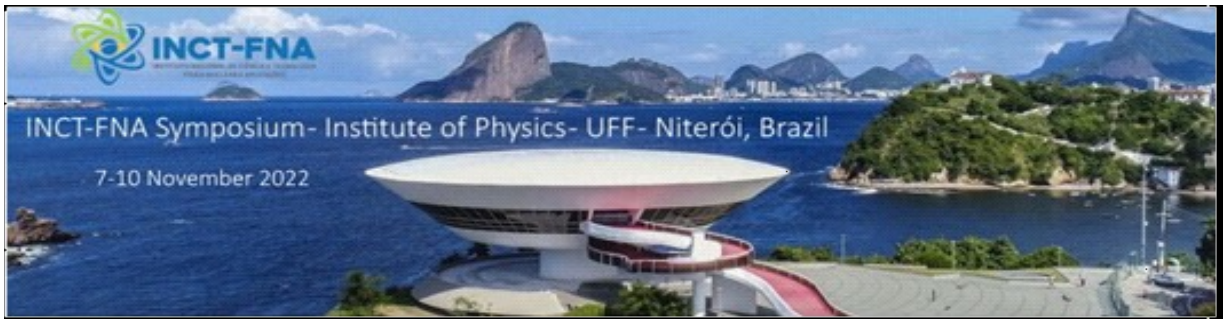


Poster FA10 - pXRF analysis of three paintings by Thomas Gainsborough

Letícia Martins Birelo, Carlos Roberto Appoloni*

Applied Nuclear Physics Laboratory, State University of Londrina (UEL), 86057-970 Londrina, PR, Brazil

Three paintings of Thomas Gainsborough, Francis Rawdon (1783-1784), Portrait of Mrs. John Bolton (1770) and Drinstone Park (1747), belonging to the collection of MASP were analyzed. This study aimed at non-destructive and in situ analysis of the paintings using pXRF at MASP. This methodology allows to obtain information about the materials and pigments used by the painter. The pXRF was equipped with a SiPIN detector by Amptek and a mini Moxtek X-ray tube with W anode, which was set at voltage of 30kV and current of 4μA, and an Ag collimator of 3mm at the entrance of the detector. Respectively 57 areas, 37 areas and 42 areas, of each painting were investigated. For data acquisition the software DppMCA created by Amptek was used, and for data analysis it was employed the software PyMCA, version 5.5.0, created by ESRF. Due to the restricted palette of pigments used by the painter, the spectra are reasonable similar to each other, presenting the following elements: S, K, Ca, Co, Cr, Mn, Fe, Cu, Zn, Hg e Pb. It was verified that the characterization of the light elements with the W tube was adequate, considering the detector energy resolution of 149eV for the 5.9KeV Mn line. With this analysis the following materials/pigments were indicated: Lead White; Zinc White, Calcium Carbonate/ Calcium Sulfate; Ivory Black; Chrome Yellow; Yellow Ochre; Prussian Blue; Cobalt Blue; Vermillion; Red Iron Oxide; Umber earth; Sienna earth and White Vitriol, which is a drier used by eighteenth century artists. All indicated materials are in total agreement with the literature about other Gainsborough paintings. It was also identified three paints of the 19th century in some areas of the paintings, the Chrome Yellow in all three paintings, and the Zinc White and Cobalt Blue in two of them, indicating areas which were restored.

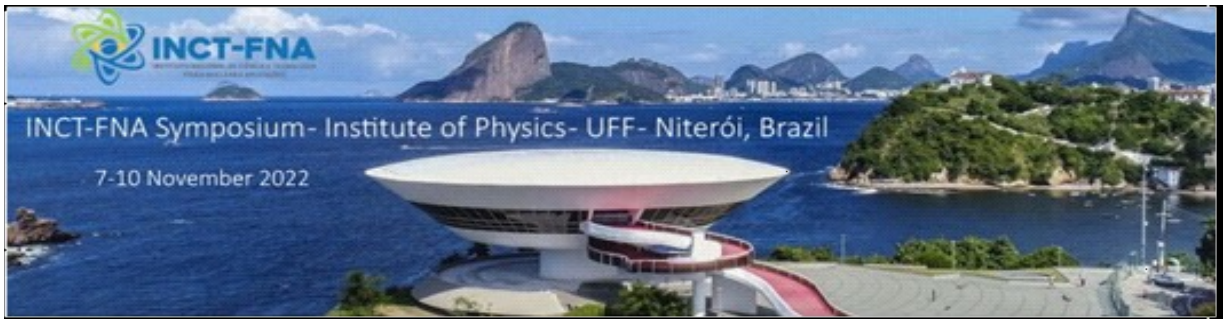


Poster FA11 - Laboratory of Sample Preparation for ^{14}C Dating via Accelerator Mass Spectrometry at UFBA

Tárcio Henrique Ribeiro dos Santos, Maria do Rosário Zucchi, Alexandre Barreto Costa, José Roberto Bispo de Souza, José Marques Lopes, Fabiana Monteiro de Oliveira and Kita Chaves Damásio Macário*

Instituto de Física - Universidade Federal da Bahia (UFBA), Rua Barão de Jeremoabo s/n, Campus Universitário de Ondina, Salvador - BA, Brasil CEP: 40170-115

The study of the carbon cycle and, especially, its radioactive isotope ^{14}C has provided the resolution of several problems concerning marine, geological, environmental, archaeological processes, etc. The development of the radiocarbon dating technique has been going on since the 1950s by measuring the decay rate of this isotope. With the development of mass spectrometry with particle accelerators, it became possible to date samples with approximately 1 mg of carbon. This work presents the calibration process of this laboratory of sample preparation for ^{14}C dating at UFBA using the technique of mass spectrometry with accelerators to apply it in paleoenvironmental, archaeological studies, etc. The creation of this laboratory is part of the INCT - Nuclear Physics and Applications project and has the main collaboration of the Laboratory of ^{14}C Samples (LAC) of the Physics Institute of the Fluminense Federal University - UFF. This laboratory is prepared regarding equipment and materials; is in the recovery phase after the pandemic and starting the intercalibration work with the LAC to validate the preparation routine and apply the technique in organic and inorganic samples from different matrices. Part of the graphite produced with the C2, C6, C9 and OXII standards were analyzed in the Accelerator Mass Spectrometry (AMS) system at LAC-UFF, to validate the preparation routine performed about the absence of contamination. In another part of the graphite, replicas were made for measurements of $\delta^{13}C$ in the Elementary Analyzer coupled to the Isotope Ratio Mass Spectrometer (EA-IRMS) in the LFNA-UFBA to study the isotopic fractionation and yield of the graphitization reaction. The creation of this laboratory in Bahia will make research in this area more accessible, mainly for the North and Northeast regions of Brazil.

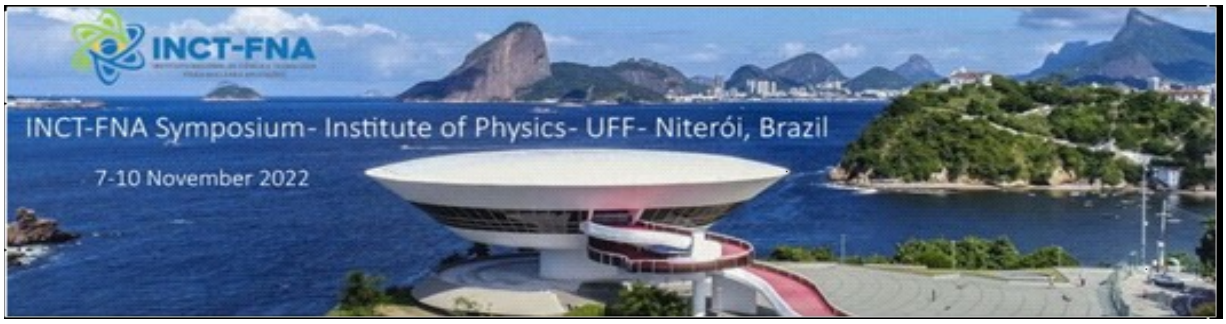


Poster FA12 - Influence of staining time on the quality of microtomographic images obtained by DICE-CT in adult Aedes (Stegomyia) aegypti (Linnaeus, 1762) samples

Mateus Gruener Lima, Eduardo Inocente Jussiani, Avacir Casanova Andrello, João Antonio Cyrino Zequi and Edson Kenji Kawabata*

Applied Nuclear Physics Research Group, State University of Londrina, Rodovia Celso Garcia Cid/Pr 445 Km 380, 86057-970, Londrina, Paraná, Brazil

The application of X-ray micro-computed tomography in biological samples of soft tissue, such as insects, is a challenge because of the low values of the attenuation coefficients and the low contrast between the structures. In the last decade, the DICE-CT (diffusible iodine-based contrast-enhanced computed tomography) technique was developed and uses iodine as a contrast agent. Due to the recent development of the technique and the great variety of biological samples of soft tissue, many specimens have not yet been micro-CT scanned, and an adequate methodology must be developed for that. That is the case of the mosquito of great sanitary importance, the Aedes aegypti. Within the context of DICE-CT, the present work aimed to apply different staining times in females of A. aegypti, evaluating the influence of staining time on the images to determine the most suitable, and to study by micro-CT the mosquito in the adult stage for the first time in the literature. Seven samples went through the fixation, dehydration, staining, and washing stages. Except for the staining step, every step was performed equally. For staining, each mosquito remained for a different time, between 6 and 72 hours, in the iodine solution (1%). For comparison, a mosquito was not stained. After treatment, mosquitoes were measured on the SkyScan-Bruker 1172 micro-CT scanner and reconstructed under the same settings for adequate comparisons of results. After the analysis, was revealed that it was possible to identify several morphological structures after the iodine staining. Furthermore, was observed that times shorter than 18 hours were not enough to increase the contrast, and times longer than 24 hours saturate some structures, which could lead to loss of information. In conclusion, the technique was effective in studying insect samples, and times around 20 hours are the most suitable for morphological studies of A. aegypti mosquitoes.



Poster FA13 - Electrical Characterization of Power Transistors under Ionizing Radiation Effects - Linear Transistors and ELT Transistors

Paulo R. Garcia Jr, Marcilei A. Guazzeli, Ana L. Guidi, Alexis C. Vilas Bôas, Renato C. Giacomini, André L. Perin*

Centro Universitário FEI, SBC, SP, Brazil

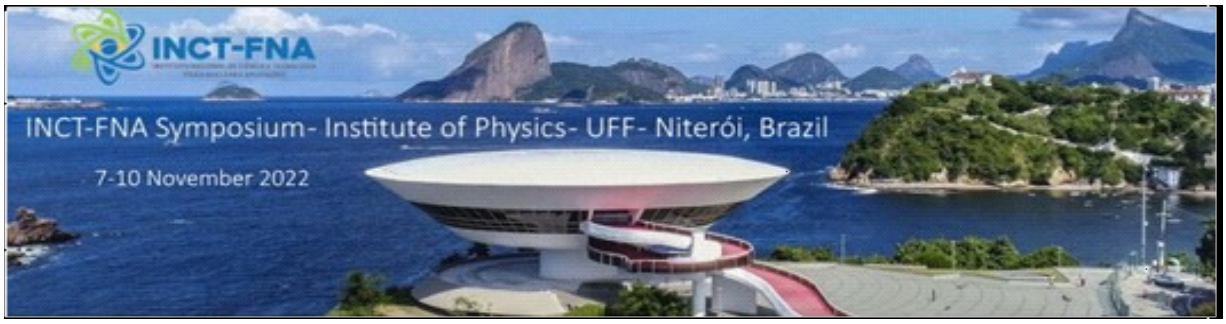
The invention of transistors was of immense importance for the development of technologies used daily, the tool was introduced to the world in the 1950s, and today it is present in most electronic equipment used by humans, including the aerospace area, particle accelerators and others that require tolerance to the effects of ionizing radiation. Considering this, new techniques are being used to reduce the radiation effects in

power transistors, such as the ELT structure, witch use polysilicon around the drain and source terminals in other to promote a good isolation in those terminals [1].

Therefore, this work presents the effects of Total Ionizing Dose (TID) on an integrated circuit (IC) PPTLEXT06SOID40 with five transistors, three of them are linear transistors and the others are Enclosed Layout Transistors (ELT). The IC were characterized before, during and after exposing to 10-keV X-ray beam. The electrical parameters that determine the functionality of the device both in ON and OFF MODE were analyzed. During the ON MODE the gate terminal was polarized, and the other terminals grounded.

In the OFF MODE all the terminals were grounded. The radiation dose rate was adjusted to 100 krad(Si)/h accumulating a total dose of 300 krad(Si) in the device under test (DUT). During both modes, the irradiation occurred in one step until the device accumulated 300krad.

The characteristic curves IDSxVGS and IDSxVDS were analyzed and the parameters of transconductance and threshold voltage were determined to verify the tolerance of the DUT as a function of the trapping of charges generated by ionization caused by radiation. The results show that the devices present major changes in its electrical parameters, which indicates that the devices are not good candidates to be used in harsh environments with exposure to the effects of ionizing radiation [2,3].



Poster FA14 - Study of ceramics of the XVIII and XIX centuries from Brazilian slave quarters by EDXRF and multivariate analysis

Cheila S. de Araújo, Carlos R. Appoloni, Renato A. Ikeoka and Luis C. P. Symanski*

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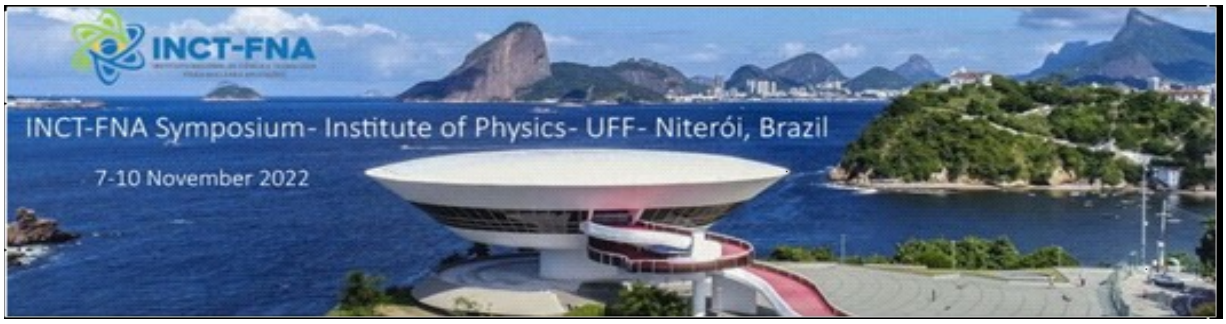
In Brazil, archaeological research on sites of African and Afro-descendant occupation is sti l scarce, although these studies have mobilized several researchers to complement written records with material culture only in the last few decades These materialized vestiges found are an important access to the history of slavery, a lowing, then, to explore the diversity of practices that were carried out. Therefore, the present study refers to the archeometric analysis of ceramic fragments found in archaeological excavations around slave quarters of Colégio dos Jesuítas and São Bento plantations, both located in Campos dos Goytacazes- RJ. They are part of the project caled “Coffee with sugar: archeology of slavery in a comparative perspective in the rural slave south-east, from the 18th and 19th centuries”. The question whether handmade ceramics were produced by the slaves themselves or acquired through local trade networks is an open and important question in the African diaspora. The ceramic fragments and samples of clay sources were analyzed using the Energy Dispersion X-Ray Fluorescence technique with the aid of multivariate statistical analysis (PCA and HCA). The analysis by PCA and HCA showed that the samples from the four clay sources are different from each other and that its manufacturing method had no influence on the final result, i.e., there was no significant difference between the samples made in an oxidizing environment in the electric oven and those made with handmade burning. The ceramic fragments differ statistica ly among them, showing that there is no similarity between fragments in relation to the excavation area. In the combined analysis, the results of PCA and HCA showed a clear separation between samples of clay sources and ceramic fragments, indicating that the ceramic fragments were not made with clays from the clay sources close to the slave quarters.



