Quarto Incontro Nazionale di Fisica Nucleare INFN2018

Abstracts book

Table of contents

Abstract ID : 2

Studying the decay of 46Ti*: does different partner structure influence the competing mechanisms and the following compound nucleus decay?

Content :

A useful tool to underline possible structure effects on the competition between different reaction mechanisms and the possible evidence of nuclear clustering effects, which may change the expected decay chain probability, is the exclusive study of light charged particles emission in hot light composite systems. In particular, the influence of projectile cluster structure may be evidenced studying the competition between pre-equilibrium and thermally emitted particles: the NUCL-EX collaboration (INFN, Italy) has carried out an extensive research campaign on pre-equilibrium emission of light charged particles from hot nuclei [1].
In this framework, the reactions 16O+30Si, 18O+28Si, 19F+27Al at 7 MeV/u and 16O+30Si at 8MeV/n have been carried out using the GARFIELD+RCo array [2] at Legnaro National Laboratories, as a first step, where the fast emission mechanisms could be kept under control.
After a general introduction on the experimental campaign performed on different systems, which have evidenced anomalies in the alpha-particle emission channel, this contribution will focus on the analysis results obtained in the measurement reported above, showing in an exclusive way the observed effects related to the entrance channels. The experimental results will be compared to model prediction, for which the same filtering and complete event selection have been applied.

[1] T. Marchi et al., F. Gramegna et al. - Nuclear Particle Correlations And Cluster Physics – Chapter 20 –pag. 507 (2017) –ISBN 978-981-3209-34-3; L. Morelli et al., Journ. of Phys. G 41 (2014) 075107; L. Morelli et al., Journ. of Phys. G 41 (2014) 075108; D. Fabris et al., PoS (X LASNPA), 2013, p. 061.D; V.L. Kravchuk, et al. EPJ WoCs, 2 (2010) 10006; O. V. Fotina et al., Int. Journ. Mod. Phys. E 19 (2010) 1134.
[2] F. Gramegna et al., Proc. of IEEE Nucl. Symposium, 2004, Roma, Italy, 0-7803-8701-5/04/; M. Bruno et al., M. Eur. Phys. Jour. A 49 (2013) 128.

Primary authors : CICERCHIA, Magda (LNL)

Co-authors : GRAMEGNA, Fabiana (LNL)

Presenter : CICERCHIA, Magda (LNL)

Track classification :

Contribution type : Oral

Submitted by : CICERCHIA, Magda

Submitted on Thursday 31 May 2018

Last modified on : Thursday 31 May 2018

Comments :

instead of all list of authors:

on behalf of NUCLEX Collaboration

Status : SUBMITTED

Track judgments :

Abstract ID : 3

The Dose Profiler PT treatments online monitor: in-room test results at CNAO

Content :

The use of C, He and O ions as projectiles in Particle Therapy (PT) treatments is getting more and more widespread as a consequence of their enhanced Relative Biological Effectiveness and Oxygen Enhancement Ratio. The advantages in the tumour control probability, related to the improved efficacy of the incoming radiation, requires an accurate online monitor of the dose release spatial distribution. Such monitor is necessary in order to prevent unwanted damage to the tissues surrounding the tumour that can arise, for example, due to morphological changes occurred in the patient during the treatment with respect to the initial CT scan. PT treatments with C, He and O ions can be monitored by detecting the secondary radiation produced by the primary beam interactions with the patient body along the path towards the target volume.
Charged fragments produced in the nuclear process of projectile fragmentation can be emitted at very large angles with respect to the incoming beam direction and can be detected with high efficiency in a nearly background free environment. The Dose Profiler (DP) detector, developed within the INSIDE project, is a scintillating fibre tracker that allows an online charged fragments reconstruction and backtracking.
The construction and preliminary in-room tests performed on the DP, carried out using the 12C ions beam of the CNAO treatment centre using a RANDO® anthropomorphic phantom as a target, will be reviewed in this contribution. The impact of the secondary fragments interactions with the patient body in their exit path towards the detector (multiple scattering and absorption) will be discussed in view of a clinical application. Furthermore, the results implications for a pre-clinical trial on CNAO patients, foreseen in 2018, will be discussed.

Primary authors : Mrs. FISCHETTI, Marta (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.)

Co-authors : Prof. BATTISTONI, Giuseppe (Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Milan, Italy.) ; Mrs. DE SIMONI, Micol (Università di Roma "La Sapienza", Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Mr. DONG, Yunsheng (Università di Milano, Fisica, Milan, Italy, Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Milan, Italy.) ; Mrs. EMBRIACO, Alessia (Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Milan, Italy.) ; Mr. MANCINI TERRACIANO, Carlo (Università di Roma "La Sapienza", Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy) ; Ms. MARAFINI, Michela (Museo Storico della Fisica e Centro Studi e Ricerche “E. Fermi”, Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Mrs. MATTEI, Ilaria (Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Milan, Italy.) ; Mr. MIRABELLI, Riccardo (Università di Roma "La Sapienza", Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Ms. MURARO, Silvia (Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Pisa, Italy.) ; Prof. PATERA, Vincenzo (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Italy; Museo Storico della Fisica e Centro Studi e Ricerche “E. Fermi”, Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Mr. SARTI, Alessio (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Italy; Museo Storico della Fisica e Centro Studi e Ricerche “E. Fermi”, Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali di Frascati, Frascati, Italy.) ; Prof. SCHIAVI, Angelo (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Mr. SCIUBBA, Adalberto (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Italy; Museo Storico della Fisica e Centro Studi e Ricerche “E. Fermi”, Fisica, Rome, Italy; Istituto

Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Ms. SOLFAROLI CAMILLOCCI, Elena (Università di Roma "La Sapienza", Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.) ; Mrs. VALLE, Serena Marta (Università di Milano, Fisica, Milan, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Milan, Italy.) ; Mr. TRAINI, Giacomo (Università di Roma "La Sapienza", Fisica, Rome, Italy; Istituto Nazionale di Fisica Nucleare, Sezione di Roma, Rome, Italy.)

Presenter : Mrs. FISCHETTI, Marta (Università di Roma "La Sapienza", Scienze di Base e Applicate per l'Ingegneria, Rome, Ital

Track classification :

Contribution type : Oral

Submitted by : FISCHETTI, Marta

Submitted on Wednesday 13 June 2018

Last modified on : Wednesday 13 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 4

The chiral and deconfinement phase transition at finite temperature and density

Content :

The restoration of chiral symmetry and breaking of center symmetry as a sign of deconfinement with increasing temperature and density are analysed within the Polyakov-loop extended versions of the Quark-Meson and NJL models. Comparison with results of lattice calculations of pure gauge theory and of QCD at vanishing and up to moderate densities allows to identify the important ingredients of the framework and where further improvements are needed. The study of isentropic trajectories in the phase diagram allows the connection to the phenomenology of heavy ion collisions and the consistency check with constraints on the tidal polarisability of compact stars permits to probe the presence of quark matter inside compact stars.

Primary authors : STIELE, Rainer (TO)

Co-authors :

Presenter : STIELE, Rainer (TO)

Track classification :

Contribution type : Oral

Submitted by : STIELE, Rainer

Submitted on Wednesday 13 June 2018

Last modified on : Wednesday 13 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 5

Star on table: beta-decay properties of neutron rich nuclei for astrophysics applications.

Content :

New generation ISOL facilities such as SPES [1], which will be operational in a few years at LNL Legnaro allows for production of more neutron rich spices pushing experimentalists closer towards r-process nuclei. Physics cases using non-accelerated beams radioactive isotopes, so-called decay studies, are very vast. Even at low production yield relaying on a relatively compact experimental setup the gross properties of beta-decay, such as half live and probability of delayed (multi) neutron can be measured providing thus the first hints on the nuclear structure.
Although, the available experimental methods have not yet opened doors to asses the most „delicious" nuclei from astrophysical accepts, nowadays already about ~30 r-process nuclei have been synthesized and studied. Many more neutron-rich species have been investigated to provide beta decay properties as input parameters for astrophysical calculations. But it is also true that astrophysical scenarios these parameters are derived from various theoretical models. Indeed, in the region nearby to the beta-stability line the reliability of such predilections is tipically very high. However, in more exotic regions, there experimental data is poor, most of the models fail to reproduce experimental trends obtained for newly produced isotopes. Thus, experiments provide a comfortable play ground to tune theoretical models.
The milestone is at the neutron closed shells. It is usually accepted that the probability of forbidden decays will increase with the neutron number of neutrons. Due to higher Q-values and lower neutron-separation energy one may expect that the Pn will be higher with a higher neutron number. However, in our recent work performed at ALTO ISOL facility [2] using a decay station [3] and high-sensitivity, high-efficiency detector set-up TETRA [4] we observed a different pattern. Crossing the N=50 shell Pn values for Ga isotopes revealed an oscillation behaviour as a function of neutron number N [5]. This effect was related to the existence of low-lying satellites of the GTGR, thereafter interpreted as components of a pygmy Gamow-Teller resonance (GTPR) predicted in [6] and observed in the region of lighter K nuclei [7]. This phenomena is also known to have important consequences for r-process calculations [8]. While it is still in general difficult to exploit the integrated properties of beta-decay far from the stability, their measurements for a series right after a neutron closed shell may bring an insights of the structure of nuclei in the region. In the talk it will be presented the outfits of a few experimental campaigns at ALTO ISOL facility in the vicinity of neutron N =50, 82 closed shells to reveal beta decay properties of neutron-rich nuclei in the region. The LoI to extend beta-delayed studies benefiting SPES beams was positively evaluated by SAC.

[1] G.Bisoffi, G.Prete, A.Andrighetto et al., Nucl.,Inst.,and Meth., in Phys., Res., B, 376 240 (2016)
[2] F. Azaiez, S. Essabaa, F. Ibrahim, D. Verney, Nuclear Physics News 23 (2013) 2.
[3] A. Etilé, D. Verney, N.N. Arsenyev, et al., Phys. Rev. C 91 064317 (2015)
[4] D. Testov, D.Verney, B.Roussiere, Nucl.,Instr.,and Meth. in Phys.,Res., A, 815 96 (2016)
[5] D.Verney, D.Testov, F.Ibrahim et al., Phys. Rev. C 95 054320 (2017)
[6]] H. Ejiri, K. Ikeda, and J.-I. Fujita, Phys. Rev. 176, 1277 (1968).
[7] L. Carraz, P. Hansen, A. Huck at al., Phys. Lett. B 109, 419 (1982).
[8] H. V. Klapdor, T. Oda, J. Metzinger, W. Hillebrandt, and F. K. Thielemann, Z. Phys. A: At. Nucl. 299, 213 (1981).