Poster BE01 - One-neutron transfer, complete and incomplete fusion for the ^{9}Be + ^{197}Au system

B. Paes, D. Abriola, A. Arazi, M.A. Cardona, E. de Barbará, J. de Jesús, F. Gollan, D. Hojman, R.M. Id Betan, J. Lubian, A.J. Pacheco, D. Schneider and H.O. Soler*

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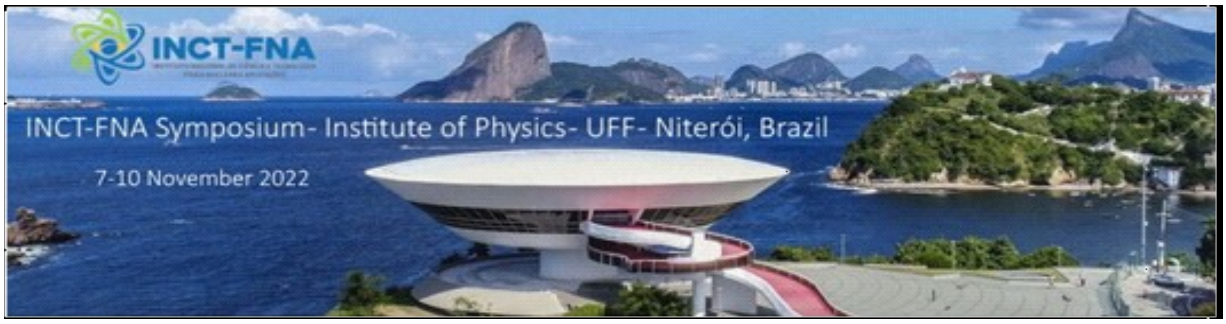
In the last few years, a large number of activities related to the study of the weakly bound nuclei at energies around the Coulomb barrier was investigated. These studies involved both experimental and theoretical aspects. All the theoretical analysis were performed using the parameter free São Paulo potential (SPP) as an optical potential [1]. A consistent treatment of the elastic, inelastic, transfer, breakup and fusion channels [2-4], together with the energy dependence of the optical potential near the Coulomb barrier [5-8] and the effect of breakup channels on other reaction channels [3,9-14] was performed.

In this work we investigated the one-neutron transfer and complete and incomplete fusion reactions for the ^{9}Be + ^{197}Au system at 33 bombardment energies between 22 and 50.5 MeV. All of these experimental data was measured at the Tandar Laboratory in Buenos Aires, Argentina. In order to study the elastic and inelastic cross sections a coupled channel (CC) calculations were used. For the transfer cross section a

coupled reaction channels (CRC) calculations were made and also a coupled discretized channels calculations (CDCC) of three bodies to determine the effect of the breakup channel on the other reaction mechanisms.

The description of the transfer experimental data has a good agreement with that calculated theoretically, together with the conclusion of a large dependence on the number of excited states, of the residual nucleus, included in the calculation. The reduction of complete and total fusion was found to be decreased above and increased below the barrier of Coulomb vs. universal fusion function (UFF) due to projectile breakup plus transfer effects.



Poster BE02 - Investigation of the transfer reactions induced by ^{16}O in ^{27}Al and ^{28}Si at E_{lab} = 240 MeV

C. C. Seabra, R. Linares, V. A. B. Zagatto, F. Cappuzzello, M. Cavallaro, D. Carbone, C. Agodi, J. R. B. Oliveira*

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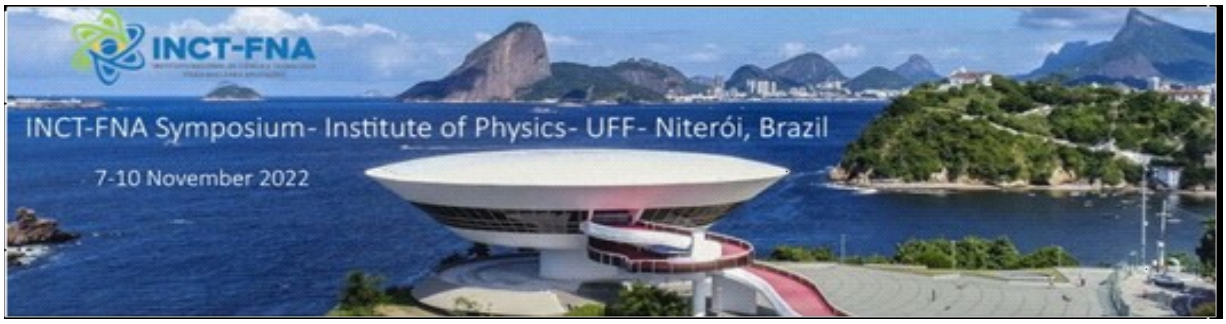
Transfer reactions are powerful tools to probe single particle configuration as well as correlations of nucleons inside atomic nuclei. Advances on theoretical models and increasing of the computational power have allowed to achieve a good description of transfer reactions induced by heavy ions and to study details in the two-nucleon transfers. In such process, the particles can be transferred in a simultaneous, in which the di-nucleon system is transferred in a single step, and sequential processes, in which the two nucleons are independently transferred. Comparisons between high-quality angular distribution of the experimental cross sections for the two-neutron transfer and calculations indicates that the simultaneous transfer is the main process in the $^{12}C(^{18}O,^{16}O)^{14}C$ reaction at $E_{lab.}$ = 84 MeV [1]. The process by which the two particles are transferred depends on the target nucleus. For instance, in the $^{28}Si(^{18}O,^{16}O)^{30}Si$ reaction at the same energy, calculations indicate a competition between the simultaneous and sequential processes [2].

In this work we will present experimental results for the deuteron pick-up transfer in the $^{16}O+^{28}Si$ system at $E_{lab.}$ = 240 MeV. This reaction populates states of the ^{26}Al target-like nucleus. In the same experimental campaign we also measured the single particle transfers $^{28}Si(^{16}O,^{17}O)^{27}Si$, $^{28}Si(^{16}O,^{17}F)^{27}Al$ and $^{27}Al(^{16}O,^{17}O)^{26}Al$ at the same beam energy. These measurements were performed at the Istituto Nazionale di Fisica Nucleare - Laboratori Nazionali del Sud, Catania, Italy, and analyzed by the MAGNEX spectrometer. Elastic and inelastic scattering were also measured during this experimental campaign, which allowed a good definition for the optical potential parameters for these systems [3].



Poster BE03 - 2p2n-QTDA for Double Beta Decay and Double Charge-Exchange Reactions

C. De Conti, V. dos S. Ferreira, A.R. Samana, C.A. Barbero and F. Krmpotić*

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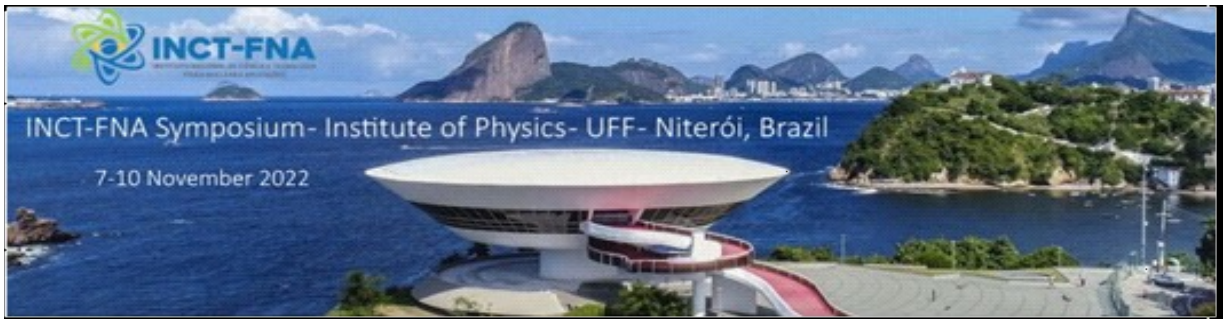
We developed a nuclear model, 2p2n-QTDA, designed to describe ββ-decay and double charge-exchange reactions, which is a natural extension of the pn-QRPA model for single β-decay to ββ-decay (Ferreira, 2020). Ergo, this model, in addition to including the pairing correlations and having the same number of free parameters, brings into play the proton-proton and neutron-neutron quasiparticle excitations and the Pauli Principle, which are essential ingredients to correctly account for the nuclear matrix elements for ββ-decays and nuclear reactions to all 0^+ and 2^+ final states, including resonances, and not just to the ground state as in pn-QRPA. In addition, it allows us to evaluate the Q-values, and the excitation energies in final nucleus, and to work with a single-particle space large enough for the double charge exchange sum rules to be satisfied. So far it has been applied to the 2νββ-decay, and here we extend it to the 0νββ-decay. The model that comes closest in terms of its advantages is the shell model, but so far it has only been used in light nuclear systems. We describe here the double charge exchange observables in: i) ^{76}Se, which have been recently measured in the GERDA and MAJORANA Experiments (Agostini, 2020; Arnquist, 2021) , and ii) ^{124}Te, for which has been reported recently the first direct observation of 2ν double electron capture with the XENON1T Dark Matter detector (Aprile, 2019). A good agreement with the data is obtained for both the ground state and the excited states.



Poster BE04 - One deuteron transfer in the $^{19}F(^{6}Li,^{4}He)^{21}Ne^{*}$ at 20 MeV energy incident

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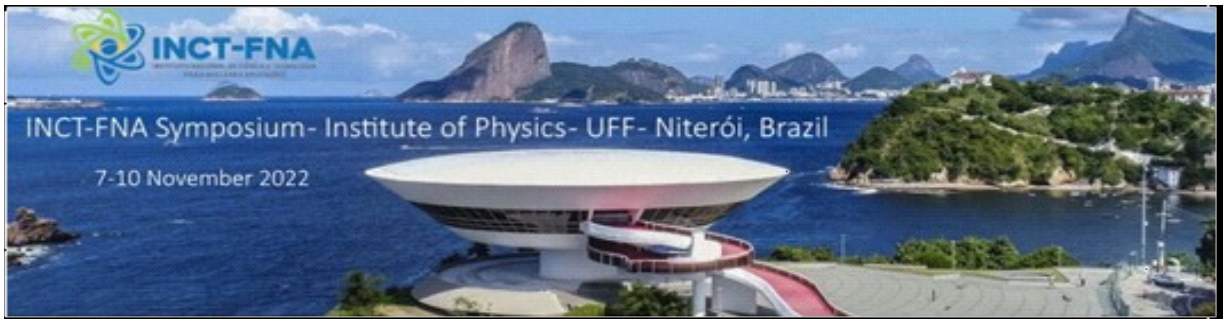
The experimental data of elastic scattering and angular distributions of one deuteron transfer for the $^{6}Li+^{19}F$ system at 20MeV in the laboratory frame was measured at the TANDAR facility [1]. The deuteron can be transferred via simultaneous (one-step) or sequential (two-step) processes. The studies of these processes are important to obtain information about the effects of the paring correlation between neutrons and protons, checking which mechanism is dominant in the reaction process.

Coupled reaction channel (CRC) and coupled channel Born approximation (CCBA) calculations were performed using the Fresco code [2]. The spectroscopic amplitudes were performed by shell model calculations using the NushellX code [3]. The experimental data distributions of $^{19}F(^{6}Li,^{4}He)^{21}Ne^{*}$ were described reasonable well by the theoretical result calculations. One can observe that the one-step process is dominant, and the two-step process is about two orders of magnitude smaller than the direct process. Therefore, the dominance of direct two-nucleon transfer suggests a strong np correlation.



Poster BE05 - Investigation of the elastic scattering of nuclei with mass A=13 on ^{208}Pb target at intermediate energies

E. O. N. Zevallos, V. Guimarães, Y. Y. Yang, E. N. Cardozo, J. Lubian and RIBLL Collaboration*

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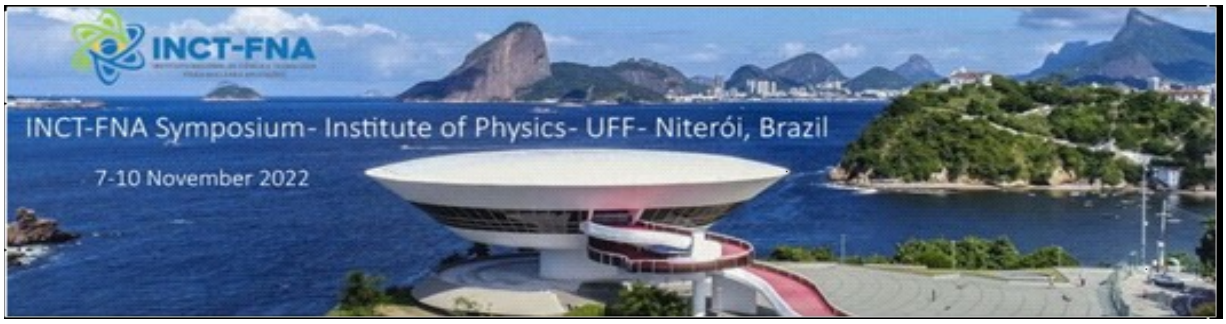
In this work we performed an alternative analysis on the previously published data of ^{13}B+^{208}Pb (254 MeV) and ^{13}O+^{208}Pb (414 MeV) [1] and a complete analysis for the unpublished data of ^{13}B+^{208}Pb (242 MeV). These data were obtained at the Laboratory of the Heavy-Ion Research Facility in Lanzhou (HIRFL) [2,3] within the collaboration of the NEAN group in São Paulo and the group in of Lanzhou. To complete a systematic study of projectiles with mass A=13, we also analyzed elastic scattering data for the ^{13}C+^{208}Pb (390 MeV) system, also already published [4]. The systems were measured at intermediate energies, around five times above the Coulomb barrier. The data analysis involved optical model calculations, coupled channel calculation, reorientation effect, continuum discretized coupled channels (CDCC). The code used for these calculations is FRESCO [5].