Primary authors : TESTOV, Dmitry (PD)

Co-authors : Dr. VERNEY, David (IPN Orsay) ; Dr. IBRAHIM, Fadi (IPN Orsay) ; Prof. PENIONZHKEVICH, Yuri (joint institute for nuclear research) ; Dr. SMIRNOV, Vladimir (JINR Dubna)

Presenter : TESTOV, Dmitry (PD)

Track classification :

Contribution type : Oral

Submitted by : TESTOV, Dmitry

Submitted on Wednesday 13 June 2018

Last modified on : Wednesday 13 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 6

Measurement of the 235U(n.f) cross section relative to n-p scattering up to 1 GeV at n_TOF

Content :

The neutron induced fission of 235U is extensively used as a reference for neutron fluence measurements in various applications, ranging from the investigation of the biological effectiveness of high-energy neutrons, to the measurement of high-energy neutron cross sections of relevance for accelerator-driven nuclear systems. At intermediate energies, the 235U(n,f) cross section plays an important role also for fundamental nuclear physics. Despite its widespread use, few data exist on neutron-induced fission of 235U above 200 MeV. Hence, there is a clear and long-standing demand from the International Atomic Energy Agency (IAEA) to extend the experimental data from 20 MeV to 1 GeV.
For this purpose at the neutron facility n_TOF at CERN the measurement of 235U (n,f) cross section is planned in October 2018, taking advantage of the intense neutron beam with a wide energy spectrum available in the experimental area. The cross section measurement will be performed relative to the elastic neutron-proton scattering, a very well known reaction generally accepted as primary reference.
A prototype of the Proton Recoil Telescope detector, that will be used to measure the incident neutron flux, has been built and tested at n_TOF. The detector consists of two silicon detectors and four fast plastic scintillators (BC-408) to detect and identify the recoiling protons.
The motivations of the measurement, the main features of the Proton Recoil Telescope and preliminary results will be presented in this talk.

Primary authors : MANNA, Alice (University and INFN Bologna)

Co-authors :

Presenter : MANNA, Alice (University and INFN Bologna)

Track classification :

Contribution type : Oral

Submitted by : MANNA, Alice

Submitted on Wednesday 13 June 2018

Last modified on : Thursday 14 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 7

Energy and multiplicity dependence of hadronic resonance production with ALICE at the LHC

Content :

The study of strange hadronic resonances plays an important role both in pp and in heavy-ion collisions as it provides information about strangeness production and the hadronic phase of the system. Since the lifetimes of short-lived resonances are comparable with the lifetime of the fireball formed in heavy-ion collisions, regeneration and rescattering effects can modify the measured yield especially at low transverse momentum. Measurements in pp collisions at different energies constitute a baseline for studies in heavy-ion collisions and provide constraints for tuning QCD-inspired event generators. Furthermore the high multiplicity pp collisions, where the density and the volume of the system are expected to be larger compared to minimum bias pp collisions can help in the search for the onset of collective phenomena. A comprehensive set of recent results obtained by ALICE on hadronic resonances in pp, p-Pb, and Pb-Pb collisions will be presented. Finally, the comparison of the results with model predictions will also be discussed.

Primary authors : GARG, Kunal (CT)

Co-authors :

Presenter : GARG, Kunal (CT)

Track classification :

Contribution type : Oral

Submitted by : GARG, Kunal

Submitted on Wednesday 13 June 2018

Last modified on : Wednesday 13 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 8

Particle Therapy applications of FRED, a fast GPU based MC tool for proton energy deposition in matter.

Content :

Particle Therapy (PT) is a widespread technique for treating inoperable tumors with protons or heavier ions, that exploits the specific dose release mechanism of these particles (the so called Bragg Peak distribution) to maximise tumor control probability while sparing surrounding healthy tissues. Software tools are needed to produce for each patient a treatment plan, i.e. a series of proton energy, number and direction in order to adapt the dose release to the tumor volume. The need to perform several optimisations of such treatments and the limited time available for such patient-specific procedure, force clinical centres to use fast analytical models to predict the dose, not fully profiting from the benefits of a full MC approach (much more time consuming but more accurate). The code FRED has been developed to allow a fast optimisation of the treatment plans while profiting from the dose release accuracy of a MC tool. Within FRED the proton interactions are described with the precision level available in leading edge MC tools used for medical physics applications, with the advantage of reducing the simulation time up to a factor 1000, allowing a plan re-optimisation in few minutes on GPU cards, instead of several of hours on CPU hardware. The exceptional speed of the proton tracking algorithms implemented in FRED opened the door for several applications within the PT field. Besides the obvious application for proton treatment planning, FRED can be used to study the interactions undergone by charged fragments produced in PT treatments involving light ions (He, C and O) in their exit path towards the detectors used for online monitoring purposes. In this respect, the effects of traversed matter has to be taken into account in order to reconstruct the secondary emission spectrum starting from the detected spectrum. FRED can be used as an engine for the calculation of the unfolding matrix. These and other applications to the PT field, as well as the performance attainable with FRED will be reviewed in this contribution.

Primary authors : Dr. SCHIAVI, Angelo Schiavi (SBAI Department, Sapienza University of Rome)

Co-authors : FISCHETTI, Marta (ROMA1) ; BATTISTONI, Giuseppe (MI) ; DE SIMONI, Micol (ROMA1) ; PATERA, Vincenzo (ROMA1) ; SARTI, Alessio (LNF)

Presenter : Dr. SCHIAVI, Angelo Schiavi (SBAI Department, Sapienza University of Rome)

Track classification :

Contribution type : Oral

Submitted by : Dr. SCHIAVI, Angelo Schiavi

Submitted on Thursday 14 June 2018

Last modified on : Thursday 14 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 9

Direct measurement of the 2H (p,γ)3He cross section at the BBN energy range at LUNA

Content :

Deuterium is the first nucleus produced in the Universe, whose accumulation marks the beginning of the so called Big Bang Nucleosynthesis (BBN). Its primordial abundance is very sensitive to some cosmological parameters like the baryon density and the number of the neutrino families. Presently the main obstacle to an accurate theoretical deuterium abundance evaluation comes from the poor knowledge of the 2H(p,γ)3He cross section at BBN energies. A measurement of this reaction cross section in the energy range 10keV < Ecm < 300keV is desirable with a high accuracy [1]. Furthermore it is crucial for testing ab-initio calculations in theoretical nuclear physics [2].
The measurement of the 2H(p,γ)3He cross section is ongoing at the Laboratory for Underground Nuclear Astrophysics (LUNA).
The experiment consists of two main phases characterized by two different set-ups. The first comprises a windowless gas target filled with deuterium and a 4π BGO detector. This high efficiency detector has been used for investigating the energy range between 30 keV and 260 keV [3], extending the previous results obtained by the LUNA collaboration in [4], where the 2H(p,γ)3He cross section was studied in the Solar Gamow peak (2.5keV < Ecm < 22keV).
The second phase, instead, covers the medium-high energies (70keV < Ecm < 260keV) using a High Purity Germanium detector (HPGe), whose high resolution allows the differential cross section of the reaction to be evaluated by peak-shape analysis.
The progress of experiment and data analysis will be reported.

References:
[1] E. Di Valentino et al., Phys. Rev. D 90 (2014) 023543.
[2] L.E. Marcucci et al., Phys. Rev. Lett. 116 (2016) 10250;
[3] V. Mossa, Study of the 2H(p,γ)3He reaction in the Big Bang Nucleosynthesis energy range, PhD thesis, Università degli Studi di Bari, 2018.
[4] C. Casella et al., Nucl. Phys.,A 706 (2002) 203.

Primary authors : Dr. MOSSA, Viviana (BA)

Co-authors :

Presenter : Dr. MOSSA, Viviana (BA)

Track classification :

Contribution type : --not specified--

Submitted by : MOSSA, Viviana

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 10

Innovative device for online in-vivo dose monitoring based on charge unbalance in patients undergoing radiotherapy

Content :

A completely new on-line, non-invasive, bias-free detector for relative and absolute in-vivo dose monitoring, has been realized to be employed for patients undergoing charged particles radiotherapy. The basic idea is to use the patient as a Faraday cup, collecting the current injected from the beam directly from a section of its skin, far from the beam entering point and using a conductive electrode. Such new dosimeter has been tested in-vitro, in an electrically-isolated phantom irradiated with 62 MeV clinical proton beams at CATANA facility of INFN-LNS (Catania, Italy). The proton beam current has been collected from an electrode immersed in a water phantom and positioned outside the irradiation field. The charge measurements resulted in accordance with the theoretical prevision. The detector response has been studied as a function of the dose released in water, dose rate and irradiation field. In all cases, the experimental data have been compared with the theoretical results.
The acquired data demonstrate the usefulness of the proposed approach as in-vivo beam monitoring during a charged particles irradiation. Preliminary tests have been also carried out by using electron and carbon beams. In-vivo tests, carried out on protontherapy patients demonstrated the clinical applicability of the developed as on-line dose monitoring. The system has been protected by a National Italian patent, N 102017000087851 while submission for international patent is ongoing.

Primary authors : Dr. PETRINGA, Giada (LNS)

Co-authors : CIRRONE, Giuseppe (LNS) ; AMATO, Antonino Salvatore (LNS) ; CUTTONE, Giacomo (LNS) ; Mr. MAZZAGLIA, Alfio (LNS-INFN) ; RANDAZZO, Nunzio (CT) ; RAFFAELE, Luigi (LNS) ; Dr. PRIVITERA, Giuseppe (Ospedale Universitario Policlinico Vittorio Emanuele) ; Dr. SPATOLA, Corrado (Ospedale Universitario Policlinico Vittorio Emanuele) ; Dr. VINCENZO, Salamone (Ospedale Universitario Policlinico Vittorio Emanuele)

Presenter : Dr. PETRINGA, Giada (LNS)

Track classification :

Contribution type : Oral

Submitted by : Dr. PETRINGA, Giada

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 11

Proton-Boron fusion reaction increases proton radiobiology effectiveness

Content :

Protontherapy is a pillar in the battle against cancer but the higher Relative Biological Effectiveness (RBE) of 12C-ions can overcome cancer radioresistance. Thus, enhancing proton RBE is desirable. To this end, we exploited the 11B(p,a)2a nuclear fusion reaction to generate high-LET alpha particles with a clinical proton beam. To maximize the reaction rate, we used sodium borocaptate (BSH) with natural boron content. Boron-treated cells were irradiated at mid-SOBP (Spread Out Bragg Peak) depth and assayed for clonogenic survival and DNA damage induction We recorded significantly increased cellular lethality and occurrence of chromosome aberrations. Specifically, we proved that, if human cells are irradiated with a given amount of 11B the interaction with protons results in an increase of almost a factor 2 in cell killing compared to boron-free irradiated controls. The findings suggest that the effect is due to the generation of low-energy, high LET alpha particles since we measured a marked increase in the complexity of DNA damage. The alphas produced have a sufficient range to come to a halt and release almost their entire energy in the cell nucleus by which severe damage is induced to the DNA, thereby enhancing the biological efficacy of the proton beam.
The presence of Boron atoms and of the associated gamma-prompt emissions generated from their interaction with protons, could also give an added value to this approach giving the possibility of the treatment on-line verification.

Primary authors : Dr. PETRINGA, Giada (LNS)

Co-authors : CIRRONE, Giuseppe (LNS) ; MANTI, Lorenzo (NA) ; CAMMARATA, Francesco Paolo (LNS) ; CUTTONE, Giacomo (LNS) ; Dr. MARGARONE, Daniele (ELI-Beamlines, IoP-ASCR) ; PISCIOTTA, Pietro (LNS) ; Dr. RUSSO, Giorgio (IBFM-CNR; LNS-INFN) ; Dr. SCUDERI, Valentina (LNS)

Presenter : Dr. PETRINGA, Giada (LNS)

Track classification :

Contribution type : Oral

Submitted by : Dr. PETRINGA, Giada

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 12

Particle Therapy secondary neutrons characterization and cross section measurements within the MONDO project

Content :

Particle Therapy (PT) is a non-invasive technique that exploits charged light ions for the irradiation of tumours untreatable with surgery or conventional radiotherapy. Despite the largest fraction of dose is released to the tumour volume by the primary beam, a non-negligible amount of additional dose is deposited due to the contribution of secondary charged and neutral particles emitted from the fragmentation of the therapeutic beam with the patient's tissues. In particular, neutrons are particularly dangerous as they can release energy far away from the treated area, increasing the risk of developing a radiogenic secondary malignant neoplasms many decades after undergoing a treatment.
A precise measurements of the neutron flux, energy spectrum and angular distributions is eagerly needed in order to improve the TPS software, so to predict the normal tissue toxicity in the target region and the risk of late complications in the whole body. The request becomes particularly urgent in the case of paediatric treatments considering the related large life expectancy.
The MONDO (MOnitor for Neutron Dose in hadrOntherapy) project is dedicated to the characterisation of the secondary ultrafast neutrons produced in PT in the range of [20-400] MeV. The neutron tracking system is based on the reconstruction of the recoil protons produced in two consecutive (n,p) elastic scattering interactions. The tracker - 10x10x20 cm3 - is made by a matrix of thin squared scintillating fibers (250 μm) arranged in layers orthogonally oriented. A tailored readout sensor – SBAM - based on a silicon detector developed exploiting SPAD (Single Photon Avalanche Diode) array in CMOS technology, has been developed in collaboration with Fondazione Bruno Kessler (FBK).

The secondary neutrons produced in PT will be measured in a clinical environment exploiting the high efficiency and high background rejection of the MONDO tracking detector. The tracker is also suitable to significantly improve the experimental precision on neutron double differential production cross section in Carbon irradiation of tissue equivalent materials. The data obtained could have a great impact not only in PT applied physics but also in other fields of great interest such as the radioprotection in space.
The detector and the readout system are under development and a prototype of the tracker has been tested with protons at the Proton Therapy Centre of Trento.
Experimental results, efficiency studies and the light yield measurements will be presented. The Monte Carlo FLUKA simulation work performed to characterise the detector response to the incoming neutron radiation and to optimise the readout system will be also presented.

Primary authors : TRAINI, Giacomo (ROMA1)

Co-authors : BATTISTONI, Giuseppe (MI) ; DE SIMONI, Micol (ROMA1) ; DONG, Yunsheng (MI) ; FISCHETTI, Marta (ROMA1) ; GIOSCIO, Eliana (LNF) ; Dr. MARAFINI, Michela (Centro Fermi) ; MATTEI, Ilaria (MI) ; MIRABELLI, Riccardo (ROMA1) ; SARTI, Alessio (LNF) ; Dr. SCHIAVI, Angelo Schiavi (SBAI Department, Sapienza University of Rome) ; SCIUBBA, Adalberto (ROMA1) ; VALLE, Serena Marta (MI) ; PATERA, Vincenzo (ROMA1)

Presenter : TRAINI, Giacomo (ROMA1)

Track classification :

Contribution type : Oral

Submitted by : TRAINI, Giacomo

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 13

Magnetized Plasmas in Compact Traps for Astrophysics and Nuclear Astrophysics

Content :

Experiments performed on Storage Rings have shown that lifetimes of beta-radionuclides can change dramatically as a function of the ionization state. An even more attractive experiment may consist in measuring, for the first time, nuclear β-decay rates in stellar-like conditions, especially for radionuclides involved in nuclear-astrophysics processes and cosmology (BBN, s-processing, CosmoChronometers, Early Solar System formation). Compact magnetic plasma traps, where plasmas reach density ne~10^11-10^14 cm^-3, and temperature Te~0.1-30 keV, are suitable for such studies. The decay rates can be measured as a function of the charge state distribution of the in-plasma ions. This idea is the subject of the PANDORA (Plasmas for Astrophysics, Nuclear Decay Observation and Radiation for Archaeometry) project, now supported by the 5th Nat. Comm. of INFN as a feasibility study. Possible physics cases include 85Kr (a crucial branching point of the s-process); 176Lu and the pairs 187Re-187Os and 87Sr-87Rb, which play a crucial role as cosmo-clock; the 7Be, that is responsible of the primordial abundance of 7Li and in primordial nucleosynthesis happens in a quite peculiar plasma environment. The paper will give an overview about methodologies and experimental scenarios for in-plasma nuclear astrophysics research.

Primary authors : Dr. MASCALI, David (LNS)

Co-authors : GALATÀ, Alessio (LNL) ; Prof. LEONE, Francesco (LNS) ; CASTRO, Giuseppe (LNS) ; CELONA, Luigi Giuseppe (LNS) ; COSENTINO, Luigi Giovanni (LNS) ; GAMMINO, Santo (LNS) ; Dr. GIARRUSSO, Marina (Università di Catania) ; MASSIMI, Cristian (BO) ; Dr. MAZZAGLIA, Maria (INFN-LNS) ; NASELLI, Eugenia (LNS) ; PALMERINI, Sara (PG) ; Dr. ROMANO, Francesco Paolo (LNS) ; Dr. TORRISI, Giuseppe (LNS)

Presenter : Dr. MASCALI, David (LNS)

Track classification :

Contribution type : Oral

Submitted by : Dr. MASCALI, David

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 14

Measurement of 235U(n,f) cross section between 10 and 30 keV

Content :

The 235U(n,f) cross section is established as a standard reference for measurements and evaluations at thermal neutron energy and in the range between 150 keV and 200 MeV. Thanks, amongst other considerations, to this wide energy interval the 235U fission is one of the most used standards, but recent experimental data suggest the presence of discrepancies in the 235U(n,f) reaction cross section between 10 and 30 keV. Although not considered as a standard in this energy range, it is often used as reference for the measurement of the neutron flux at various facilities. Any correction to the values adopted in evaluated libraries has an immediate impact over all the results of experiments that use the 235U fission as reference.

In order to overcome this problem an accurate measurement of 235U(n,f) cross section in the energy range between 10 and 30 keV has recently been performed in the n_TOF facility at CERN, where is available a neutron beam with a remarkable energy resolution and high instantaneous flux. A new experimental setup has been used, consisting of a stack of single pad silicon detectors and 235U, 10B and 6Li targets placed directly on the beam, the boron and lithium are used as standard reference. This measurement represents the first case of fission products measured using silicon detectors at n_TOF facility, proving the suitability of silicons even in this critical configuration. The customized experimental apparatus and the data analysis with definitive results will be presented.

Primary authors : AMADUCCI, Simone (LNS)

Co-authors :

Presenter : AMADUCCI, Simone (LNS)

Track classification :

Contribution type : Oral

Submitted by : AMADUCCI, Simone

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 15

Advanced treatment planning techniques in pencil beam scanning proton therapy

Content :

The gradual spread of proton therapy (PT) registered in the last years is due on the one hand to PT getting more established for the treatment of specific cancer types (e.g. head and neck, brain tumours), on the other hand to the growing interest in the possibility to extend the use of PT for the treatment of a larger spectrum of lesions, as for instance breast cancer.

The presentation will summarize some of the activities performed in both directions in the last years. Specifically, based on patient data, we will discuss how the quality of pencil beam scanning (PBS) proton plans can be improved by the use of advanced optimization techniques, combining the use of Monte Carlo (MC) dose calculation algorithms with robust optimization tools. We will also compare the impact of physical uncertainty (i.e. setup and range uncertainty) with so-called biological uncertainty obtained by considering a variable Relative Biological Effectiveness (RBE). Our data indicate that, even though usually neglected, the dose variation due to biological uncertainty is comparable to the physical one.

In addition to that, the study of the impact of MC dose engine on the quality of PBS proton plans for breast cancer will be discussed. Treatment plans obtained with the use of an analytical pencil beam and with a MC algorithm will be compared. Simulated data will be benchmarked against experimental measurements. The results of our study clearly show that while analytical algorithms lead to an under-dosage of the target volume, MC results into an improved accuracy. This is due to a sub-optimal parameterization of nuclear interactions in the analytical algorithm, assuming an important role especially when a range-shifter is included in the plan. These data indicates that the use of a MC algorithm is recommended for the treatment of breast cancer with PBS protons.

Primary authors : Dr. TOMMASINO, Francesco (University of Trento - TIFPA)

Co-authors : LORENTINI, Stefano (Agenzia Provinciale per i Servizi Sanitari Trento) ; FARACE, Paolo (Agenzia Provinciale per i Servizi Sanitari Trento) ; SCHWARZ, Marco (Agenzia Provinciale per i Servizi Sanitari Trento) ; SCIFONI, Emanuele (TIFP)

Presenter : Dr. TOMMASINO, Francesco (University of Trento - TIFPA)

Track classification :

Contribution type : Oral

Submitted by : Dr. TOMMASINO, Francesco

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Presenter author might change.

Status : SUBMITTED

Track judgments :

Abstract ID : 16

Beta-delayed neutron emission to study 52,53,(54)Ca

Content :

Recent results have pointed out that high Q-values beta decays, as often found in exotic nuclei, proceed by Gamow-Teller (GT) decays of deeply-bound core nucleons [Madurga]. This is at variance with the paradigm of a statistical-only dependence of the GT strength at high energies. This phenomenon has been studied in the decay of 52,53K into 51-53Ca. The >14MeV Q-values of these β decay makes them an ideal case to study decay from neutrons in the N=28 and N=20 cores. The exotic 52,53K isotopes where produced at ISOLDE, using UCx
fragmentation/fission induced by a 2 μA 1.4 GeV proton beam. The surfaced-ionized isotopes were extracted and delivered to the IDS tape station for β-delayed γ and neutron spectroscopy. The Sn of 52,53Ca are in fact up to
several MeVs lower than the states populated by GT decays, hence neutron emission dominates the decay path.
The VANDLE array was employed to measure the energy of the emitted neutrons via TOF technique, in coincidence with β particle and γ rays. Preliminary results will be presented, comparing the 52Ca spectrum with
what has been obtained before [Perrot] and then showing how the energy of states populated by GT core decays changes in 53Ca following 53K decay. Possibility of high energy (>6 MeV) β-delayed neutron emission will be
presented, and its implications addressed. Tentative evidence for 54K decay observation will also be shown.

[Madurga] M. Madurga et al, Phys. Rev. Lett. 117, 092502 (2016)
[Perrot] F. Perrot et al., Phys. Rev. C 74, 014313 – Published 21 July 2006

Primary authors : GOTTARDO, Andrea (LNL)

Co-authors :

Presenter : GOTTARDO, Andrea (LNL)

Track classification :

Contribution type : Oral

Submitted by : GOTTARDO, Andrea

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 17

Multidiagnostics setups for Magnetoplasmas devoted to Astrophysics and Nuclear Astrophysics Research

Content :

Magnetized plasmas in compact trap may become experimental environments for the investigation of nuclear beta-decays of astrophysical interest. In the framework of PANDORA (Plasmas for Astrophysics, Nuclear Decays Observation and Radiation for Archaeometry) the research activities are devoted to demonstrate the feasibility of an experiment aiming at correlating radionuclides lifetimes to the in-plasma ions charge state distribution (CSD). The paper describes the multidiagnostics setup now available at INFN-LNS, which allows unprecedented investigations of magnetoplasmas properties in terms of density, temperature and CSD. The setup includes an interfero-polarimeter for total plasma density measurement, a multi-X-ray detectors system for X-ray spectroscopy (including time resolved spectroscopy), an X-ray pin-hole camera for 2D space resolved spectroscopy, and different spectrometers for the plasma-emitted visible light characterization. A description of recent results about plasma parameters characterization in quiescent and turbulent Electron Cyclotron Resonance-heated plasmas will be given, along with the perspectives towards nuclear astrophysics experiments.