Poster BE06 - The energy-dependent behavior of polarization potentials

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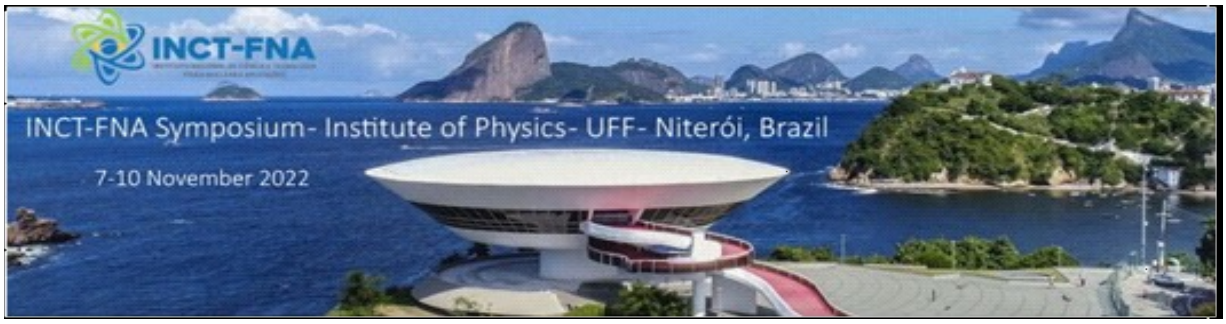
One of the successful formalisms to systematically describe the elastic and fusion data of weakly-bound systems is the Extended optical model (EOM). We use the EOM to analyze different reactions with weakly-bound projectiles on medium- and light-mass targets. The São Paulo potential is used as a bare potential, and surface and fusion polarization potentials, UD and UF, are added to simulate the effects of couplings to direct and fusion reactions, respectively. The parameters of the polarization potentials are optimized using the FRESCO code, and the validity of the dispersion relation is verified for the systems considered. The energy-dependent behavior of the respective direct reaction and fusion polarization potentials indicates different features for the light-mass target compared to the medium-mass ones. The energy-dependent behavior found and the corresponding threshold anomalies are discussed.



Poster BE07 - Investigation of cluster structure in ^{13}C by the of ^{9}Be(^{13}C,^{9}Be)^{13}C and ^{9}Be(^{13}C,^{10}B)^{12}C transfer reactions

F. L. Miletto, M. Assunção, V. Guimarães, A. Arazi, M. B. Angelo, M. A. Cardona, E. De Barbará, L. M. G. Figueroa, J. Gómez, D. Hojman, P. D. Magro, M. Moyano, B. Paes, E. O. N. Zevallos*

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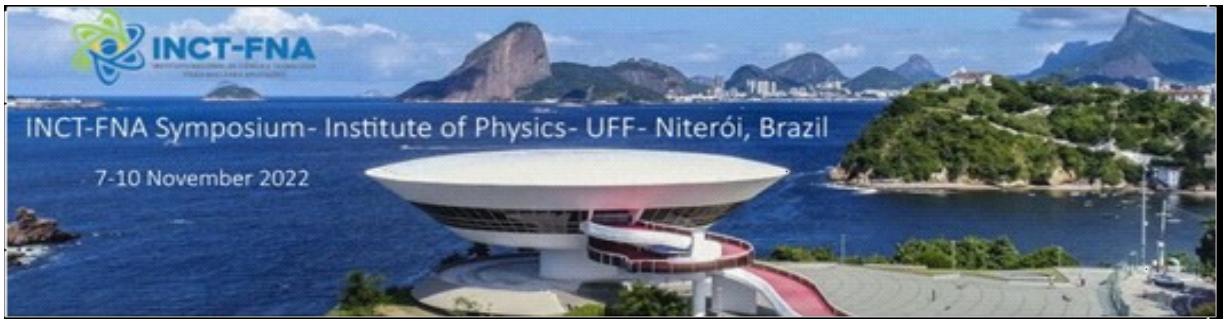
Cluster structure is an interesting phenomenon in light nuclei. Theoretical calculations [1] indicate that extra neutrons added to self-conjugate system, as ^{8}Be and ^{12}C, can give rise to a new form of clustering in nuclei, in where the extra neutron behaves as covalent particle, analog of covalent bonding in molecular physics. In the present work we are proposing to investigate the cluster structure of ^{13}C by the ^{9}Be(^{13}C,^{9}Be)^{13}C elastic transfer reaction (^{4}He transfer). A simultaneous analysis of the ^{3}He and neutron transfer reactions, ^{9}Be(^{13}C,^{10}B)^{12}C and ^{9}Be(^{13}C,^{12}C)^{10}B, will be also performed. The 13C beam from the 20 UD Tandem Accelerator, installed at the TANDAR-Argentina Laboratory, has been used as projectile for bombarding a ^{9}Be target of 2 mm thickness. The mentioned reactions have been measured at two energies, E_{lab}= 55 and 62 MeV, and at an angular range from q_{lab} = 7.5 to 80 degrees. A system of 4 DE-E silicon telescopes (called T4) was used to detect the ^{13}C, ^{12}C, ^{10}Be and ^{9}Be particles. In addition, the experiment allows for the investigation of excited states of transfer reactions beyond those studied by Barbadoro et al. [1], and still aims at obtaining the spectroscopic factor for $<^{13}C|^{9}Be+\alpha>$ from DWBA calculations. Details of the experiment and preliminary results are presented.



Poster BE08 - Investigation of nuclear reactions relevant for astrophysics using the Brazilian Nuclear Potential

*G. P. Cessel**

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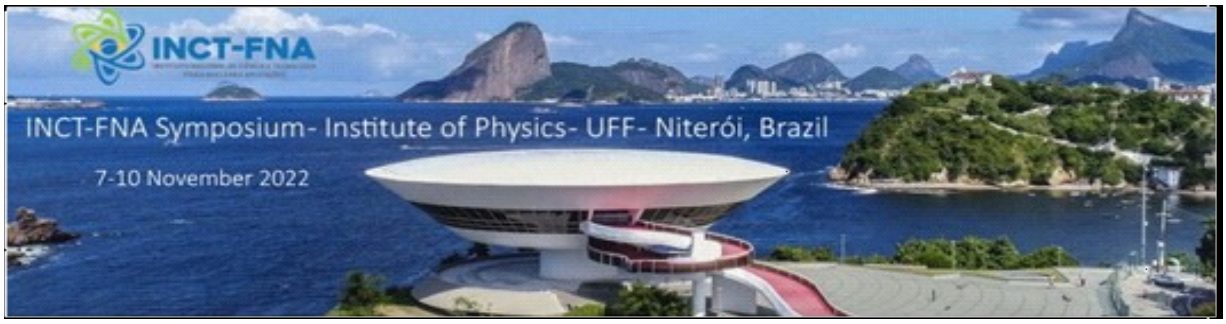
In general, the understanding of stellar nucleosynthesis and the evolution of massive stars comes from the study of the fusion of two nuclei forming a new compound nucleus. The present work investigates three reactions of paramount importance to astrophysics: $^{12}C+^{12}C$, $^{12}C+^{16}O$, $^{16}O+^{16}O$. Emphasizing the investigation of the first one, which was painstakingly constructed and evidenced in [1]. The analysis is based on a potential of nuclear interaction. Recently, a new theoretical approach for the real part of the nuclear interaction has been proposed by our research group. This model, named Brazilian Nuclear Potential (BNP) [2], is based on the double-folding method, which relies on two main ingredients: the density distribution of the nuclei and the nucleon-nucleon interaction. To calculate the fusion cross sections, the BNP has been used within the context of the coupled-channel (CC) formalism. The CC calculations were performed using the FRESCO code [3]. An imaginary potential, W(r), is adopted to simulate the corresponding absorption by the fusion process, being, therefore, directly related to the fusion probability of each J value (partial wave). Thus, we can also calculate the total fusion cross sections [1]. In our approach, the imaginary potential is proportional to a convolution of the matter density distributions of the reacting nuclei. Conventionally, fusion cross sections at very low energies, typical for astrophysical conditions, are represented by the so-called modified S*- fator (a change of scale in the analysis), which is proportional to Sommerfeld parameter, to center-of-mass energy and to a constant g , which varies according the reaction. To reproduce the magnitude and the resonant behavior of the data obtained from the S* -factor, three adjustable parameters have been adjusted within the CC calculation: Nr, Ni e X, which are related to the real part and imaginary part of the optical potential, respectively. Variations in the Ni parameter infer in a modification of width and magnitude of fusion cross secions. The corresponding position of the centroids of each resonance can be adjusted by small changes in the real part of the nuclear interaction. For this reason, for each J value, the BNP was multiplied by a normalization factor Nr.



Poster BE09 - About convergence in four-body treatment for reactions of ^{6}He projectile with heavy targets

H. O. Soler, M. Rodríguez-Gallardo and J.Lubian*

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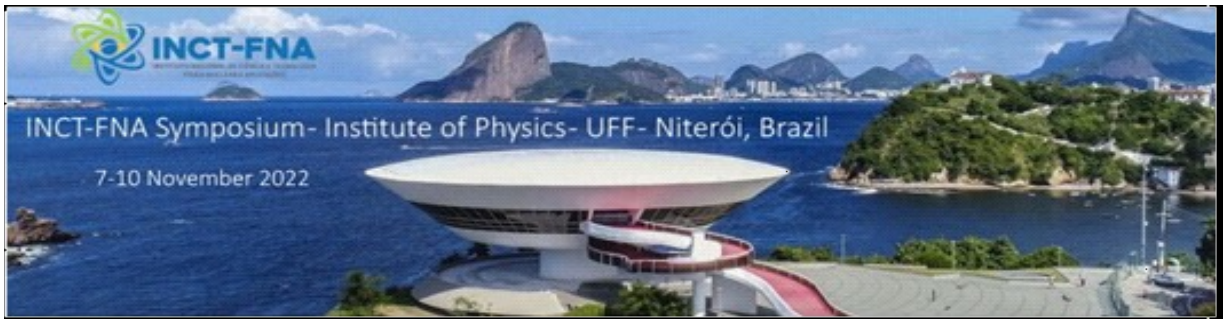
Due to the effect of the breakup channel on the nuclear reactions, interactions involving weakly-bound, exotic, stable, and radioactive nuclei have been investigated extensively in the last years. The fusion cross section, non-capture direct breakup, inelastic and transfer channels, and total reaction are examples of reaction channels that could be sensible to the breakup. Some methods are developed to study these types of reactions. A very successful method to study the breakup mechanism is the continuum-discretized coupled-channels (CDCC) method that explicitly considers the breakup channel. The method has been extensively used for three-body reactions (two-body projectile plus a target). Yet, an appropriate description of Borromean nuclei needs a three-body description for the projectile, considering the four-body CDCC formalism. The reactions induced by the Borromean nucleus ^{6}He can be described by four-body CDCC calculations. The four-body CDCC formalism using bin method was firstly implemented by Ref. [1] for three-body projectiles. The binning procedure was employed by using the hyperspherical coordinates. The elastic scattering angular distribution for ^{6}He+^{208}Pb where very well described using the maximum hyperspherical momentum K_{max} = 8, correspondent to the maximum relative orbital angular momenta between the fragments. This work is an attempt to address the inaccuracies that might appear in the truncation of the size of the hyper-momentum space considered in the four-body CDCC calculations concerning other observables.



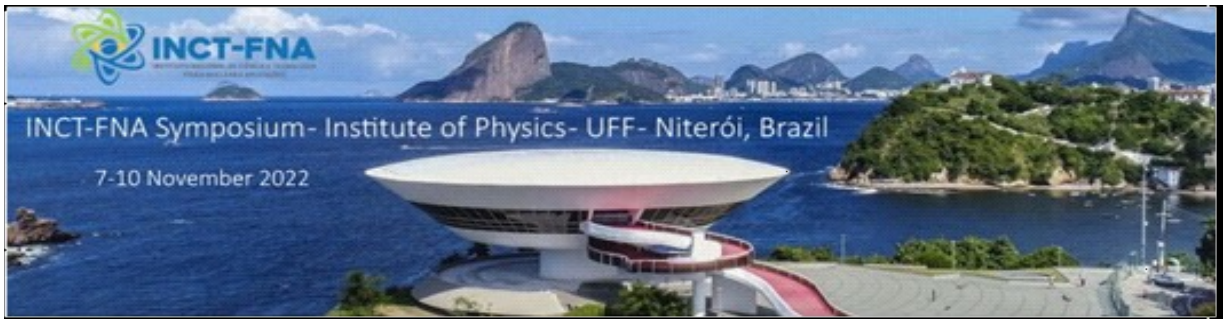
Poster BE10 - Nuclear Battery Sizing Based on Microreactor Technology

Orlandi, Horus I., Moreira, João M. L. and Rossi, Pedro C. R.*

Universidade Federal do ABC, Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas - Laboratório Interdisciplinar de Energia Nuclear (Nuc-Lab). Avenida dos Estados, 5001 – Bloco L. Santa Terezinha 09210-580 - Santo André, SP – Brasil

The present work aims to study microreactors based on heat pipe technology and proposes an innovative alternative that can be developed and built in Brazil. Heat pipe microreactors for terrestrial application, also called nuclear batteries, are an evolution derived from space reactors technology [1]. Its objective is supplying electricity and heat directly to end users in isolated systems, industries or via microgrids. The main targets would be factories, military bases, charging stations for electric vehicles, desalination plants, data centers, airports and seaports, large buildings, among others [2].

The Nuclear Battery proposal is based on a patent in which it is formed by assembling a plurality of Nuclear Cells containing each a microreactor [3]. The Nuclear Cell may generate thermal power between 80 kW and 240 kW depending on the size of its microreactor. The power density may vary between 2 W/cm 3 and 20 W/cm 3 while in power reactors it is around 200 W/cm 3 . This low power density seeks to ensure greater safety, low burnup at the end of the fuel cycle and, consequently, longer fuel cycles of 10 to 20 years. It uses HALEU fuels (enrichment below 20%) and has a low production of 239 Pu and other actinides which reduce nuclear proliferation risks. The heat transfer of nuclear heat from the core is carried out through heat pipes, a passive heat transfer system based on capillary forces. We present a parametric study to furnish the microreactor specification for Nuclear Cells systems with power level output between 20 and 80 kWe, and nuclear batteries with power level ranging from 20 kWe to 1 MWe.



Poster BE11 - A complete study of the main reaction channels for systems involving weakly bound beams

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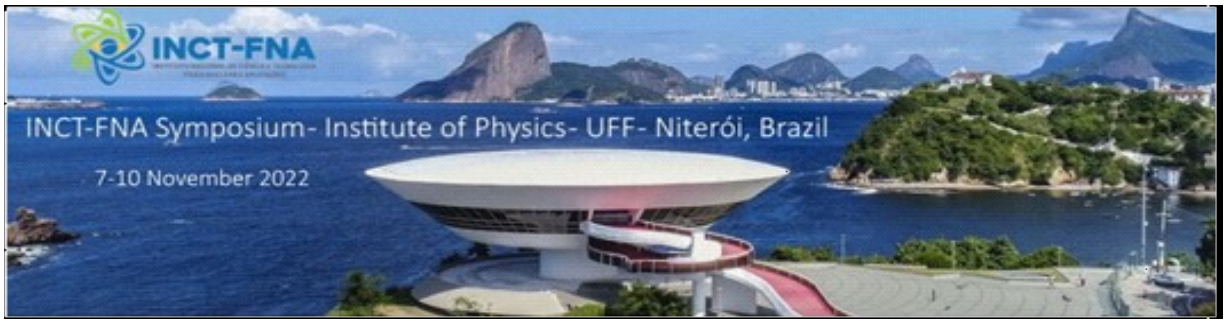
The investigation of reactions between heavy ions involving weakly bound stable and unstable nuclei, such as ^{6,7}Li, ^{9}Be and ^{10}B, plays an important role in the study of the properties of radioactive nuclei. Nuclei of this nature have a high probability of fragmentation (breakup) during the interaction with the target nucleus [1], giving rise to a complex problem of three or more bodies. Due to this characteristic, the reaction mechanisms associated with collisions involving weakly bound nuclei have been extensively studied at energies around and above the Coulomb barrier [2, 3, 4, 5, 6, 7]. While, for most stable nuclei, the average nuclear binding energy is around 8 MeV, the ^{6}Li nuclei have binding energy for the ^{4}He + ^{2}H partition equal to Q_{α} = 1.47 MeV, and the nucleus ^{7}Li has binding energy equal to Q_{α} = 2.47 MeV [4]. Collisions involving weakly bound stable nuclei are interesting from the point of view of understanding both nuclear structure and nuclear reactions. Although a considerable number of theoretical models successfully explain results of diverse reactions, in a wide range of energy and mass, a unified theory, capable of explaining simultaneously all the open channels that emerge from nuclear collisions, has not yet been developed. In order to contribute to a deeper understanding of this research field, we proposed the study of different reaction channels for the ^{6}Li + ^{124}Sn and ^{7}Li +^{124}Sn systems, and we measured angular distributions of elastic, inelastic scattering and transfer of nucleons for them. A simultaneous analysis of the various processes resulting from these measurements plays a fundamental role in understanding the reaction mechanisms associated with nuclear collisions at energies close to the Coulomb barrier.