Primary authors : Dr. NASELLI, Eugenia (INFN-LNS and Università di Catania)

Co-authors : Dr. MASCALI, David (LNS) ; CASTRO, Giuseppe (LNS) ; CELONA, Luigi Giuseppe (LNS) ; COSENTINO, Luigi Giovanni (LNS) ; GAMMINO, Santo (LNS) ; GIARRUSSO, Marina (LNS) ; GALATÀ, Alessio (LNL) ; Dr. MAZZAGLIA, Maria (INFN-LNS) ; Dr. ROMANO, Francesco Paolo (LNS) ; Prof. REITANO, Riccardo (Dipartimento di Fisica e Astronomia, Università di Catania) ; Dr. TORRISI, Giuseppe (LNS)

Presenter : Dr. NASELLI, Eugenia (INFN-LNS and Università di Catania)

Track classification :

Contribution type : Poster

Submitted by : Dr. MASCALI, David

Submitted on Friday 15 June 2018

Last modified on : Friday 15 June 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 18

Particle detectors modeling and designing capabilities at Turin INFN Division: the RSD project and beyond

Content :

In this contribution I will review the ongoing activities dealing with the development of fast silicon detectors for 3D and 4D particle tracking.

As reference person of device simulation and design in Turin, I will give an overview about the expertise we achieved in this field by introducing the framework of institutional collaborations of our Division and by reviewing the most significative results and milestones concerning all the projects in which we are involved.

Moreover, also the computing tools and facilities used to design a detector, from the concept to its submission to the foundry, passing through device-level numerical modeling and the editing of lithographic masks, will be reviewed.

First of all, I will show comparisons between experimental data and numerical simulations about the recent UFSD2 and UFSD3 productions, whose performance and robustness gained the attention of CMS experiment at CERN in view of its timing upgrade for HL-LHC.

Then, as Principal Investigator of the Resistive AC-coupled Silicon Detectors (RSD) project, I will also focus on the first results about this new frontier in high-efficiency particle detection funded by INFN GruppoV and, finally, the state-of-the-art about the R of monolithic sensors will be presented as well.

Primary authors : Dr. MANDURRINO, Marco (INFN, Sezione di Torino)

Co-authors :

Presenter : Dr. MANDURRINO, Marco (INFN, Sezione di Torino)

Track classification :

Contribution type : Oral

Submitted by : Dr. MANDURRINO, Marco

Submitted on Thursday 05 July 2018

Last modified on : Thursday 05 July 2018

Comments :

on behalf of RSD, UFSD and FARE groups

Status : SUBMITTED

Track judgments :

Abstract ID : 19

Probing the Quark-Gluon Plasma using charmed hadrons with ALICE at the LHC

Content :

Heavy flavours (charm and beauty quarks) are powerful probes to study and characterise the colour-deconfined medium created in high-energy heavy-ion collisions, the Quark-Gluon Plasma (QGP). Because of their large masses, heavy quarks are produced in initial hard-scattering processes, and they subsequently experience the whole system evolution, interacting with the medium constituents.

The measurement of the nuclear modification factor of open heavy-flavour hadrons can provide important information about the properties of the parton in-medium energy loss, while the measurement of the azimuthal anisotropies at low transverse momentum gives insight into the participation of the heavy quarks in the collective expansion of the system and their possible thermalisation in the medium. These two observables can also help us to understand possible modifications of the heavy-quark hadronisation in the medium. In particular, the role of the recombination mechanism can be studied via the comparison between charmed mesons with and without strange-quark content and via the baryon-to-meson ratio. Finally, the comparison to theoretical calculations of heavy-quark transport in a hydrodynamically expanding medium helps to constrain the medium parameters, such as the heavy-quark spatial diffusion coefficient.

Measurements of open heavy-flavour hadron production in pp and p--nucleus collisions are also essential to provide a reference for nucleus--nucleus collisions and to study cold nuclear matter effects, respectively.

In this talk, the latest results on the production of D^0, D$^+$, D^{*+}, D$^+_{\rm s}$ mesons and $\Lambda_{\rm c}^+$ baryons at midrapidity measured in pp, p--Pb and Pb--Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV with ALICE will be presented.

Primary authors : GROSA, Fabrizio (TO)

Co-authors :

Presenter : GROSA, Fabrizio (TO)

Track classification :

Contribution type : Oral

Submitted by : GROSA, Fabrizio

Submitted on Thursday 05 July 2018

Last modified on : Thursday 05 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 20

Description of the ^{11}Li(p,t)^{9}Li transfer reaction within a three-body model

Content :

A considerable amount of current lively research is devoted to the study of neutron Borromean nuclei, very intriguing exotic systems characterized by a diffuse two-neutron density distribution extending far beyond a compact core. Among them, the nucleus ^{11}Li deserves special attention, owing to the intensive theoretical and experimental work dedicated to this system in the last decades.

The marked three-body structure of ^{11}Li renders three-body models particularly suitable to study its ground state and continuum properties. These models have also been very useful for the interpretation of reactions involving ^{11}Li. One of these models has been recently proposed and successfully applied to the analysis of one-neutron transfer [J.~Casal {\it et al.}, PLB767 (2017) 307] and quasi-free (p,pn) reactions [M.~Gomez-Ramos {\it et al.}, PLB 772 (2017) 115]. A key issue of this model is the inclusion of the ^{9}Li spin, which leads to a splitting of the $J^\pi=1^+,2^+$ resonances and $J^\pi=1^-,2^-$ virtual states.

In this contribution, we employ this model to reanalyze the two-neutron transfer data for ^{11}Li(p,t)^{9}Li at 3 MeV/u [I. Tanihata {\it et al.}, PRL 100, 192502 (2008)]. We use the second order DWBA method, and include both sequential and simultaneous contributions. For the former, the required $\langle ^{11}\rm{Li} | ^{10}\rm{Li} \rangle$ overlaps are consistently evaluated from the three-body wave function of ^{11}Li. Our results will be compared with those obtained with previous analyses ignoring the spin of ^{9}Li.

Primary authors : Dr. BURRELLO, Stefano (INFN - Laboratori Nazionali del Sud, Catania, Italy and Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain)

Co-authors : Dr. CASAL, Jesus (European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento, Italy and Dipartimento di Fisica e Astronomia, Padova, Italy) ; Mr. GOMEZ-RAMOS, Mario (Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain) ; Dr. LAY VALERA, Josè Antonio (Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain) ; Prof. MORO, Antonio (Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain)

Presenter : Dr. BURRELLO, Stefano (INFN - Laboratori Nazionali del Sud, Catania, Italy and Departamento de FAMN, Univers

Track classification :

Contribution type : Oral

Submitted by : BURRELLO, Stefano

Submitted on Monday 09 July 2018

Last modified on : Monday 09 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 21

Constraining the nuclear matter EoS from the GW170817 merger event

Content :

The observation of NS allows us to constrain the equation of state(Eos) of the dense matter well beyond the densities available in earth laboratories. For example, observations of the NS mass-radius relation and the mass–moment-of-inertia relation can be used to infer the NS Eos within a certain uncertainty. However, the mass of several NS are known with good precision but their radii still suffer from large uncertainty which leads to a weaker constraint on Eos. The recent observation of gravitational waves GW170817, and its electromagnetic counterparts allows us to constrain the dense matter Eos in new and complementary ways. The upper limit of the tidal deformability is put on by the merger event and the lower limit by the kilonova AT2017gfo signal. This translates into an allowed window for the radius of the 1.4Mo stellar configuration between~11.5 and 13. 5km. In this case, we calculate neutron star's moment of inertia and tidal deformability using various microscopic Eos which are derived based on two- and three-body realistic nucleon interaction for nuclear and hybrid star configurations. We show that they are fully compatible with constraints imposed by interpretation of the first observed neutron-star merger event.

Primary authors : BURGIO, Giuseppina Fiorella (CT)

Co-authors : DRAGO, Alessandro (FE) ; PAGLIARA, Giuseppe (FE) ; SCHULZE, Hans Josef (CT) ; WEI, Jinbiao (CT)

Presenter : WEI, Jinbiao (CT)

Track classification :

Contribution type : Oral

Submitted by : WEI, Jinbiao

Submitted on Thursday 12 July 2018

Last modified on : Thursday 12 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 22

DESCRIZIONE TEORICA DELLE REAZIONI NUCLEARI DI SCAMBIO DI CARICA TRA IONI PESANTI

Content :

Negli ultimi anni le reazioni nucleari di singolo (SCE) e doppio scambio di carica (DCE) tra ioni pesanti hanno riscosso crescente interesse, per via della loro natura trasversale, multidisciplinare; infatti, se da un lato il loro carattere diretto permette di condurre studi sulla struttura dei nuclei proiettile e bersaglio, con particolare attenzione ad effetti legati alla componente isovettoriale dell'interazione nucleare forte, dall'altro lato tali reazioni potrebbero fornire informazioni importanti per la fisica delle alte energie, per la determinazione del valore della costante di accoppiamento assiale efficace e per dirimere la questione sulla natura di Dirac o di Majorana del neutrino. Quest'ultimo aspetto è basato sulle analogie che si possono cogliere tra reazioni DCE tra ioni pesanti ed il doppio decadimento beta con o senza emissione di neutrini ($0\nu\beta\beta$). Dalla sezione d'urto dei processi DCE tra ioni pesanti potrebbero estrarsi, sotto opportune ipotesi tutt'ora sotto studio, informazioni sull'elemento di matrice nucleare di $0\nu\beta\beta$, facendo così luce sui vari modelli di struttura nucleare, che ne forniscono valori differenti di circa un fattore 3. Ciò consentirebbe, in ultima analisi, di determinare la massa efficace del neutrino, da eventuali misure della vita media di un nucleo che decade $0\nu\beta\beta$, con un errore significativamente piccolo.
Questo risultato è basato sulla possibilità di fattorizzare la sezione d'urto DCE nel prodotto di un termine di reazione ed uno di struttura nucleare, quest'ultimo foriero di informazioni sull'elemento di matrice in istudio. Le reazioni DCE possono essere interpretate come convoluzione di due processi SCE correlati (à la Majorana) o incorrelati, con relative anologie rispetto ai decadimenti $0\nu\beta\beta$ e $2\nu\beta\beta$ (permesso dal Modello Standard). Il presente contributo illustra gli studi condotti sulle reazioni di scambio di carica tra ioni pesanti, trattate nell'ambito della “distorted wave Born approximation” (DWBA). Il peso che hanno struttura nucleare e parte di reazione (descritta dai potenziali ottici, Coulombiano compreso) nella determinazione sia dell'ampiezza sia della forma funzionale della sezione d'urto è stato inizialmente studiato per i processi SCE, costituenti i mattoni, ovvero i processi base, del DCE. Sotto opportune condizioni (piccolo impulso trasferito, circa 25-30 MeV), è stato possibile fattorizzare la sezione d'urto SCE nell'elemento di struttura nucleare e un fattore di distorsione. E' stata anche valutata la bontà di alcune approssimazioni, rilevando ad esempio come la “black disk approximation” (BDA) costituisca una buona ipotesi lavorativa e permetta la determinazione di un'espressione analitica del fattore di distorsione. Particolare attenzione è stata, in seguito, posta sullo studio del doppio scambio di carica descritto come convoluzione di due processi SCE incorrelati e sulla possibilità di fattorizzare la sezione d'urto anche in questo caso. L'elemento di matrice nucleare così calcolato presenta delle analogie con l'elemento di matrice nucleare del decadimento $2\nu\beta\beta$, permettendo così di avere sotto controllo, dal punto di vista delle reazioni nucleari di scambio di carica, uno dei principali canali competitivi del processo “à la Majorana”.
Questi studi teorici sono stati effettuati nel contesto dell'attività sperimentale del progetto NUMEN, svolta presso i Laboratori Nazionali del Sud.

Primary authors : Mrs. BELLONE, Jessica Ilaria (INFN - LNS and University of Catania)

Co-authors : BURRELLO, Stefano (LNS) ; COLONNA, Maria (LNS) ; Dr. LAY VALERA, José Antonio (Dpto. de Física Atómica, Molecular y Nuclear, Universidad de Sevilla) ; LENSKE, Horst (Univ. Glessen)

Presenter : Mrs. BELLONE, Jessica Ilaria (INFN - LNS and University of Catania)

Track classification :

Contribution type : Oral

Submitted by : BELLONE, Jessica

Submitted on Thursday 12 July 2018

Last modified on : Thursday 12 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 23

Activation studies in proton therapy treatment monitoring with in-beam PET

Content :

Positron emission tomography (PET) is one of the most mature techniques for monitoring in ion beam therapy. PET allows to reconstruct the β+ activity generated in the patient by the nuclear interaction of the ions. Taking advantage of the spatial correlation between positron emitters created along the ions path and the dose distribution, it is possible to perform a quality control of the treatment and estimate the particle range. Treatment verification is commonly done by comparing the width and shape of measured and Monte Carlo activity distributions, however additional information about the target composition can be gained by analyzing the time structure and the integral values of the beta+ activity acquired. In this presentation we show a few examples of the type of information that can be obtained in this way. We also summarize the use of PET as monitoring tool in hadron therapy worldwide, and we show how activity analyses lead to a validation of the low energy nuclear production cross section of beta+ emitting nuclei.

Primary authors : MURARO, Silvia (PI) ; KRAAN, Aafke Christine (PI)

Co-authors : Dr. CAMARLINGHI, Niccolo' (PI) ; MORROCCHI, Matteo (PI) ; TOPI, Albana (S) ; ROSSO, Valeria (PI)

Presenter : MURARO, Silvia (PI)

Track classification :

Contribution type : Oral

Submitted by : MURARO, Silvia

Submitted on Thursday 12 July 2018

Last modified on : Thursday 12 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 24

Studio di barioni con charm in collisioni pp, p-Pb e Pb-Pb ad LHC

Content :

Lo studio di quark pesanti (charm e beauty) è un potente strumento di indagine per il Quark – Gluon Plasma (QGP), stato in cui si ipotizza dovesse trovarsi la meteria nei primi istanti di vita dell'universo, ricreato in collisioni di nuclei ad alta energia a LHC. I quark charm e beauty sono formati in processi di hard-scattering durante le prime fasi della collisione, prima della formazione del QGP. Dunque, sono in grado di attraversare il mezzo e portare informazione sull'evoluzione dello stesso, interagendo con i suoi costituenti.
La misura del rapporto barioni/mesoni è sensibile ai meccanismi di adronizzazione e a come questi vengano modificati dalla presenza del QGP. In particolare, secondo modelli di coalescenza, un aumento di tale rapporto è atteso in collisioni tra ioni piombo rispetto a collisioni pp. In aggiunta, un ulteriore incremento è previsto nel caso in cui
sia ipotizzata l'esistenza di stati legati di di-quark. Dunque, la misura di barioni con charm permette di sondare aspetti inesplorati del QGP.
Misure in piccoli sistemi di collisione (pp e p-Pb) sono un fondamentale riferimento per misure in collisioni tra ioni piombo. Misure in collisioni pp, in particolare, permettono di testare predizioni teoriche della Cromodinamica Quantistica perturbativa (pQCD)
e modelli di adronizzazione nel vuoto. Misure in collisioni p-Pb, d'altra parte, permettono di studiare effetti di materia nucleare fredda, non dovuti alla formazione del QGP ma a modifiche delle funzioni di distribuzione partonica in materia nucleare.
Le recenti misure dei barioni $\Lambda_{\rm c}^{+}~$ e $\Xi_{\rm c}^{0}~$ ottenute in collisioni pp a 7 TeV e di $\Lambda_{\rm c}^{+}~$ in collisioni p-Pb a $\sqrt{s_{\rm NN}}$ = 5.02 TeV con l'esperimento ALICE saranno presentate e confrontate con le misure ottenute da altri esperimenti a LHC e con modelli teorici. La prima misura di $\Lambda_{\rm c}^{+}~$ in collisioni Pb-Pb alle energie di LHC, effettuata con l'esperimento ALICE, sarà anche presentata.
La misura ad alta precisione di $\Lambda_{\rm c}^{+}~$ e $\Lambda_{\rm b}^{0}~$ in collisioni Pb-Pb è uno degli obiettivi dell'upgrade dell'esperimento ALICE (presa dati prevista a partire dal prossimo 2021), grazie al miglioramento della risoluzione sul paramentro di impatto delle tracce a basso impulso trasverso e, di conseguenza, sulla determinazione dei vertici primari e secondari. Dunque nel talk si discuterà anche della performance aspettata per il rivelatore, in particolare per le misure di $\Lambda_{\rm c}^{+}~$ e $\Lambda_{\rm b}^{0}~$ attese.

Primary authors : Ms. MENINNO, Elisa (University of Salerno and INFN)

Co-authors :

Presenter : Ms. MENINNO, Elisa (University of Salerno and INFN)

Track classification :

Contribution type : Oral

Submitted by : MENINNO, Elisa

Submitted on Friday 13 July 2018

Last modified on : Friday 13 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 25

LHCb pentaquarks as compact five-quark states

Content :

We investigated the lightest pentaquark state observed by the LHCb collaboration [1,2,3] as a compact five-quark ground-state, with spin S = 3/2, and we showed that this state belongs to a SU(3) flavor octet by means of a group theory approach [4]. Moreover, we predicted in a parameter-free way the pentaquark state mass spectra for all the octet-pentaquark states and we also suggested possible bottom baryon decay channels which involve the octet-pentaquark resonances as intermediate states.
Finally, by means of an effective Lagrangian approach, we computed the octet-pentaquark decay widths for all the suggested decay channels.

[1] R. Aaij et al. [LHCb Collaboration], Phys. Rev. Lett. 115
(2015) 072001;
[2] R. Aaij et al. [LHCb Collaboration], Phys. Rev. Lett. 117
(2016) no.8, 082002;
[3] R. Aaij et al. [LHCb Collaboration], Phys. Rev. Lett. 117
(2016) no.8, 082003
[4] E.Santopinto and A Giachino, Phys.Rev. D96 (2017) no.1, 014014.

Primary authors : Mr. GIACHINO, Alessandro (INFN)

Co-authors : SANTOPINTO, Elena (GE)

Presenter : Mr. GIACHINO, Alessandro (INFN)

Track classification :

Contribution type : Oral

Submitted by : GIACHINO, Alessandro

Submitted on Friday 13 July 2018

Last modified on : Friday 13 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 26

Quarkonium production in p-Pb collisions with the ALICE experiment

Content :

The main purpose of the study of quarkonia in proton-nucleus collisions is the investigation of cold nuclear matter effects, which can influence their production. It has been observed that the relevant processes to describe the production of the most tightly bound states (J/psi and Upsilon(1S)) might be the modification of the parton distribution functions in nuclei, the presence of a color glass condensate or the coherent energy loss of the Q-Qbar pair in the medium. On the contrary, the stronger suppression observed for the loosely bound psi(2S) state can be explained with a final state effect, related to the presence of a dense medium.
Quarkonium production has been measured by the ALICE experiment in p-Pb collisions covering the backward (-4.46 < y_cms < -2.96), the mid (-1.37 < y_cms < 0.43) and the forward (2.03 < y_cms < 3.53) rapidity ranges, down to zero transverse momentum.
The nuclear modification factor (RpA) in different rapidity ranges at sqrt{sNN}=5.02 and 8.16 TeV will be presented. Results on the transverse momentum, rapidity and centrality dependence of J/psi and Upsilon(1S) RpA, measured at backward and forward rapidity at sqrt{sNN}= 8.16 TeV will be shown, comparing them with the less tightly bound states psi(2S) and Upsilon(2S). Finally all the results will be compared to those obtained at lower energies and with theoretical predictions.

Primary authors : MICHELETTI, Luca (T)

Co-authors :

Presenter : MICHELETTI, Luca (T)

Track classification :

Contribution type : Oral

Submitted by : MICHELETTI, Luca

Submitted on Friday 13 July 2018

Last modified on : Friday 13 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 27

Coherent Deeply Virtual Scattering off 4He

Content :

The handbag contribution to coherent deeply virtual Compton scattering off the 4He nucleus is studied here in impulse approximation. Within this scenario, a convolution formula for the only Generalized Parton Distribution (GPD) describing the 4He partonic structure is derived in terms of the non-diagonal nuclear spectral function and the GPD of the struck nucleon. A model for the off-diagonal spectral function, based on the momentum distribution corresponding to the Argonne 18 nucleon-nucleon interaction, is used in the actual calculation together with the Goloskokov-Kroll model as far as it concerns the nucleonic GPD. Then, the numerical results of this approach [1] are compared with the experimental results recently published by the EG6 experiment at the Jefferson Laboratory (JLab), showing an overall good agreement. On the light of this comparison, one can conclude that the description of the present data does not require exotic arguments, such as dynamical off-shellness or non-nucleonic degrees of freedom. More refined nuclear calculations, necessary for the expected improved accuracy of the next generation of experiments at the Jefferson Laboratory, with the 12 GeV electron beam and high luminosity, will be addressed.