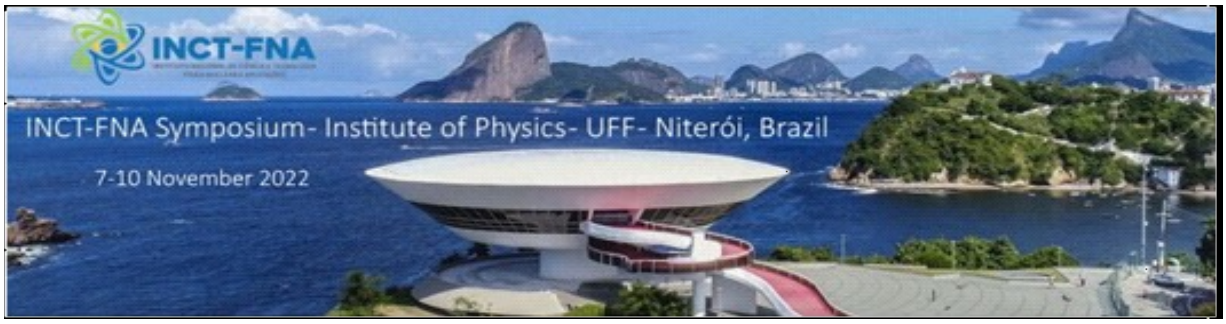
Poster BE12 - Development of new silicon telescopes array for nuclear physics - OSCAR

J. M. Brandão Neto, L. R. Gasques, L. C. Chamon, V.Scarduelli, J. K. L. Chaves and W. A. Y. Hatano*

Universidade de Sao Paulo, Instituto de Fisica, Rua do Matao, 1371, 05508-090, Sao Paulo, SP, Brazil

The low threshold against breakup of stable and radioactive weakly-bound nuclei in heavy ion collisions gives rise to a complex three-body problem. To investigate the role of breakup in reactions involving weakly-bound projectiles, the charged break-up fragments arising from the projectile-like must be detected in temporal coincidence. Therefore, two large acceptance telescopes for ΔE-E identification of light charged particles [1] have been developed to increase the efficiency of temporal coincidence measurements and will be mounted at the 30B beamline of the Open Laboratory of Nuclear Physics (LAFN, acronym in Portuguese) of the University of São Paulo (USP).

The development of such detectors is based on the OSCAR (hOdoscope of Silicons for Correlations and Analysis of Reactions) device, in collaboration with researches from the Instituto Nazionale di Fisica Nucleare - Laboratori Nazionali del Sud (INFN-LNS), Catania – Italy. OSCAR is based on two segmented silicon detection stages, formed by a 20 μm Single Sided Silicon Strip Detector (SSSSD) manufactured by Micron Semiconductor, followed by 16 independent Si PIN photodiodes detectors manufactured by Hamamatsu. The OSCAR telescopes have been conceived to identify light charged particles with high energy resolution and granularity.

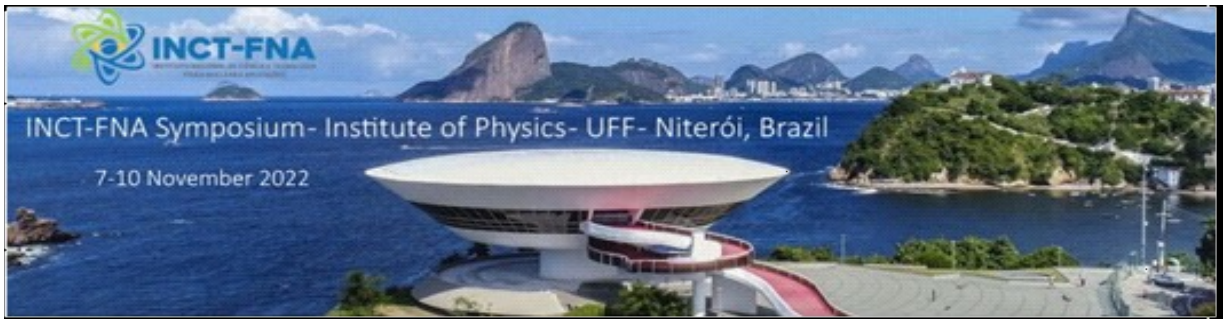


Poster BE13 - Study of the ^{8}Li beam focusing in the RIBRAS system

Kaique Albuquerque, Osvaldo Camargo Botelho dos Santos and Rubens Lichtenthäler Filho*

University of Sao Paulo, Butantã, São Paulo - SP, 05508-060

The objective of the present work is to study the production of radioactive beams using the RIBRAS facility. In particular, the 8Li radioactive nuclei is produced by the ^{9}Be(^{7}Li,^{8}Li)^{8}Be transfer reaction in the ground state (gs) and also in the first excited state (1st, Eexc = 0.980 MeV). In order to carry out experiments only using the ^{8}Li beam produced in the ground state (beam with higher energy), a computer code was developed to simulate the production of radioactive beams using the Monte Carlo method. The main idea is to check if there is any region that makes it possible to completely block the ^{8}Li particles produced in the first excited state. In general, the results obtained by the simulations showed that the two beams are sufficiently separated, around 20 cm from the target, making it possible to block the beam produced in the excited state. In the next stage of this project, an experiment will be carried out to verify the obtained predictions by the simulations. The success of this work may contribute to the study of ^{8}Li excitation in collisions with a secondary target.

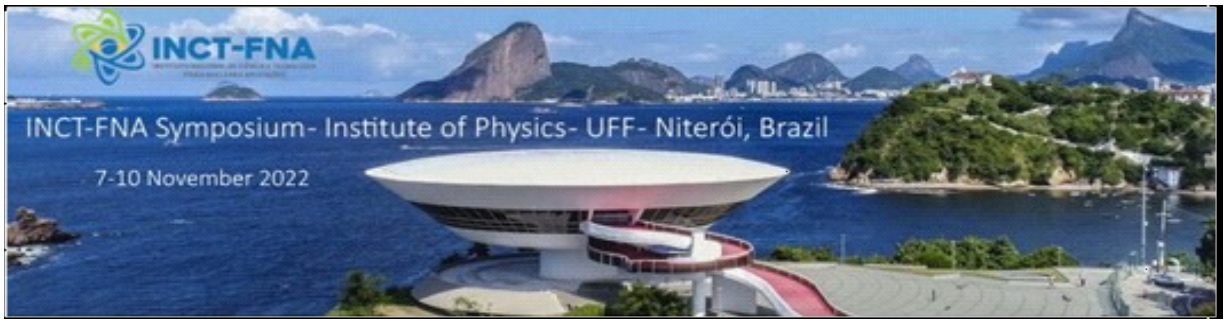


Poster BE14 - The gross theory model for weak interactions in the r-process nucleosynthesis

M. dos Santos, S.B. Duarte, A.R. Samana*

Centro Brasileiro de Pesquisas F´ısicas, Rua Dr. Xavier Sigaud 150, CEP 22290-180, Urca, RJ, Brazil

The weak processes are a key to understand the nucleosynthesis of heavy elements in the universe. In this work we have studied weak processes such as β-decay and neutrino capture that are very important for the r-process. This process takes place in a region between neutron drip and β-stability line. For nuclei far from β-stability line the experimental data are very scarce. To study the nucleosynthesis of heavy elements in astrophysics sites like Binary Neutron Star merger (BNS) [1] and Supernova explosions [2], we have employed the Gross Theory of Beta Decay (GTBD) [3] to evaluate the neutrino-nucleus cross sections and β-decay half-lives. Our ^{56}Fe(νe, e−)^{56}Co cross section shows a excelent agreement with microscopic models and the half-lives well reproduce the experimental data with a satisfactory accuracy. We have fitted the neutrino-nucleus cross sections obtained by GTBD using a four degree polynomial dependence of the incident neutrino energy. This dependence allows us to systematically calculate the neutrino-nucleus cross sections for a large amount of nuclei, as occurs in the r-process nucleosynthesis calculation (more than 4000 nuclei). Our fitting and interpolation procedures are shown to be in a good agreement and the GTBD cross sections are successfully reproduced. We also calculate the neutrino-nucleus cross sections averaged by a thermal flux for those nuclei present in the BNS and supernova scenario.

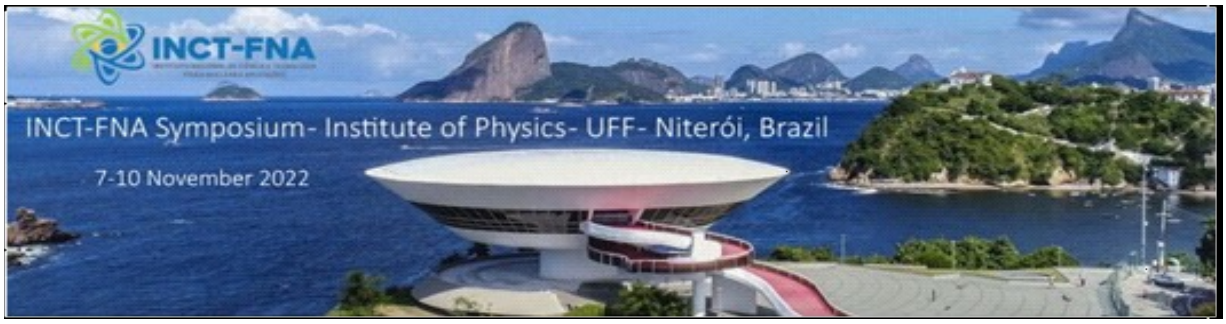


Poster BE15 - Damping of Mott oscillations in the ^{6}Li+^{6}Li elastic scattering

M. B. Angelo, V. Guimarães, M. Assunção, L. F. Canto, J. Lubian, A. Arazi, B. Paes, D. Hojman, J. Gómez and M. A. Cardona*

Instituto de Física, Universidade de São Paulo, 05508-090, São Paulo, Brazil

Mott oscillations are a quantum oscillation pattern observed in angular distributions of identical particle scatterings. When both incident and target particles have integer spin, there are energies at which Mott oscillations are damped around 90° in the center-of-mass frame, a phenomenon called Transverse Isotropy (TI). This phenomenon has been analytically predicted by the recent works of L. F. Canto and M. Hussein [1, 2]. Different optical potentials predict different TI energies, so TI energy measurements can provide insight into nucleus-nucleus interaction. Data on angular distribution for identical scattering of 6Li nuclei (s = 1) is available in the literature but at very limited values of energies and angular range. Using Python scripts and the code Fresco [3], available nuclear potentials for this system were used to predict TI energies. We considered Woods-Saxon-shaped potentials and the São Paulo potential [4] in the calculations. Taken into account the predictions, we performed an experiment to measure the ^{6}Li + ^{6}Li elastic scattering angular distributions for E_{LAB} = 18, 22, 23 and 24 MeV at Tandar Laboratory in Argentina. An initial analysis will be present for discussion.

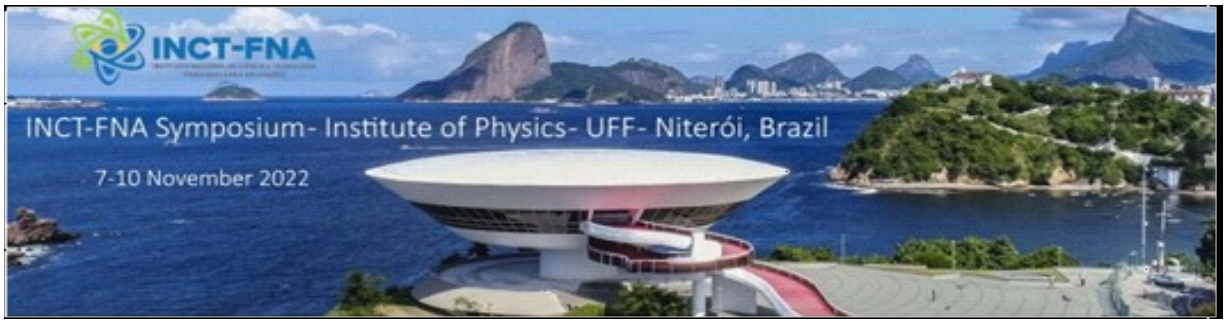


Poster BE16 - Evidence of the effect of strong stripping channels on the dynamics of the ^{8}Li+^{58}Ni reaction

O. C. B. Santos, R. Lichtenthäler, K. C. C. Pires, U. Umbelino, E. O. N. Zevallos, A. L. de Lara, A. S. Serra, V. Scarduelli, J. Alcántara-Núñez, V. Guimarães, A. Lépine-Szily, J. C. Zamora, A. M. Moro, S. Appannababu, M. Assunção, A. Barioni, R. Linares, V. A. B. Zagatto, P. N. de Faria, M. C. Morais, V. Morcelle, J. M. B. Shorto, and Jin Lei*

Departamento de Física Nuclear, Instituto de Física, Universidade de São Paulo, 05508-090 São Paulo, Brazil

Recent experimental measurements for the ^{8}Li+^{58}Ni system at 23.9, 26.1, 28.7 and 30 MeV bombarding energies have been obtained using the RIBRAS facility [1–5]. A strong production of ^{7}Li particles has been observed from the breakup of the ^{8}Li into ^{7}Li+n and the one neutron transfer reaction of the 8Li projectile to the ^{58}Ni target. The ^{7}Li angular distributions have been analyzed considering the Coupled-Reaction Channels (CRC) formalism, which includes the coupling of the elastic channel to the ^{59}Ni=^{58}Ni+n states below and above the neutron threshold. The CRC calculations provided a simultaneous description of both, the ^{7}Li and the elastic scattering angular distributions. Furthermore, the angular and energy distributions of ^{7}Li particles have been simultaneously well described considering the combination of the Ichimura Austern and Vincent (IAV) model [5,6] and Continuum Discretized Coupled Channels (CDCC) methods, for the inelastic and elastic breakup, respectively.