[1] S. Fucini, S. Scopetta and M. Viviani, Phys. Rev. C98 015203 (2018)

Primary authors : FUCINI, Sara (PG)

Co-authors : Prof. SCOPETTA, Sergio (University of Perugia and INFN section of Perugia) ; VIVIANI, Michele (PI)

Presenter : FUCINI, Sara (PG)

Track classification :

Contribution type : Oral

Submitted by : FUCINI, Sara

Submitted on Friday 13 July 2018

Last modified on : Friday 13 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 28

INFN-TROPIC: Target for Radioisotope Production via Anti-Channeling

Content :

The research of more efficient production techniques for radionuclides is a field of special interest, especially for modern nuclear medicine, in order to overcome some possible limitations in the supply chain of Mo-99 with nuclear reactors [1]. In particular, the usage of cyclotrons for the production of radioisotopes is spreading worldwide, despite its higher cost with respect to the production in nuclear reactors.
Oriented ordered structure can modify particle trajectories inside the medium, leading to a sensible variation of the interaction rate with atomic nuclei. Under specific orientations of a crystalline target with respect to the incident beam, a higher probability of inelastic interaction with nuclei can be obtained, compared to the standard rate into amorphous medium. This effect is called anti-channeling and leads to an increase of the radioisotope production yield.
The INFN-TROPIC project aims to the characterization in laboratory- and production- environment of a crystalline target for the production of radioisotopes of interest for nuclear medicine. In particular, a dedicated study of the anti-channeling phaenomenon through Monte Carlo simulations is required. Alongside, the research of a target material with a crystalline quality sufficiently high to observe the anti-channeling effect is mandatory.
First target materials considered are Yttrium and Rhodium, which are already used in cyclotrons respectively to produce Zirconium-89, useful as a Positron-Emission Tomography (PET) tracer, and Palladium-103, used for prostate cancer treatment. Y and Rh can be supplied in crystalline form by some specialized manufacturers, both of them have the advantage of naturally occurring in only one isotope, and they have a rather high cross section (hundreds of millibarns) for the reaction with protons at the typical energy obtained with commercial cyclotrons (10 to 15 MeV). The crystalline structure of the first samples was characterized with a 140 keV photon beam at the European Synchrotron Radiation Facility (ESRF) of Grenoble (France). Preliminary simulations with the Monte Carlo N-Particle (MCNP6) code confirm the possibility of measuring the radionuclide production rate online via spectroscopy of the prompt γ-rays upon de-excitation of produced nuclei. A dedicated setup aimed to measure radionuclide production rate via gamma spectroscopy is under development at the Legnaro National Laboratories (INFN-LNL).

1. http://www.oecd-nea.org/ndd/reports/2010/nea6967-radioisotpes-full-report.pdf

Primary authors : Dr. GERMOGLI, Giacomo (INFN Ferrara)

Co-authors : Mr. BACCI, Luca (Dipartimento di Fisica e Astronomia “G. Galilei”, Padova) ; Dr. BAGLI, Enrico (INFN Ferrara) ; Dr. BANDIERA, Laura (INFN Ferrara) ; Dr. CAMATTARI, Riccardo (INFN Ferrara) ; CARTURAN, Sara Maria (INFN LNL) ; Dr. CASOTTI, Davide (Dipartimento di Fisica e Scienze della Terra, Ferrara) ; Prof. DE SALVADOR, Davide (INFN LNL) ; EVANGELISTI, Federico (FE) ; Dr. GUIDI, Giacomo (Comecer) ; Prof. GUIDI, Vincenzo (INFN ferrara) ; MAGGIONI, Gianluigi (INFN LNL) ; Dr. MAZZOLARI, Andrea (INFN Ferrara) ; Mr. ROMAGNONI, Marco (Dipartimento di Fisica e Scienze della Terra, Ferrara) ; Dr. SYTOV, Alexei (INFN Ferrara)

Presenter : Dr. GERMOGLI, Giacomo (INFN Ferrara)

Track classification :

Contribution type : Oral

Submitted by : GERMOGLI, Giacomo

Submitted on Friday 13 July 2018

Last modified on : Friday 13 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 29

QCD analitica nell'infrarosso da princìpi primi: uno sviluppo perturbativo massivo

Content :

Nonostante i progressi compiuti di recente grazie all'utilizzo di tecniche non perturbative, ad oggi una descrizione completa della dinamica di quark e gluoni nell'infrarosso rimane inaccessibile. La costante di accoppiamento forte definita nell'ambito della teoria perturbativa standard diverge alle basse energie; di conseguenza, le tecniche perturbative usuali non sono applicabili nel regime in cui le interazioni tra quark e gluoni danno vita alla fenomenologia rilevante per la fisica di tutti i giorni: confinement e formazione degli adroni, interazioni nucleari residue, etc. Negli ultimi anni, simulazioni numeriche di QCD su reticolo hanno stabilito che nel limite di bassi impulsi il propagatore gluonico rimane finito anziché divergere, una chiara indicazione del fatto che alle basse energie i gluoni possiedono una massa dinamicamente generata. Un fenomeno analogo si verifica per i quark a seguito della rottura spontanea della simmetria chirale. Ancora grazie ai risultati del reticolo, oggi sappiamo che è possibile definire una costante di accoppiamento forte che, pur raggiungendo un massimo ad una determinata scala di energia, ridiscende verso valori finiti nell'infrarosso e rimane sufficientemente piccola da rendere la teoria perturbativa, almeno in linea di principio, applicabile ad ogni scala. Questi dati, unitamente al fatto che la teoria perturbativa standard vieta a priori la generazione di massa ad ogni ordine finito, suggeriscono l'idea che il fallimento dell'approccio perturbativo possa essere dovuto non tanto ad un'inconsistenza interna dello stesso, quanto piuttosto ad una cattiva scelta del punto di espansione della serie perturbativa. L'obbiettivo della nostra presentazione è mostrare che modificando tale punto di espansione in modo tale che sia i gluoni che i quark possiedano una massa all'ordine zero della serie, è possibile ottenere una teoria perturbativa in grado non solo di incorporare in maniera non triviale il fenomeno della generazione di massa, ma anche di riprodurre quantitativamente i risultati del reticolo. Con particolare enfasi sulla teoria di Yang-Mills pura, discuteremo aspetti quali la rinormalizzabilità e la gauge-invarianza del nuovo approccio, forniremo un'argomentazione variazionale della sua validità ed esploreremo previsioni teoriche inerenti la transizione di fase di deconfinement. Presenteremo infine alcuni risultati ad oggi non ottenuti sul reticolo, quali la posizione dei poli di massa gluonici e la gauge-dipendenza del propagatore gluonico.

Primary authors : Mr. COMITINI, Giorgio (Università di Catania)

Co-authors : Prof. SIRINGO, Fabio (Università di Catania)

Presenter : Mr. COMITINI, Giorgio (Università di Catania)

Track classification :

Contribution type : Oral

Submitted by : Mr. COMITINI, Giorgio

Submitted on Sunday 15 July 2018

Last modified on : Sunday 15 July 2018

Comments :

Bibliografia:

F. Siringo, Nucl. Phys. B 907 (2016) 572-596
F. Siringo, Phys. Rev. D 94, 114036 (2016)
G. Comitini, F. Siringo, Phys. Rev. D 97, 056013 (2018)
G. Comitini, F. Siringo, arXiv:1806.08397 (2018)

Status : SUBMITTED

Track judgments :

Abstract ID : 30

Realistic shell-model calculations with chiral three-body force

Content :

We show an evolution to derive the shell-model effective Hamiltonian employing two- and three-body interactions based on the chiral effective field theory. A new way to calculate three-body matrix elements of the chiral interaction is given. We apply our framework to the p-shell nuclei,
and perform benchmark calculations to compare our results with those by an ab initio no-core shell-model. We report that our results are satisfactory and the contribution of the three-body force is essential to explain experimental low-lying spectra of the p-shell nuclei.

Primary authors : Dr. FUKUI, Tokuro (INFN, Sezione di Napoli)

Co-authors : Dr. DE ANGELIS, Luca (INFN, Sezione di Napoli) ; Mr. MA, Yuanzhuo (Peking University) ; Dr. CORAGGIO, Luigi (INFN, Sezione di Napoli) ; Dr. GARGANO, Angelina (INFN, Sezione di Napoli) ; Dr. ITACO, Nunzio (INFN, Sezione di Napoli) ; Prof. XU, Furong (Peking University)

Presenter : Dr. FUKUI, Tokuro (INFN, Sezione di Napoli)

Track classification :

Contribution type : Oral

Submitted by : FUKUI, Tokuro

Submitted on Monday 16 July 2018

Last modified on : Monday 16 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 31

Neutrino Mean Free Path in neutron matter from QMC equation of state

Content :

Neutron stars and their properties can be seen as laboratories to test fundamental theories spacing from microscopic nuclear interactions to gravitational theories. In this talk I will present a study of the effects of spin polarization, which might be induced by strong magnetic fields, in dense neutron systems, and in particular at densities typical of the outer core of neutron stars. Calculations are based on a (mean field) Time Dependent Local Spin Density Approximation, in which the underlying Equation of State is computed using Quantum Monte Carlo Methods. Both a chiral EFT and an Argonne-type Hamiltonians were used to assess the effects of the choice of the potential. Statical and dynamical properties of these dense partially spin polarized neutron systems and the effects on the interaction with neutrinos through lepton weak neutral currents will be also presented.

Primary authors : Mr. RIZ, Luca (TIFP)

Co-authors : PEDERIVA, Francesco (TIFP)

Presenter : Mr. RIZ, Luca (TIFP)

Track classification :

Contribution type : Oral

Submitted by : Mr. RIZ, Luca

Submitted on Tuesday 17 July 2018

Last modified on : Tuesday 17 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 32

Threshold effects in heavy quarkonium spectroscopy and decays

Content :

We discuss the possible importance of threshold corrections in Chi_c(2P) and Chi_b(3P) heavy quarkonium multiplets [1]. In particular, we calculate the threshold mass shifts and the hidden-flavor J/Psi rho and J/Psi omega strong decays of the X(3872). According to our results, the Chi_c0(2P) and Chi_b(3P) resonances are interpreted as pure quarkonia, while the X(3872), h_c(2P) and Chi_c2(2P) as the superposition of quarkonium and meson-meson molecular-type (or continuum) components [1, 2].

References
[1] J. Ferretti and E. Santopinto, arXiv:1806.02489.
[2] J. Ferretti, G. Galatà and E. Santopinto, Phys. Rev. D 90, 054010 (2014).

Primary authors : Dr. FERRETTI, Jacopo (Yale University) ; SANTOPINTO, Elena (INFN)

Co-authors :

Presenter : Dr. FERRETTI, Jacopo (Yale University) ; SANTOPINTO, Elena (INFN)

Track classification :

Contribution type : --not specified--

Submitted by : Dr. FERRETTI, Jacopo

Submitted on Saturday 21 July 2018

Last modified on : Saturday 21 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 33

Description of (p,pN) reactions induced by Borromean nuclei: The case of 14Be(p,pn)13Be

Content :

One-nucleon removal (p,pN) reactions in inverse kinematics, performed at intermediate energies to increase the mean free path of the proton inside the nucleus, can provide quite clean spectroscopic information on exotic nuclei. The Transfer to the Continuum framework, originally developed for the case of two-body projectiles [1], has been recently extended to describe (p,pN) reactions induced by Borromean (core+N+N) nuclei [2]. In this method, the final wave function is expanded in proton-nucleon continuum states. The relative-energy distribution of the residual unbound two-body subsystem, which is assumed to retain information on the structure of the initial three-body projectile, is computed by evaluating the transition amplitude for different neutron-core final states in the continuum. These amplitudes depend on the overlaps between the original three-body ground-state wave function and the two-body continuum states populated in the reaction, thus ensuring a consistent description of the incident and final nuclei.

The method was previously applied to the 11Li(p,pn)10Li reaction at 280 MeV/u, obtaining a very good agreement with GSI data [3]. In order to describe the 14Be(p,pn)13Be reaction, in which gamma coincidences from the decay of 12Be provide additional information [4], the effect of core excitations has been incorporated in the structure description of the three-body projectile. Preliminary results show the sensitivity of the cross sections to the structure input. The comparison with recent RIKEN data at 250 MeV/u [5], for both the 12Be+n spectrum and the momentum distributions of the removed neutron, suggests the dominance of a p-wave resonance at low relative energies.

[1] A. M. Moro, PRC 92 (2015) 044605.
[2] M. Gómez-Ramos, J. Casal, and A. M. Moro, PLB 772 (2017) 115.
[3] Y. Aksyutina et al., PLB 666 (2008) 430.
[4] Y. Kondo et al., PLB 690 (2010) 245.
[5] A. Corsi et al., in preparation.

Primary authors : Dr. CASAL, Jesús (ECT*) ; Mr. GOMEZ RAMOS, Mario (University of Seville) ; Dr. ANTONIO, Moro (Universidad de Sevilla, Spain) ; Dr. CORSI, Anna (CEA Saclay)

Co-authors :

Presenter : Dr. CASAL, Jesús (ECT*)

Track classification :

Contribution type : Oral

Submitted by : Dr. CASAL, Jesús

Submitted on Monday 23 July 2018

Last modified on : Wednesday 25 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 34

HCAL-J: Hadron calorimeter for the study of nucleon Form Factors at Jefferson Lab

Content :

HCAL-J is a hadron calorimeter,under construction at Jefferson Laboratory in Newport News, VA-US.
The main interest of JLAB physics is the study of fundamental interactions and constituents of hadronic matter using a longitudinally polarized electron beam; in particular, researchers investigate the electromagnetic Form Factors of the nuclei and nucleons using the CEBAF (Continuous Electron Beam Accelerator Facility) accelerator, which provides a beam of 12 GeV electrons. The upgrade to higher energies allows measurements at high values of Q2 and a more in-depth study of the internal structure of the hadron matter. To this purpose, HALLA Collaboration are building the SBS (Super Big Bite Spectrometer) , which consists of a series of elements including a dipole magnet to curve the track of the recoil particles, to be able to determine their momentum, and a series of GEM (Gas Electron Multiplier) trackers, which have the task of measuring the direction of the recoils. Moreover there are two analyzers for the measurement of the polarization components and a hadron calorimeter called HCAL-J for the measurement of particle energy, in order to apply the so called recoil polarization method which consists of the measurement of the longitudinal and transverse polarization of the scattered recoil nucleon.
The study, through SBS, of the electromagnetic form factors of nucleons allows for deriving the ratio between these two components, which results to be proportional to the ratio between the electric and magnetic Form Factors of the studied nucleon. We will use the HCAL-J hadron calorimeter in several experiments for the study of the internal structure of nucleons, i.e. for the study of proton and neutron Form Factors. HCAL-J is a sampling calorimeter useful for measuring the energy of a particle, after that it is absorbed; the peculiarity of this detector is that the output signal is proportional to particle energy. HCAL-J has a modular structure in which each module, with a front surface of 15x15cm2 and a length of 1m, consists of alternating layers of iron in which the hadron shower forms, and plastic scintillators in which its energy is sampled. The active area consists of 288 modules that include a matrix with 24 modules in length and 12 in width; the thickness of the iron plates is 1.5cm, while the sparkling plate one is 1cm. There are optical bers between each module, connected to a photomultiplier, in order to look at the light from the scintillating material and convert it into an electric signal, related to the energy of the incident particle. The requirements for any SBS experiment are: match acceptance of SBS magnet/polarimeter, high threshold in energy, while high trigger efficiency is kept, linear energy response, angular resolution about 5mrad and a time resolution TOF < 1.0ns. The energy resolution of HCAL-J, estimated through preliminary simulations by Geant4,6 was found to be 42.3 for a hadron momentum of 2.7GeV/c, gradually improving with increasing the hadron momentum. During the summer 2018 the INFN Catania Group, in collaboration with JLab started the test of some HCAL-J modules using cosmic rays and the rst results about the amplitude recorded for a subset of modules, using as a trigger the cosmic rays, con rm the amplitude estimated by GEANT4 Monte Carlo simulations.

Primary authors : BRIO, Vanessa (CT)

Co-authors : BELLINI, Vincenzo (CT) ; PETTA, Catia Maria Annunziata (CT) ; SUTERA, Concetta Maria (CT) ; TORTORICI, Francesco (CT) ; Mr. RE, Leonard (CT) ; Dr. WOJTSEKHOWSKI, Bogdan (TJNAF)

Presenter : BRIO, Vanessa (CT)

Track classification :

Contribution type : Oral

Submitted by : BRIO, Vanessa

Submitted on Tuesday 24 July 2018

Last modified on : Tuesday 24 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 35

Theoretical calculation of p-6Li capture reaction

Content :

The 6Li abundance measured in the atmosphere of metal-poor stars
is three orders of magnitude larger than predicted by the theory of standard Big Bang Nucleosynthesis (BBN) [1].
Even if the results of the astronomical measurements are still under debate [2-4], the knowledge of thecross section (or astrophysical S-factor) of the reactions that contribute to determine the 6Li abundance is fundamental in order to distinguish between different explanations.

In this sense, 6Li(p,g)7Be reaction can contribute to the depletion of 6Li. Therefore, the evaluation of the S-factor at BBN energies (50-400 keV) is crucial in order to determine its contribution
in the BBN reaction network but still very large uncertainties
on the S-factor are present.
A recent work [5] pointed out the presence of a possible resonance in the BBN energy window, that reduces the S-factor at zero energy.
In order to solve this puzzle, a new campaign of measurement was performed by the LUNA collaboration.

In this talk we present a theoretical calculation of the
S-factor of the p-6Li capture reaction, performed in a two-body framework based on an improved version of the model reported in
Ref. [6]. We reproduce the p-6Li elastic scattering data and the bound states properties of the 7Be using phenomenological potentials.
Then, the wave functions obtained solving the two-body Schroedinger equation are used to predict the S-factor of the radiative capture reaction. The final results are compared with the available experimental data.

We present also some preliminary results we have obtained going towards
a complete ab-initio description of the radiative capture reaction within the Hyperspherical Harmonics formalism [7].

References

[1] M. Asplund et al., Astrophys. J. 644, 229 (2006).
[2] R. Cayrel et al., Astron. Astrophys. 473, L37 (2007).
[3] A. E. Garcia Perez et al., Astron. Astrophys. {\bf{504}}, 213 (2009).
[4] K. Lind et al.,Astron. Astrophys. 554, A96 (2013).
[5] J.J. He et al., Phys. Lett. B 725, 287 (2013).
[6] S. B. Dubovichenko et al., Phys. Atom. Nucl. 74, 1013 (2011).
[7] A. Kievsky et al., J. Phys. G 35, 063101 (2008).
\end{thebibliography}

Primary authors : Mr. GNECH, Alex (Gran Sasso Science Institute)

Co-authors : MARCUCCI, Laura Elisa (PI) ; VIVIANI, Michele (PI)

Presenter : Mr. GNECH, Alex (Gran Sasso Science Institute)

Track classification :

Contribution type : Oral

Submitted by : Mr. GNECH, Alex

Submitted on Wednesday 25 July 2018

Last modified on : Wednesday 25 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 36

Study of shell evolution around the doubly magic 208Pb, via multi-nucleon transfer reaction at ISOLDE

Content :

The shell model nowadays can provide a comprehensive view of the atomic nucleus along the Segré chart. In fact, the regions around double-shell closures are a fantastic benchmark for nuclear structure studies, since they provide a direct source of information on the nucleon-nucleon effective interaction. A case of great interest is the study of the east region around the doubly magic 208Pb, in fact it represents an ideal testing ground to understand the effects related to the effective three-body forces and the prospect of the state-of-the-art realistic shell-model calculations for heavy nuclei [1].

However, this region has been traditionally difficult to access experimentally due to its neutron richness and low cross sections. Although, it has been investigated using different techniques like fission, deep-inelastic and transfer reaction [2-4], all of them with stable beams. Even with the recent instrumental improvements and the new facilities, we still have a lack of information around this region.

On the other hand, Multi-Nucleon Transfer (MNT) reactions have proved to be an important tool in order to investigate exotic nuclei with stable beams in the region of interest [5]. With this technique, it is possible to excite yrast and close to the yrast states, to understand the different band structures of a nucleus and to investigate possible isomers and/or short-lived states. In addition, in one experiment it is possible to investigate several nuclei at the same time.

Hence, the aim of this experiment is twofold: firstly, it represents the proof of principle that MNT reactions with unstable beams efficiently populates neutron-rich nuclei, and it can be employed as a competitive method to cold fragmentation. Secondly, it allows to populate medium- to high-spin states in the neutron-rich Pb and Hg region [6-8]. With those goals, a MNT experiment with a high intensity radioactive ion beam (RIB) was carried out in September 2017, at the ISOLDE facility. Although the analysis is still ongoing, some preliminary results will be reported.

[1] L. Coraggio et al., Prog. Part. Nucl. Phys. 62, 135 (2009).
[2] R. Broda. J. Phys. G: Nucl. Part. Phys. 32 R151 (2006).
[3] G.J. Lane et al., Nucl. Phys. A 682 71c (2001).
[4] M. Pfützner et al., Phys. Lett.B 444 32 (1998).
[5] L. Corradi, G. Pollarolo, and S. Szilner, J. Phys. G 36, 113101 (2009).
[6] N. Al-Dahan et al., Phys. Rev. C 80, 061302(R) (2009).
[7] A. Gottardo et al., Phys. Rev. Lett. 109, 162502 (2012).
[8] A. Gottardo et al., Phys. Lett. B 725, 292-296 (2013).

Primary authors : ILLANA SISON, Andres (LNL)

Co-authors : VALIENTE DOBON, Jose' Javier (LNL) ; Dr. SZILNER, Suzana (Ruder Boskovic Institute) ; COLOVIC, Petra (Ruder Boskovic Institute)

Presenter : ILLANA SISON, Andres (LNL)

Track classification :

Contribution type : Oral

Submitted by : ILLANA SISON, Andres

Submitted on Wednesday 25 July 2018

Last modified on : Wednesday 25 July 2018

Comments :

On behalf of the IS572 collaboration

Status : SUBMITTED

Track judgments :

Abstract ID : 37

A global study of the 6Li+p system in inverse kinematics with the MAGNEX spectrometer

Content :

A global study of the 6Li+p system was performed by measuring elastic scattering, breakup and 6Li(p,3He)4He reaction which is the only other reaction channel with significant probability at these energies. All reaction channels were measured under the same experimental conditions in inverse kinematics. The relevant experiment was performed at the MAGNEX facility at the Laboratori Nazionali del Sud (INFN-LNS) in Catania, Italy. Angular distribution measurements for both elastic scattering and 6Li(p,3He)4He reaction have been performed at the energies of 16, 20, 25 and 29 MeV while exclusive breakup measurements have been performed at the two highest energies. The elastic scattering data were considered in the microscopic approach of the Jeukenne-Lejeune-Mahaux (JLM) potential (without any coupling), as well as, together with breakup and 6Li(p,3He)4He reaction, in a global study within the Continuum Discretized Coupled Channel (CDCC) framework. The results of the CDCC calculations were found in a very good agreement with elastic scattering and breakup data presenting a strong evidence for the important influence on the elastic scattering of coupling to breakup. Direct and sequential (via the first 3+ resonance) breakup cross sections were found to be equally large at the higher incident energies, but the dominant effect on elastic scattering was attributed to coupling to the sequential breakup. At the lowest incident energy of 16 MeV, we found an example of a “virtual” coupling effect, where although the sequential breakup cross section is predicted to be almost zero it remains the dominant coupling influence on the elastic scattering. Finally, the predicted absorption cross sections from other reaction channels was also found in excellent agreement with the measured ones giving further support to the accuracy of this global study within the CDCC framework.