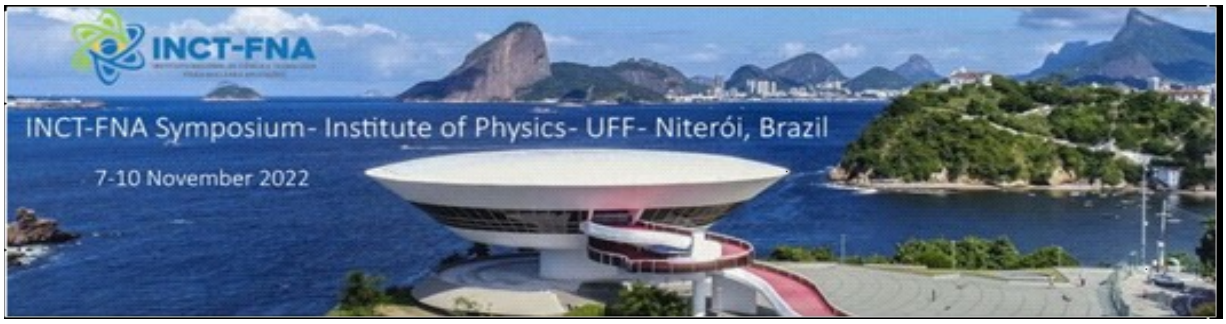


Poster BE17 - Investigation of cluster structure of the ^{12}N proton-rich nucleus from elastic scattering on ^{197}Au target at near barrier energy

P. L. Domingues-Magro, V. Guimarães, R. Linares, G. Rogachev, E. Koshchiy, B. T. Roeder, M. Barbui, J. Bishop, C. E. Parker, E. Harris, A. Saastamoinen*

Instituto de Física da Universidade de São Paulo, São Paulo, Brazil

The description of the elastic scattering cross sections is very sensitive to the interaction potential between the projectile and target nuclei and to the structure of the nuclei involved. Thus, elastic scattering measurements have been used to investigate and uncover unusual features in light nuclei such as extended halos [1]. To investigate the cluster structure of the ^{12}N proton-rich nucleus, we performed elastic scattering measurement on a ^{197}Au target at 73 MeV, a little above of the Coulomb barrier (68 MeV). The ^{12}N is a weakly-bound proton-rich nucleus, which can be described as ^{11}C core plus one valence proton binding by Sp=0.601 MeV. The ^{12}N radioactive beam was produced with the recoil separator MARS [2] of Cyclotron Institute of Texas A&M University, Texas, USA, by the ^{3}He(^{10}B,^{12}N) reaction, with an intensity of 1x103 p/s. The detection setup consisted of three Double Sided Silicon Strip detectors (DSSS) with 128 vertical and 128 horizontal fixed strips segmented with 16x16 connecting 8 strips. The measured angular distributions ranged from 40° to 140°. Preliminary results will be present.

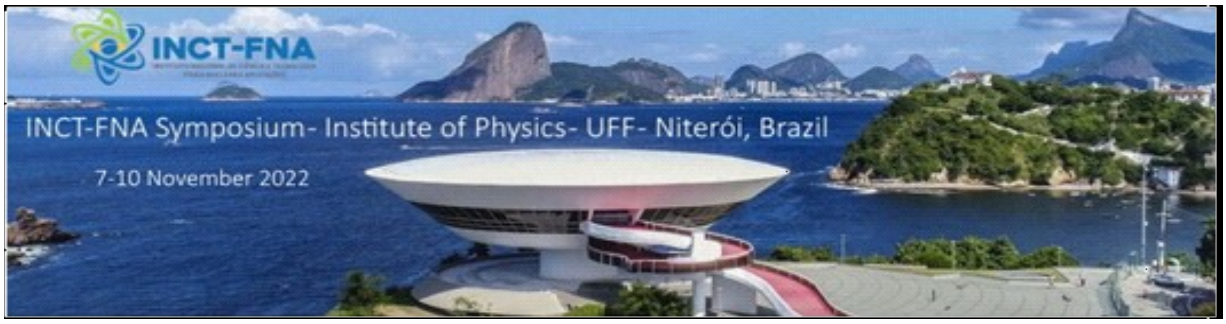


Poster BE18 - Study of scattering and reactions induced by light radioactive nuclei

U. Umbelino, R. Lichtenthäler, O. C. B. Santos, et al*

Instituto de Física, Universidade de São Paulo, São Paulo 05508-090, SP, Brazil

In this work, angular distributions of the elastic scattering of the radioactive ^{8}Li, ^{7,10}Be and ^{8,12}B cocktail beams on ^{9}Be and ^{197}Au targets have been measured, at energies above the Coulomb barrier, using the RIBRAS system and the electrostatic accelerator Pelletron-USP. The angular distributions were analyzed by optical model formalism, that provided the interaction potentials that best reproduce the data as well as the total reaction cross-sections. In the ^{8}B+^{9}Be case, long-range real nuclear potential was obtained, different to the long-range imaginary potentials obtained for the neutron-rich projectiles. Furthermore, the strong cluster structure present in most of the projectiles studied here suggests that the coupling to the inelastic excitation, projectile breakup and transfer reaction channels could have some effect in the angular distributions. In addition, the low lying bound excited states of some projectiles associated with our limited energy resolution requires an estimation of the effect of an inelastic contamination in the elastic scattering peaks (quasi-elastic scattering). All these effects were investigated by the Coupled Channels Method: CC calculations for the inelastic scattering, CDCC for the projectile breakup and CRC for stripping reactions.

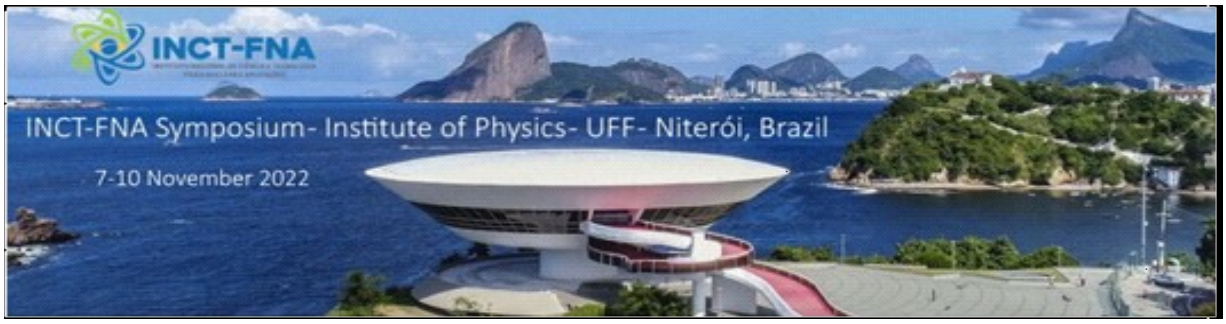


Poster BE19- Study of ^{10,11}B+^{124}Sn reactions at energies around Coulomb barrier

W.A.Y. Hatano, L.R. Gasques, L.C. Chamon, V. Scarduelli, and J.K.L. Chaves*

Instituto de Física – Universidade de São Paulo, Rua do Matão 1371, CEP 05508-090

The present project consists of the study of different reaction channels for the ^{10,11}B+^{124}Sn systems at energies around the Coulomb barrier, using techniques already well established in the Nuclear Physics research field. Will be carried out angular distributions measurements of elastic scattering, inelastic and nucleon transfer for the aforementioned reactions, with the aim of understanding better how nuclear interactions occurs and testing hypotheses and models developed for such interactions. The experiments will be carried out at Laboratório Aberto de Física Nuclear (LAFN) at the Instituto de Física - Universidade de São Paulo , using the renewed 30B beamline together with the appropriate electronics for such measurements. A new detector array named OSCAR (hOdoscope of Silicons for Correlations and Analysis of Reaction) will also be used, which is being built in collaboration with italian researches of the Istituto Nazionale di Fisica Nucleare (INFN) in Legnaro, which will allow a greater resolution and a new geometry in particle's detection. After its construction, will be carried out all detector’s characterization.



Poster AE01 - Tachyonic AdS/QCD, Determining the Strong Running Coupling and β-function in both UV and IR Regions of AdS Space

Adamu Issifu, Elijah A. Abbey, and Francisco A. Brito*

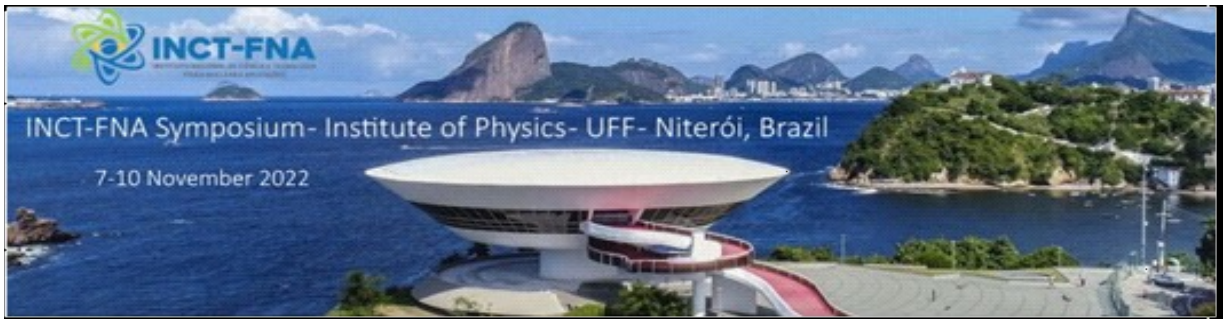
Departamento de F´ısica, CFM—Universidade Federal de Santa Catarina, Caixa Postal 476, 88040-900 Florianópolis, SC, Brazil

In this paper, we investigate QCD-like running coupling $\alpha^{AdS}{}_s(Q^2)$ and its associated β-function $\beta(Q^2)$ in the spirit of tachyonic AdS/QCD. We distort the AdS_5 conformal symmetry using a color dielectric function $G(\varphi(z))$ associated with tachyons, with $\varphi(z)$ the tachyon field. The function presents different properties of $\alpha^{AdS}{}_s$ (Q^2) at small and large values of the fifth-dimensional holographic variable z. The function distorts the AdS space, giving $\alpha^{AdS}{}_s$ (Q^2) and its β-function β(Q2) at any Q^2 scale. The result obtained for a large value of z is expected to show characteristics similar to nonperturbative QCD. On the other hand, the result obtained for a small value of z is expected to show characteristics similar to perturbative QCQ. The presence of free tachyons leads to distortion of the AdS space at a small z, that notwithstanding, condensed tachyon states also lead to large z distortion. This provides a unified background for determining $\alpha^{AdS}{}_s$ (Q^2) and its $\beta(Q^2)$ in both the ultraviolet (UV) and infrared (IR) regions using a single function in the framework of tachyonic AdS/QCD.

In this work, we deform the AdS space with a Higgs-like dimensionless color dielectric function $G(\varphi)$ associated with tachyonic potential. The color dielectric function deforms the AdS space in the UV region in the presence of free tachyons, whilst tachyon condensed color dielectric function $G(\eta)$, where η is the condensed tachyon field, also deforms the AdS space in the IR region similar to the positive sign dilaton profile used in determining strong couplings in AdS/QCD. We show that the tachyon field φ is associated with glueball field φ, and the color dielectric function is also associated with higher dimensional operator $H_{\mu\nu}H^{\mu\nu}$ coupled to a Standard Model (SM) gauge field OSM that leads to strongly interacting light glueballs. The AdS action intended for this study is similar to Sen's AdS_5 tachyonic action. Firstly, we investigate the characteristics of both the strong running coupling $\alpha_s(Q^2)$, and the associated β-function $\beta(Q^2)$, by distorting the AdS space with tachyonic $G(\varphi)$. Secondly, we examine $\alpha_s(Q^2)$ and $\beta(Q^2)$ by distorting the AdS space with $G(\eta)$. We expect $\alpha_s(Q^2)$ and $\beta(Q^2)$ to behave similarly to the

perturbative QCD (pQCD) for the UV deformation of the AdS space. On the other hand, we expect AdS/QCD or nonperturbative

QCD-like behavior for the IR deformation of the AdS space. The results obtained from these regions will be compared with effective couplings determined from different observables, such as; lattice QCD results, QCD phenomenology, and g_1 scheme where $\alpha_{g1}(Q^2)$ is extracted from the well-measured Bjorken sum rule. This approach will bring a new perspective to AdS/QCD, where pQCD coupling characteristics can be determined through direct UV deformation of the AdS space instead of extrapolation from the IR deformation of the AdS space. Also, we will study the parameter that controls the transition from the pQCD to nonperturbative QCD. Additionally, we show that $\alpha_s(Q^2)$ and $\beta(Q^2)$ are related to strongly interacting scalar glueballs with mass $m\varphi$ and discuss its effect. We will discuss any Landau singularity that may be observed in the UV region and propose how to deal with it in the model framework. Strong running coupling is a subject of active research due to its limited understanding in the low momentum transfer region. Good knowledge of $\alpha_s(Q^2)$ at $Q \to \infty$ is necessary to match for the growing precision of hadron scattering experiments and enhance the understanding of high energy unification of strongly interacting and electroweak theories. On the other hand, a precise understanding of $\alpha_s(Q^2)$ at $Q \to 0$ on the scale of proton mass enables us to understand hadron structure, confinement, and hadronization.



Poster AE02 - Equações de Estado para Matéria de Quarks e Aplicações

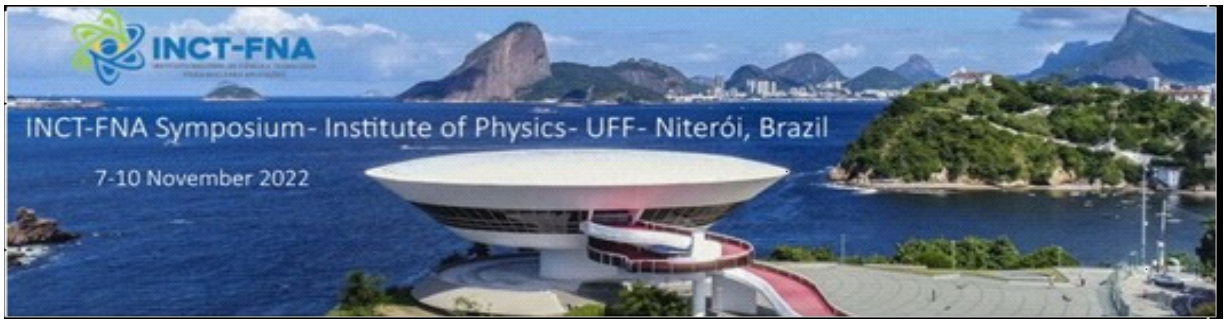
Bianca Luise Paulino e Débora Peres Menezes*

Departamento de Física, CFM - Universidade Federal de Santa Catarina; C.P. 476, CEP 88.040-900, Florianópolis, SC, Brasil

Este projeto teve por objetivo estudar o formalismo necessário para descrever diferentes fases da matéria através de equações de estado, com posterior foco em objetos densos, tais como estrelas de nêutrons. Neste contexto, foram vistos tópicos de evolução estelar, física nuclear, termodinâmica e cálculos numéricos. Com estas ferramentas, trabalhamos com as equações de estado dos gases ideal e de Fermi, analisando suas propriedades e características, dada a diferença entre um modelo clássico e um quântico. Com o gás livre de Fermi, tratou-se de duas situações distintas: um gás de elétrons e um gás de nêutrons.

Feito isso, partimos para o estudo de modelos usados atualmente na descrição de estrelas de nêutrons. Foram vistos os MIT bag model original e vetorial, que, numa primeira aproximação, tratam os bárions como objetos constituídos por quarks confinados por um potencial infinito (a “sacola"). Foi dada especial atenção às diferenças entre os dois, observando como é possível modelar as equações de forma a obter resultados que melhor correspondem às observações atuais (estrelas mais massivas, por exemplo). Na versão original do modelo, os quarks são não interagentes, enquanto que, em sua versão derivada, foi inserido um campo vetorial – análogo ao campo vetorial do méson ômega na teoria de Yukawa, usada no modelo de Walecka – para dar conta da interação entre os constituintes do bárion.

Após a revisão bibliográfica e os cálculos numéricos necessários para reproduzir os resultados dos modelos de gases vistos, foram estabelecidas as bases para continuar o estudo de modelos usados para trabalhar com o diagrama de fases da cromodinâmica quântica (QCD), com foco, novamente, em estrelas de nêutrons.



Poster AE03 - Causal and stable third-order fluid dynamics

C. V. Brito and G. S. Denicol*

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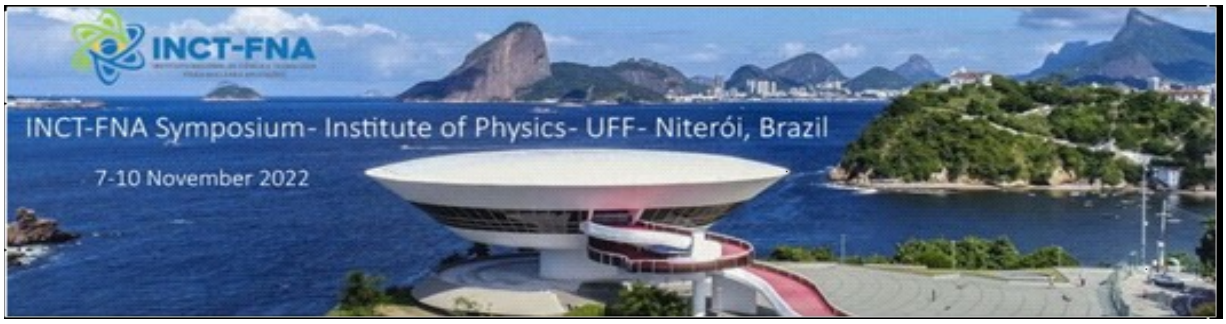
Second-order theories of fluid dynamics have been successfully employed to describe the time evolution of the hot and dense matter produced in heavy-ion collisions. In contrast to Navier-Stokes theory, which is a first-order formalism, Israel-Stewart theory is causal and stable

in the linear regime as long as the transport coefficients satisfy certain constraints. Furthermore, it has been shown that the inclusion of terms that are asymptotically of third order in gradients may be required to describe the dynamics of a fluid in the extreme conditions present at the early stages of these collisions [1]. For this purpose, third-order formulations of relativistic dissipative fluid dynamics were also developed [2]. Recently, a linear stability analysis was performed for such theories and it was demonstrated that they are intrinsically acausal and unstable [3]. In this contribution, we derive linearly causal and stable third-order fluid-dynamical equations from the Boltzmann equation using the method of moments. We show that we recover the theory proposed in Ref. [2] when certain relaxation times are taken to zero, but this limiting procedure is forbidden by causality and stability conditions. Finally, we compare the solutions of our novel theory with those of the Boltzmann equation in 0+1 Bjorken flow and show that they are in good agreement.



Poster AE04 - QCD phase diagrams via QHD and MIT based models

Carline Biesdorf, Débora P. Menezes, and Luiz L. Lopes*

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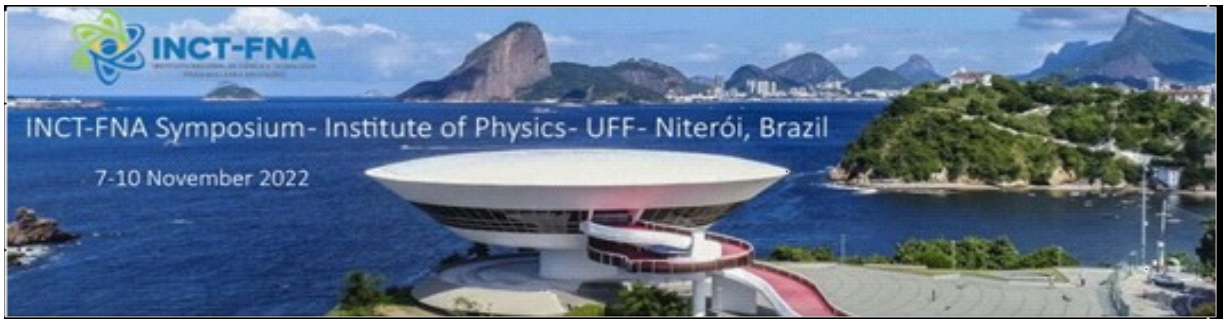
We obtain the QCD phase diagram by means of two effective models, MIT bag based models to describe the quark matter and QHD based models to describe the hadron matter, and use the Gibbs conditions to establish the crossing points of the pressures in function of the chemical potentials obtained in both phases. We analyze the results for β-stable and charge neutral stellar matter and compare two different prescriptions: one that assumes flavour conservation, so that the quark phase is completely determined from the hadronic phase, and the other based on the Maxwell construction, where the quark phase is also β-stable.

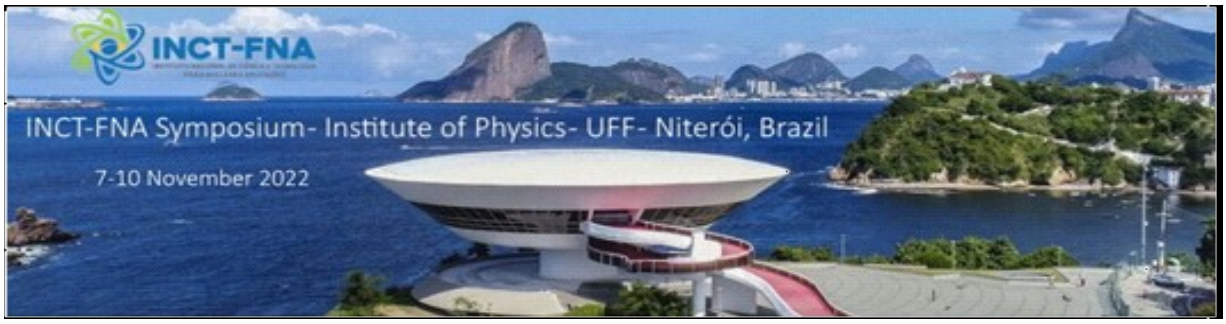


Poster AE05 - Exclusive photo- and electroproduction of excited light vector mesons with a holographic wave function model

*Cheryl Henkels**

Federal University of Santa Catarina, R. Eng. Agronômico Andrei Cristian Ferreira, s/n - Trindade, Florianópolis - SC, 88040-900

The exclusive photo- and electroproduction of the light vector mesons ρ, ω, and φ is studied within the color dipole picture as function of the center-of-mass energy of the γp collision and the momentum transfer squared |t|. The corresponding vector meson wave functions have been computed with the relativistic AdS/QCD holographic approach. This enabled us to obtain a good description of all available data for the ground-state light mesons ρ(1S), ω(1S), and φ(1S) as well as to make predictions for the excited states ρ(2S), ω(2S) and φ(2S) with the same formalism. This study revealed the existence of a sizeable theoretical uncertainty coming from modeling the partial dipole amplitude in the nonperturbative kinematical domain. These uncertainties could be investigated deeply with measurements of the light vector meson cross sections in future hadron colliders.



Poster AE06 - Double parton scattering mechanism for associated *c* and *b* quark production in ultraperipheral collisions AA.

Edgar Huayra, Emmanuel G. de Oliveira, and Roman Pasechnik*

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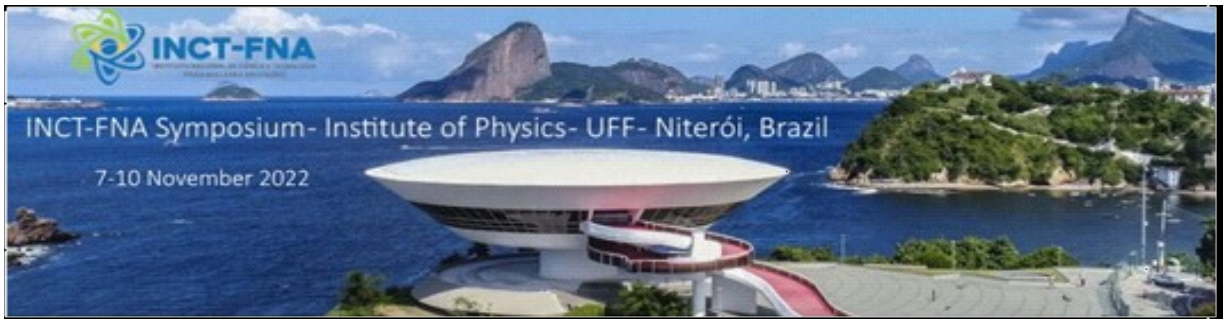
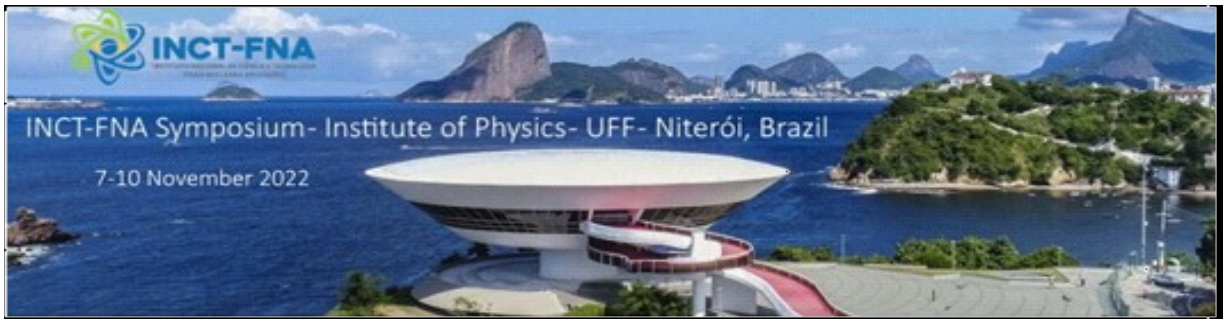
The double–parton scattering (DPS) at the hadron coliders such as the LHC is sensitive to correlations in the double–parton distributions. When looking at inclusive observables, it is dominated at high energies (small x) by the interaction of 4 gluons in the initial state. In order to extract different information about the partons, we are interested in the interaction between two gluons and two photons. To do so, we look at the associated c and b quarks production in the DPS process in ultraperipheral collisions (UPCs) AA. We derive an analogue of the pocket formula for this DPS and the photon-energy dependent effective cross section at high energies. We provide numerical predictions for this DPS cross sections at the typical energies of the LHC and FCC colliders.



Poster AE07

Evelyn Martins

Nuclear matter, like water, has a phase diagram which summarizes the

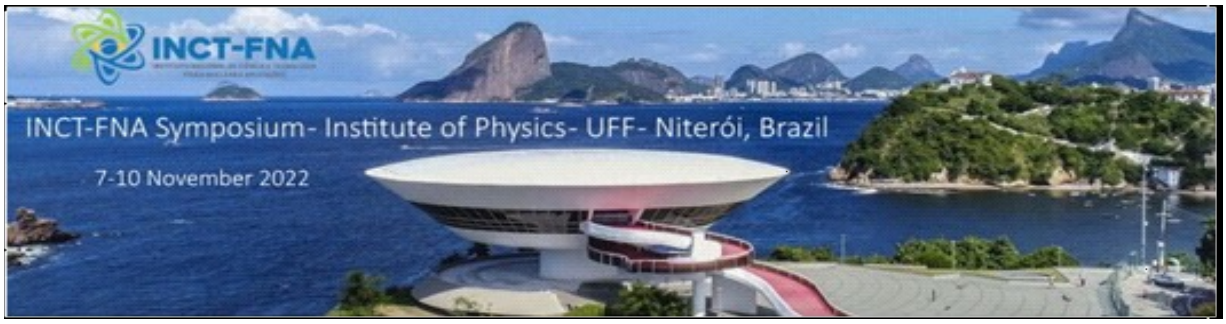


Poster AE08 - Espalhamento de Quarks e Efeitos de Confinamento

Flávia Fialho, Letícia Palhares*

Universidade do Estado do Rio de Janeiro, Instituto de Física—Departamento de Física Teórica—Rua São Francisco Xavier 524, 20550-013, Maracanã, Rio de Janeiro, Brasil

A cromodinâmica quântica é a teoria de gauge que rege a interação entre quarks, e como consequência desta teoria temos a propriedade chamada liberdade assintótica. Esta propriedade torna a interação entre os quarks assintoticamente mais fraca enquanto a escala de energia aumenta. Além disso, a liberdade assintótica está relacionada à uma constante de acoplamento variável que cresce conforme a energia diminui. Como resultado, temos o efeito de confinamento, que impede que os quarks existam livres na natureza. O objetivo do trabalho éinvestigar possíveis efeitos não-perturbativos do confinamento de glúons no regime infravermelho no cálculo da seção de choque do espalhamento de um par quark-antiquark resultando em outro par quark-antiquark. Como existem evidências da rede de que podemos ter uma geração dinâmica de massa para os glúons, seráusado um propagador modificado para tal glúon no gauge de Landau, seguindo o Modelo de Curci-Ferrari. Será então calculada a amplitude de espalhamento em tree-level e comparada com o resultado perturbativo padrão.

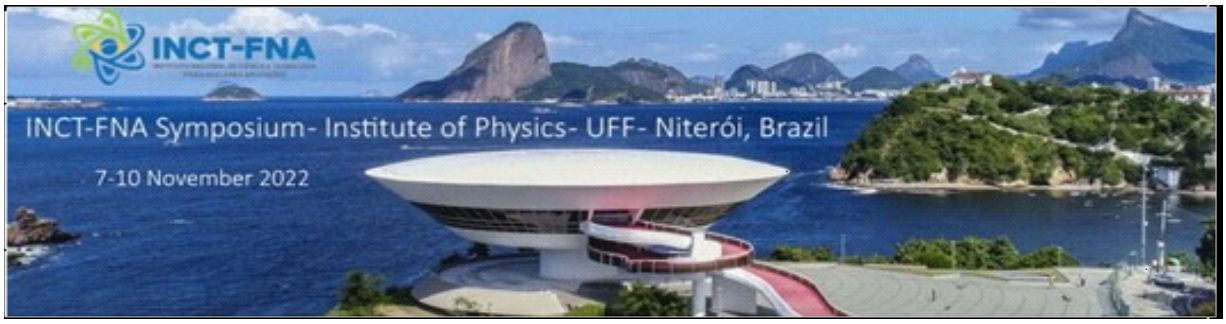


Poster AE09 - Y and ηb mass shifts in nuclear matter and the nucleus bound states

G. N. Zeminiani, J. J. Cobos-Martínez and K. Tsushima*

Laboratório de Física Teórica e Computacional, Universidade Cidade de São Paulo, 01506-000, São Paulo, Brazil

The mass shifts (scalar potentials) of the Y and ηb mesons are estimated in symmetric nuclear matter using an SU(5) flavor symmetric effective Lagrangian approach. The attractive potentials for the Y and ηb mesons in nuclei originate from the medium-modified BB, BB* and B*B* loops in their respective self-energies, and are calculated from the Y and ηb mass shifts in the local density approximation, where the medium-modified B and B* meson masses (inputs for the mass shift calculation) and the density distributions in nuclei, are calculated within the quark-meson coupling (QMC) model. Form factors were employed for the regularization of the self-energy loop integrals, using a wide range of cutoff mass values. A detailed analysis on the BB, BB*, and B*B* meson loop contributions for the Y mass shift is made by comparing with the respectively corresponding DD, DD* and D*D* meson loop contributions for the J/Ψ mass shift, in order to investigate how similar are the the interactions of bottomonium and charmonium to nuclear matter. The attractive potentials of both Y and ηb are expected to be strong enough for these mesons to be bound to various nuclei, and we have obtained such nuclear bound state energies neglecting any possible effects of the meson widths. The results suggests that the bottomonium-nuclear matter and charmonium-nuclear matter interaction strengths differ by a significant ammount. We also study the Y and ηb mass shifts in a heavy quark (heavy meson) symmetry limit, namely, by calculating their mass shifts using the same coupling constant value as that was used to estimate the J/Ψ and ηc mass shifts, and also considering the SU(5) symmetry breaking case for the ηc mass shift in this limit. In addition, initial studies are made to test the effects of different types of form factors used in the calculation.

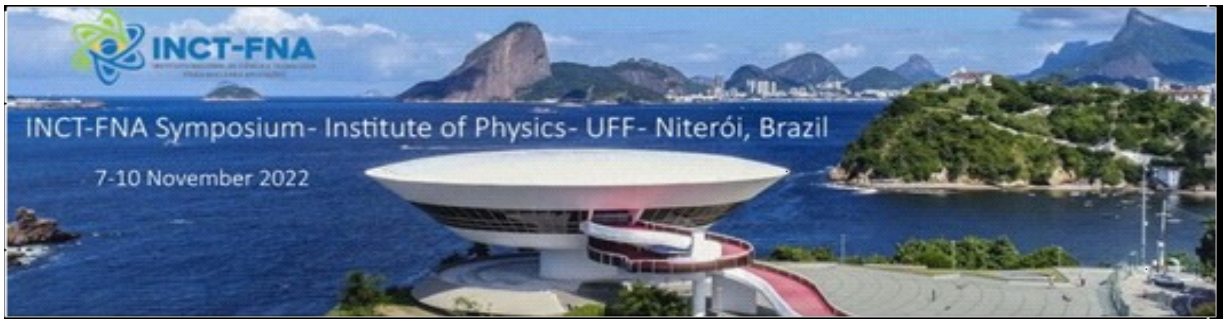


Poster AE10 - Phenomenological study of deep inelastic scattering using the BK equation

H. R. Martins-Fontes, J. T. Amaral*

Universidade Federal do Rio Grande

At high energy, or small Bjorken-x, the interaction between a virtual photon and a proton in deep inelastic electron-proton scattering can be conveniently described in the dipole frame. In this frame, the photon has enough energy to split into a quark-antiquark pair, or a dipole, which then interacts with the proton target. Within this approach, the total cross section for the inclusive reaction $\gamma^*p \rightarrow X$ (X represents an undetected hadronic state), and thus the F_2 proton structure function, is factorized and written in terms of the dipole-proton scattering amplitude. This amplitude is the solution of the Balitsky-Kovchegov (BK) equation, the simplest nonlinear evolution equation of high energy Quantum Chromodynamics. In this work we perform a phenomenological study of deep inelastic scattering, at small Bjorken-x, using two models for the diole-proton scattering amplitude: the Iancu-Itakura-Munier saturation model, which is based on asymptotic analytical solutions of the leading order (fixed coupling) Balitsky-Kovchegov equation, and the so called rcBK model, which is the numerical solution of Balitsky-Kovchegov equation with running coupling corrections. By fixing the parameters of both models at the most updated values found in the literature, we evaluate the F_2 proton structure function and compare our results with recent HERA data on inclusive deep inelastic scattering.



Poster AE11 - Investigating particlization in multistage dynamical models of heavy-ion collisions

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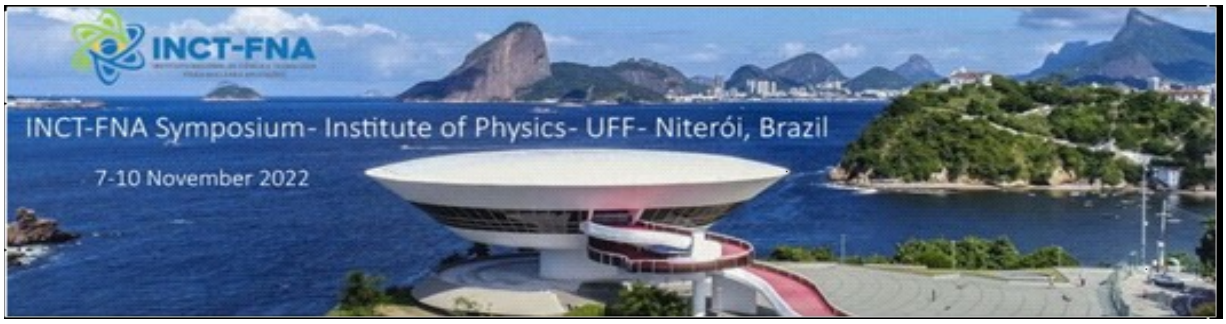
One way to understand the properties of the quark-gluon plasma (QGP) is through hybrid models. In other words, the description of the collision dynamics of heavy ions is divided into stages that model the different physical phenomena assumed to take place in the aftermath of a collision event. One of these states is particlization, which is responsible for translating the cooling QGP's hydrodynamic degrees of freedom to a hadron gas in terms of the positions and momenta of these particles. In this translation process, all the energy and momentum of the fluid are converted into hadrons on the switching hypersurface using the Cooper-Frye prescription. However, deviations of the hadron's momentum distributions and yields from local thermodynamic equilibrium are observed, arising from dissipative corrections. In this sense, it is interesting to consider the restrictions the experimental data can provide. With that in mind, the present work proposes to investigate different models of viscous corrections for the local equilibrium distribution functions to determine how energy and momentum are distributed among hadronic species and through momentum. Initially, Grad and Chapman-Enskog corrections will be investigated and compared with results generated experimentally by particle accelerators such as the relativistic heavy ion collider (RHIC) and the large hadron collider (LHC).



Poster AE12 - Relativistic equations of state for neutron stars

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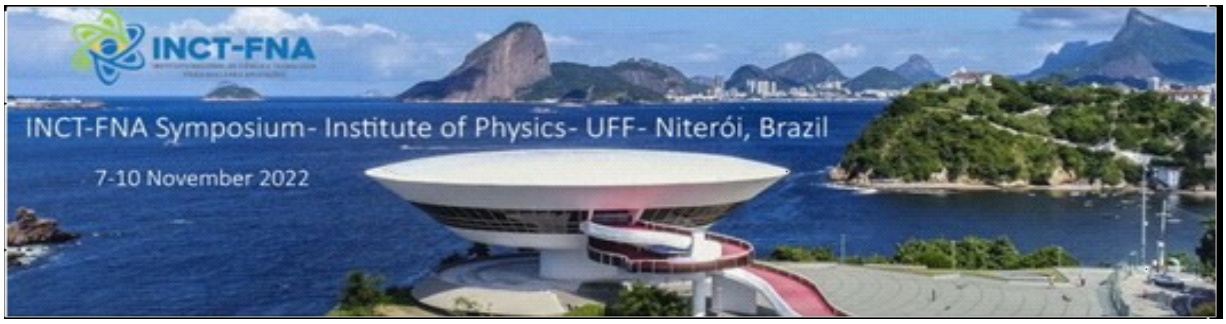
The present research aimed to describe macroscopic properties of neutron stars assuming zero temperature and different nuclear models, such as the (linear) QHD – I and the non-linear Walecka model. The first one considers that the interaction inside the nucleus has two contributions: an attractive one at large distances, and a repulsive one at short distances. Adding to that, the second model also brings to consideration the interaction between the existing scalar fields and the inclusion of a vector-isovector interaction. The equations of state (EoS) for nuclear matter are investigated and then stellar matter is obtained and then used as input to the Tolman, Oppenheimer and Volkoff (TOV), making it possible to get information such as maximum masses and radius of the compact object under study. For a better analysis, graphs were made with such data (pressure vs baryonic density, solar masses vs radius and energy density vs baryonic density) and the results for each type of matter, with its respective model and parameters, were compared.



Poster AE13 - Superconductivity of Confined Particles in a field-theory model

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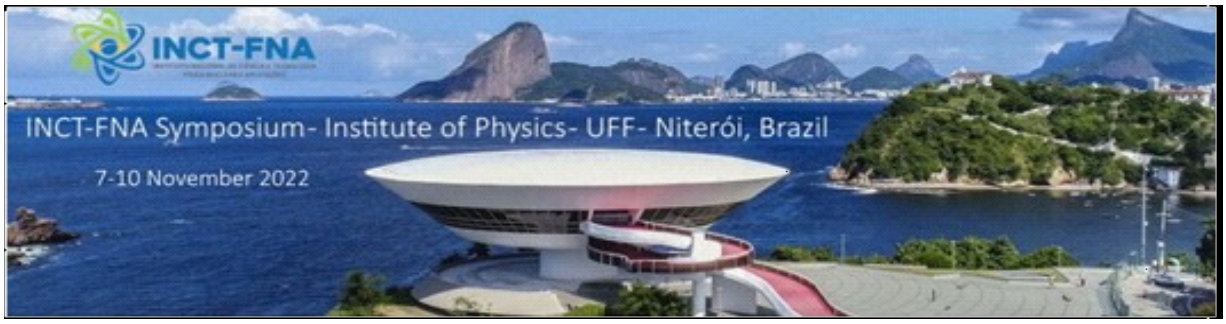
In this work, a simple model of superconductivity of confined particles, which constitute low energy hadrons, such as quarks and gluons. Many models like these of superconductivity are already present in high energy physics, mainly in the study of color superconductivity (cf. Refs. [1] and [2]). These models use in general a gluon propagator with specific electrical and magnetic effects, and after several approximations resulting in a differential gap equation, first obtained by Son, in [3]. These gaps were frequency dependent and could reach results in the order of 100 MeV, as shown numerically by Wilczek and Schäfer, in [4]. In this work we will adapt the color superconductivity model by changing the usual Gluon propagator, to a confining propagator, such as encountered in Gribov-Zwanziger and Refined Gribov-Zwanziger theories, see [5]. An analysis of the differential gap equation and the gap function will compare how the effect of corrections originated from the new propagators modify the results in the literature. This will allow us to assess how nonperturbative confinement effects might affect the phenomenon of color superconductivity at intermediate densities. Two mass limits in the bosonic propagator must be reached: the high mass limit, reproducing the behavior of the "point like" approximation, making the gap function behave like a usual BCS superconductivity and the small mass, making the gap function behave similar to early results in color superconductivity, [3].



Poster AE14 - Delta baryons in neutron stars

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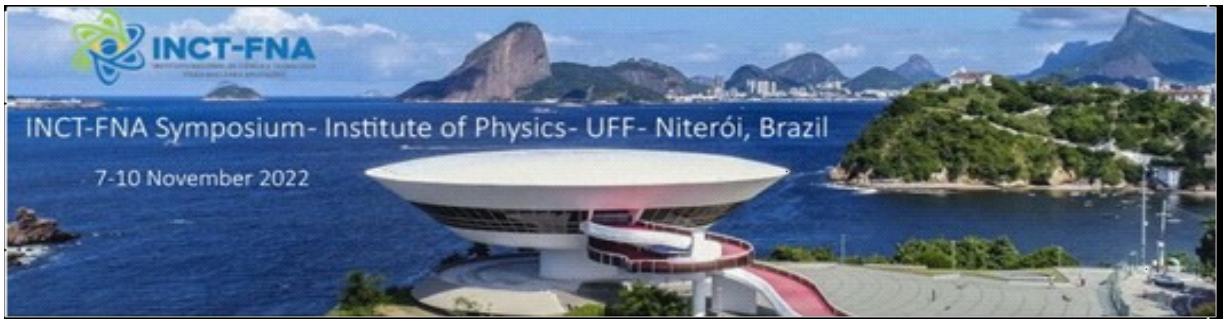
By applying a relativistic mean-field description of neutron star matter with density dependent couplings, we analyse the properties of two different matter compositions: nucleonic matter with delta baryons and nucleonic matter with hyperons and delta baryons. The delta-meson couplings are allowed to vary within a wide range of values obtained by experimental data, while the hyperon-meson couplings are fitted to hypernuclear properties. Neutron star properties with no deconfinement phase transition are studied. It is verified that many models are excluded because the effective nucleon mass becomes zero before the maximum mass configuration is attained. Hyperon-free with delta-dominated composition compact stars are possible, the deltic stars. It is found that with a convenient choice of parameters the existence of deltic stars with 80% of delta baryons at the center of the star is possible. However, the presence of hyperons lowers the delta baryon fraction to values below 20% at the center and below 30% at 2-3 saturation densities. It is discussed that in the presence of delta baryons, the hyperon softening is not so drastic because deltas couple more strongly to the ω-meson, and the stiffness of the equation of state is determined by the ω-dominance at high densities. The speed of sound reflects very well this behavior. The compactness of the pulsar RXJ0720.4-3125 imposes $x_{\sigma\Delta} > x_{\omega\Delta} > 1$ and favors $x_{\rho\Delta} > 1$.



Poster AE15 - Causal and Stable Relativistic Magnetohydrodynamics

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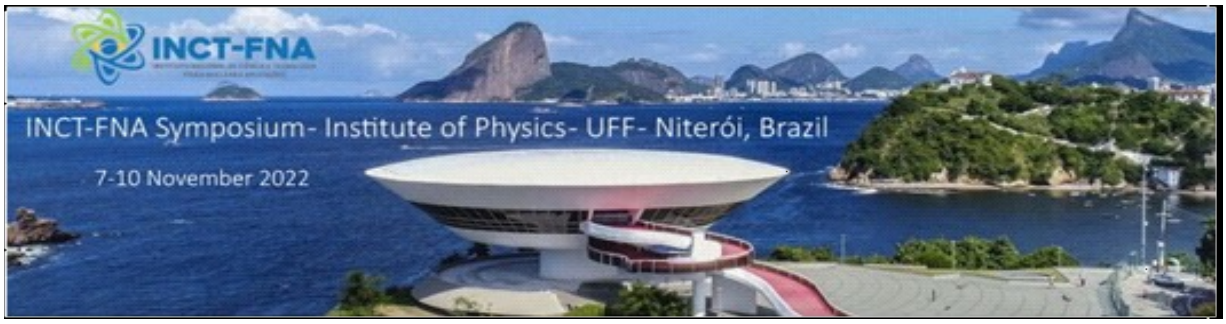
We derive the equations of motion of relativistic magnetohydrodynamics from the Boltzmann equation using the method of moments. We assume the fluid to be a locally neutral system composed of a particle and its antiparticle, with vanishing dipole moment or spin, so that the fluid has vanishing magnetization and polarization. We derive equations of motion for the irreducible moments of the deviation of the single-particle distribution function from local thermodynamical equilibrium for each particle species and truncate this system of equations using the 14-moment approximation for each particle species. We finally derive fluid-dynamical equations of motion imposing a truncation scheme in Knudsen number.



Poster AE16 - Vector MIT Bag Model: Strange Stars

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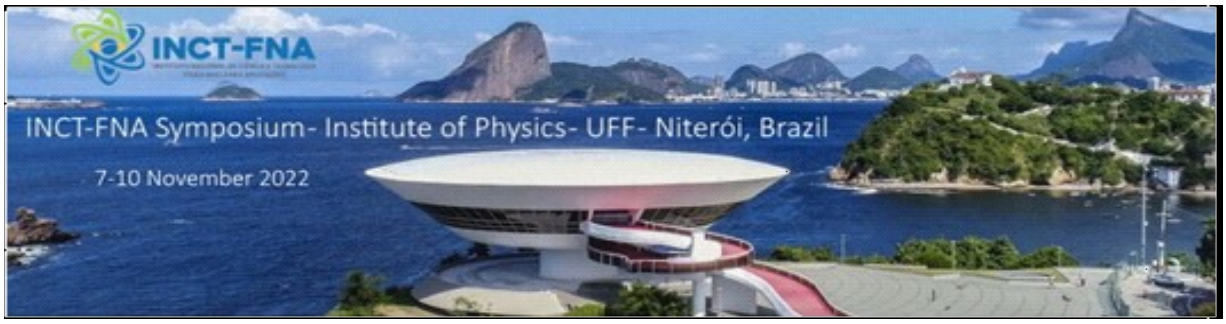
Asymptotic freedom, proposed in 1973, gave room to the discussion of deconfined quark matter. Later, the Bodmer Witten conjecture stated that, at high densities, the appearance of the strange quark decreases the binding energy of the quark matter, making strange quark matter (SQM) the true ground state of the strong interaction. Strange stars are dense astronomical objects made of SQM described by effective models of QCD. The MIT bag model is an effective model usually used to describe quark matter but does not produce massive stars, as the ones recently detected.The vector MIT bag model (MITv) considers a repulsive interaction, introduced by a vector field, that makes the equation of state stiffer and hence, can reach higher maximum star masses. I will show details of the MITv model and the results obtained when it is used as input to the TOV equations and the resulting mass - radius diagram comparing the results with some recent data.



Poster AE17 - Strange magnetars admixed with fermionic dark matter

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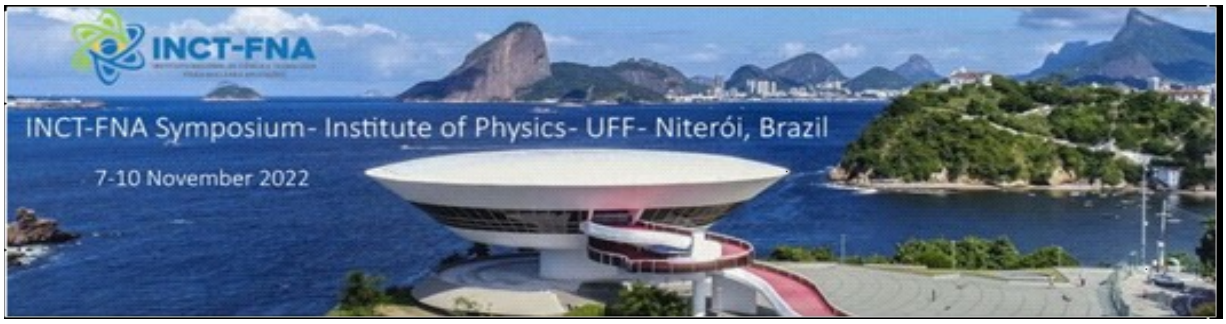
Compact stars are a unique probe of dense matter and its study gives crucial information on the phase diagram of QCD. More recently, they have also been considered as a possible source of information for the study of dark matter, e.g. being used to constrain models of dark matter. For instance, dark matter could give rise to ''dark'' compact objects or be accreted to stars, changing its structural properties or even causing them to collapse. In this work we consider the case of a strange star in the presence of a strong uniform magnetic field (a strange magnetar) with a ''cor'' containing accreted dark matter. Modelling strange matter with the MIT bag model and considering the cases of free fermionic dark matter and strongly self-interacting fermionic dark matter, we solve the two-fluid Tolman-Oppenheimer-Volkov equations for this system, taking dark matter and strange matter to only interact gravitationally. The solutions are then used to discuss the structural properties of these stars and the effects of the dark matter core on such properties. Moreover, we pay special attention to the role of the strong magnetic field when compared with previous results of a pure strange star admixed with dark matter.



Poster AE18 - Chiral fluid dynamics and kinetic theory

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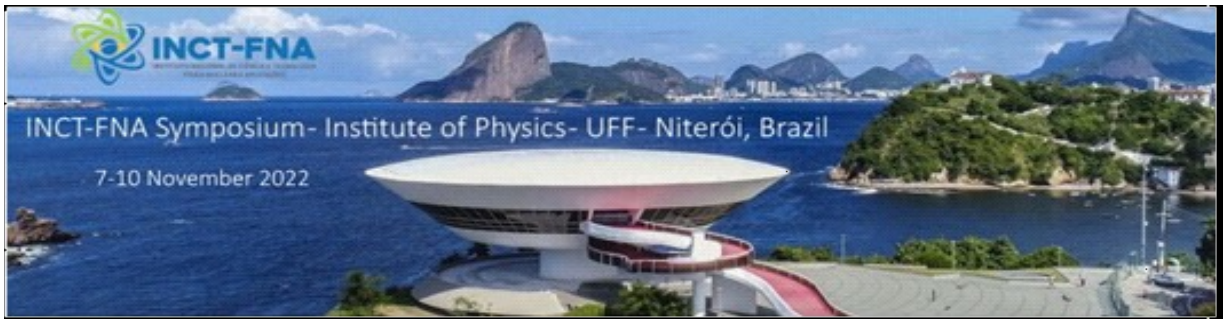
Chiral symmetry is a symmetry of QCD in the limit of vanishing quark masses. This symmetry is spontaneously broken in the QCD vacuum. It is believed that nuclear collisions at ultra-relativistic energies can reach temperatures $T \approx 150$ MeV, where chiral symmetry is believed to be restored from several results using lattice QCD simulations. To model the mechanism of chiral symmetry breaking, we adopt the linear sigma model with constituent quarks. In this formalism we can calculate the transport coefficients using a quasi-particles model within a new relaxation time approximation of the Boltzmann equation.



Poster AE19 - The smallest QGP: thermodynamic properties in p-Pb collisions

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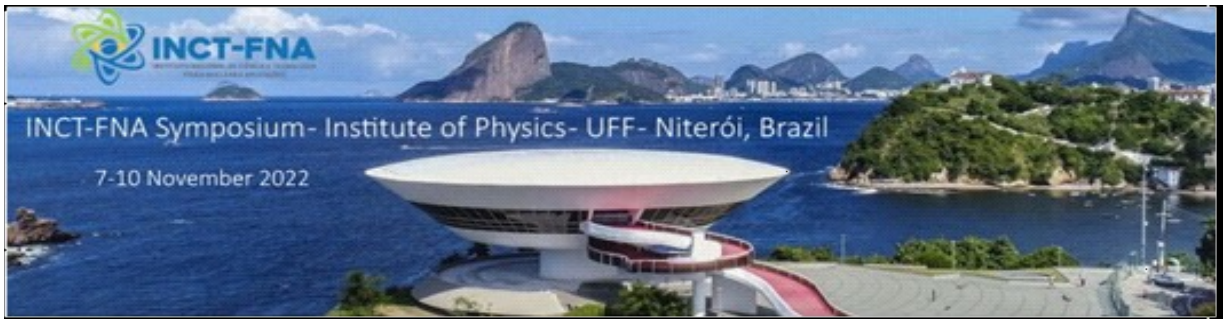
The study of relativistic heavy-ion collisions, such as those of Pb-Pb or Au-Au nuclei performed in the LHC and RHIC, has already demonstrated the capability to produce a deconfined state of hadronic matter called quark-gluon plasma (QGP), which has a collective behaviour described by a relativistic viscous hydrodynamic. It is still unknown whether the QGP is also produced in collisions of so-called small systems, like those between protons and Pb nuclei. Thus, in this work, we propose to analyse small systems collisions through hybrid simulations and study the macroscopic thermodynamic properties of the system that are linked with experimental data collected in these collisions. The results of these analyses show we can achieve a connection between the system temperature and the transverse momentum. We also show that the entropy density produced in central simulated events is consistent with results from Lattice QCD, supporting the production of QGP in central small system collisions. Hence, this work advances the understanding of the production of QGP in small systems.



Poster AE20 - Two flavor quark stars using the RGOPT

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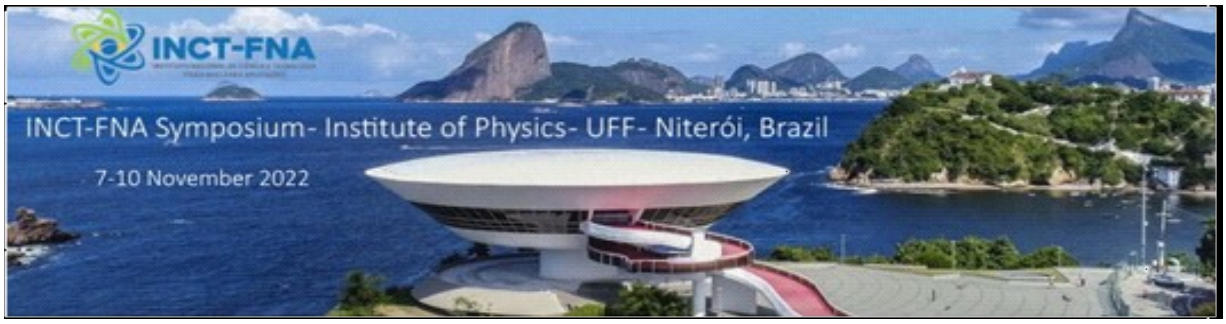
In this work, the recently developed resummation technique called renormalization group optimized perturbation theory (RGOPT) is used for the case of two flavor cold quark matter. The pressure is modified to maintain thermodynamic consistency, which is spoiled when one chooses the renormalization scale to be $\Lambda \sim \mu$. It is shown that the modification to the RGOPT pressure is negligible at values of $\mu \gtrsim 500$ MeV. On the other hand, pQCD shows a considerable modification to the original pressure. Based on the fact that stable quark matter can be made only of up and down quarks [Phys. Rev. Lett. 120, 222001 (2018)], the mass radius relation of two flavor pure quark stars is calculated using the thermodynamic consistent equation of state of the RGOPT and that of perturbative QCD. It was found that the RGOPT resummation produces in general a softer EoS than that furnished by perturbative QCD, leading to lower maximum quark star masses, and closer to two solar masses for $\Lambda = 4\mu$. The scale dependence of the mass radius relation obtained with the RGOPT is greatly improved when compared with the perturbation theory results.



Poster AE21 - Cooling of quark stars

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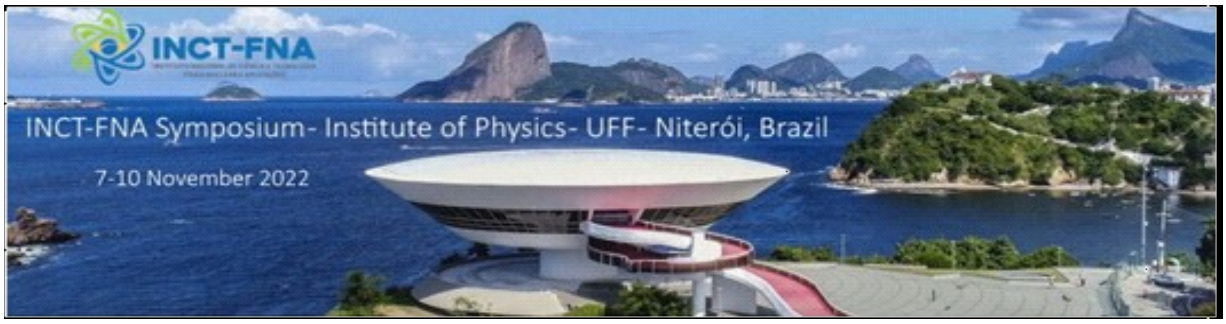
Universidade Federal do Rio de Janeiro

Since Witten's proposal that symmetric deconfined u, d, and s-quark matter may be the absolute ground state of matter, the properties of quark stars have been extensively studied. By choosing an equation of state to describe the matter inside these stars, it is possible to solve for a static and spherically symmetrical object the Tolman-Oppenheimer-Volkoff (TOV) equation and find the mass and radius values. However, we can see through current models that measuring mass and radius values is not sufficient to distinguish between neutron stars, hybrid stars and quark stars [1]. Therefore, it is necessary to take into account other observables that are closely linked to microscopic physics. One possibility is to investigate the thermal evolution of these stars, since these calculations are closely related to the structure and composition of the studied star. In this work, we propose a study of the cooling of quark stars using an interacting equation of state for quark matter given in Fraga et al. 2014.



Poster AE22 - Study of the condensation of pions using the Functional Renormalization Group

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The full description of strongly interacting matter requires complete knowledge of the phase structure generated by a quantum field theory. In many cases, analyzing the fundamental theory that describes their interactions in a medium is quite complicated, so that it becomes interesting to use alternative theories that reproduce at least part of the physical characteristics of the fundamental theory. Effective theories provide us with a powerful mathematical and physical tool for the limit in which the application of the fundamental theory - Quantum Chromodynamics (QCD) in the case of Strong Interactions - becomes extremely complex. In the dense regime of matter, the main non-perturbative technique, lattice Monte Carlo simulations, presents an open problem called the Sign Problem, due to the coupling of a specific chemical potential. However, in some situations, Monte Carlo simulations do not present such a problem, providing satisfactory results for various observable physical phenomena such as, for example, the dense isospin matter that could exist inside compact stars. Thus, the study of effective theories in environments with non-zero chemical potentials is even more relevant because it presents systems in which the Sign Problem is not present. In this work, we will investigate, using non-perturbative techniques, the phase transition of Bose-Einstein condensation in an effective theory for bosons at finite density and zero temperature. We will use the effective model called Linear Sigma Model to describe aspects of the symmetry of the vacuum of QCD and thus study the phase transition. Finally, we will implement the Functional Renormalization Group (FRG) to estimate the influence of non- perturbative effects.