Primary authors : Dr. SOUKERAS, Vasileios (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece and INFN Laboratori Nazionali del Sud, Catania, Italy)

Co-authors : Prof. PAKOU, A (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Prof. CAPPUZZELLO, F (INFN Laboratori Nazionali del Sud and Dipartimento di Fisica e Astronomia, Universita di Catania, Catania, Italy) ; Dr. ACOSTA, L (Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico D. F., Mexico and INFN - Sezione di Catania, Catania, Italy) ; Dr. AGODI, C (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Prof. ALAMANOS, N (CEA-Saclay, DAPNIA-SPhN, Gif-sur-Yvette, France) ; BETSOU, Ch (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; CALABRESE, S (INFN Laboratori Nazionali del Sud and Dipartimento di Fisica e Astronomia, Universita di Catania, Catania, Italy) ; Dr. CARBONE, D (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. CAVALLARO, M (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. DI PIETRO, A. (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. FERNANDEZ-GARCIA, J. P. (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. FIGUERA, P (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. FISICHELLA, M (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Prof. KEELEY, N (National Center for Nuclear Research, Otwock Warsaw, Poland) ; Dr. MARQUINEZ-DURAN, G. (Departamento di Fisica Aplicada, Universidad de Huelva, Huelva, Spain) ; Prof. MARTEL, I (Departamento di Fisica Aplicada, Universidad de Huelva, Huelva, Spain) ; Prof. MAZZOCCO, M (Departimento di Fisica e Astronomia, Universita di Padova and INFN - Sezione di Padova, Padova, Italy) ; Prof. NICOLIS, N. G. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Dr. PIERROUTSAKOU, D. (INFN - Sezione di Napoli, Napoli, Italy) ; Prof. RUSEK, K (Heavy Ion Laboratory, University of Warsaw, Warsaw, Poland) ; Dr. SGOUROS, O (Department of

Physics and HINP, The University of Ioannina, Ioannina, Greece and INFN Laboratori Nazionali del Sud, Catania, Italy) ; Prof. STILIARIS, E (Institute of Accelerating Systems and Applications and Department of Physics, University of Athens, Greece) ; Dr. STRANO, E (Departimento di Fisica e Astronomia, Universita di Padova and INFN - Sezione di Padova, Padova, Italy) ; Dr. TORRESI, D (Departimento di Fisica e Astronomia, Universita di Padova and INFN - Sezione di Padova, Padova, Italy)

Presenter : Dr. SOUKERAS, Vasileios (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece and INF

Track classification :

Contribution type : Oral

Submitted by : SOUKERAS, Vasileios

Submitted on Thursday 26 July 2018

Last modified on : Thursday 26 July 2018

Comments :

Dear members of the organizing committee,
please find herewith an abstract for the forthcoming "Quarto Incontro Nazionale di Fisica Nucleare INFN2018" entitled "A global study of the 6Li+p system in inverse kinematics with the MAGNEX spectrometer".
Sincerely yours
V. Soukeras

Status : SUBMITTED

Track judgments :

Abstract ID : 38

Study of the reaction 7Be+28Si at near barrier energies

Content :

The 7Be+28Si reaction was studied at four near barrier energies namely 13.2, 17.2, 19.8 and 22.0 MeV. The relevant experiment was performed at the EXOTIC facility at the Laboratori Nazionali di Legnaro (LNL). Angular distribution measurements for the elastically scattered 7Be ions as well as the α and 3He reaction products were performed with the detector array EXPADES. The elastic scattering data were analyzed in a double-folding framework and the energy evolution of the optical potential was deduced. Moreover, Continuum Discretized Coupled Channels (CDCC) calculations were also performed and were found in very good agreement with the experimental data. The reaction data were analyzed in both statistical model and Distorted Wave Born Approximation frameworks (DWBA) in order to disentangle the degree of competition between direct and compound channels. The energy evolution of the ratio of direct to total reaction cross section was mapped in comparison with similar data for 6Li and 7Li projectiles on a 28Si target, indicating larger transfer contributions for 7Be and 7Li than in the 6Li case. Fusion cross sections for the system under study were deduced and were found to be compatible with the systematics. Comparison with previous fusion data for 6Li and 7Li indicate fusion hindrance for 7Li and 7Be compared to 6Li, starting from the barrier and below it. This hindrance is attributed to the existence of large transfer channels.

Primary authors : Dr. SGOUROS, Onoufrios (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece and INFN Laboratori Nazionali del Sud, Catania, Italy)

Co-authors : Prof. PAKOU, A. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Dr. PIERROUTSAKOU, D. (INFN, Sezione di Napoli, Napoli, Italy) ; Prof. MAZZOCCO, M. (Dipartimento di Fisica e Astronomia, Universita di Padova and INFN, Sezione di Padova, Padova, Italy) ; Dr. ACOSTA, L. (Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico D.F, Mexico and INFN, Sezione di Catania, Catania, Italy) ; Prof. ASLANOGLOU, X. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Ms. BETSOU, Ch. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Dr. BOIANO, A. (INFN, Sezione di Napoli, Napoli, Italy) ; Dr. BOIANO, C. (INFN, Sezione di Milano, Milano, Italy) ; Dr. CARBONE, D. (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. CAVALLARO, M. (INFN Laboratori Nazionali del Sud, Catania, Italy) ; Dr. GREBOSZ, J. (The Henryk Niewodniczanski Institute of Nuclear Physics (IFJ PAN), Kraków, Poland) ; Prof. KEELEY, N. (National Centre for Nuclear Research, Otwock, Poland) ; Prof. LA COMMARA, M. (INFN, Sezione di Napoli and Dipartimento di Scienze Fisiche, Università di Napoli “Federico II”, Napoli, Italy) ; Dr. MANEA, C. (INFN, Sezione di Padova, Padova, Italy) ; Dr. MARQUINEZ-DURAN, G. (Departamento de Ciencias Integradas, Universidad de Huelva, Huelva, Spain) ; Prof. MARTEL, I. (Departamento de Ciencias Integradas, Universidad de Huelva, Huelva, Spain) ; Prof. NICOLIS, N. G. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece) ; Dr. PARASCANDOLO, C. (INFN, Sezione di Napoli, Napoli, Italy) ; Prof. RUSEK, K. (Heavy Ion Laboratory, University of Warsaw, Warsaw, Poland) ; Dr. SANCHEZ-BENITEZ, A. M. (Departamento de Ciencias Integradas, Universidad de Huelva, Huelva, Spain and Centro de Física Nuclear da Universidade de Lisboa, Lisboa, Portugal) ; Prof. SIGNORINI, C. (INFN, LNL, Legnaro, Italy) ; Prof. SORAMEL, F. (Dipartimento di Fisica e Astronomia, Universita di Padova and INFN, Sezione di Padova, Padova, Italy) ; Dr. SOUKERAS, V. (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece and INFN Laboratori Nazionali del Sud, Catania, Italy) ; Mr. STEFANINI, C. (Dipartimento di Fisica e Astronomia, Universita di Padova, Padova, Italy) ; Prof. STILIARIS, E. (Institute of Accelerating Systems and Applications and Department of

Physics, University of Athens, Athens, Greece) ; Dr. STRANO, E. (Dipartimento di Fisica e Astronomia, Universita di Padova and INFN, Sezione di Padova, Padova, Italy) ; Dr. STROJEK, I. (National Centre for Nuclear Research, Otwock, Poland) ; Dr. TORRESI, D. (Dipartimento di Fisica e Astronomia, Universita di Padova and INFN, Sezione di Padova, Padova, Italy and INFN Laboratori Nazionali del Sud, Catania, Italy)

Presenter : Dr. SGOUROS, Onoufrios (Department of Physics and HINP, The University of Ioannina, Ioannina, Greece and INFN

Track classification :

Contribution type : Oral

Submitted by : SGOUROS, Onoufrios

Submitted on Thursday 26 July 2018

Last modified on : Thursday 26 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 39

Single and double charge exchange and multi-nucleon transfer reactions for the system 20 Ne+116 Cd at 15 AMeV

Content :

Absolute cross section measurements of heavy-ion induced double charge
exchange (DCE) reactions represent the experimental goal of the NUMEN project [1] at the INFN-Laboratori Nazionali del Sud in Catania. The idea is to give a contribution towards the determination of Nuclear Matrix Elements (NME) of neutrinoless double beta decay ($0\nu\beta\beta$) with experimentally-driven information regarding those nuclei of interest for $0\nu\beta\beta$. In this view, an intense experimental campaign is already started using the MAGNEX magnetic spectrometer [2]. In particular, promising experimental results come from the data reduction of the ^{116}Cd(^{20}Ne,^{20}O)^{116}Sn reaction at 15 AMeV [3] as well as the other competitive multi-nucleon transfer processes. Due to the very low cross sections involved in such reactions and the limited statistics, particular attention is devoted to the sensitivity of these measurements. In this contribute, experimental results for DCE, proton- and neutron-transfers reactions for the ^{116}Cd+^{20}Ne system at 15 AMeV will be presented together with an accurate analysis of the cross section sensitivity.

Primary authors : CALABRESE, Salvatore (LNS)

Co-authors :

Presenter : CALABRESE, Salvatore (LNS)

Track classification :

Contribution type : Oral

Submitted by : CALABRESE, Salvatore

Submitted on Friday 27 July 2018

Last modified on : Friday 27 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 40

Gravitational and Compton form factors at GPDs

Content :

By following the same procedure adopted in Ref. [1] in the calculation of gravitational form factors, we compute the nucleon gravitational transverse density, and the valence quark angular momentum, by means of the generalized parton distributions (GPDs). At finite momentum transfer, the second moment of the GPDs is related to the gravitational form factors, as it was shown by Ji [2]. In our previous work [3], two different ansatzes were used: the modified Gaussian, and the extended Regge ansatzes. Thus, in order to extract the gravitational form factors we use both these two ansatzes by choosing the GRJ07 [4] and JR09 [5] as parton distribution functions. The extracted results turned out to be compatible with the other studies [6]. Finally, by using both the two different ansatzes we will extract the Compton form factors in order to obtain the differential cross-section for the Compton scattering [7].

[1] N. Sattary Nikkhoo and M. R. Shojaei, Nucl. Phys. A 969, (2018).
[2] X. D. Ji, Phys. Rev. D 55, 7114 (1997).
[3] N. Sattary Nikkhoo and M. R. Shojaei, Phys. Rev. C 97, 055211 (2018).
[4] M. Glück, P. Jimenez-Delgado, and E. Reya, Eur. Phys. J. C 53, 355 (2008).
[5] P. Jimenez-Delgado and E. Reya, Phys. Rev. D 79, 074023 (2009).
[6] M. Guidal et al., Phys. Rev. D 72, 054013 (2005).
[7] N. Sattary Nikkhoo and E. Santopinto, work in preparation.

Primary authors : Ms. SATTARY NIKKHOO, Negin (INFN)

Co-authors : SANTOPINTO, Elena (INFN) ; Dr. SHOJAEI, Mohammad Reza (Shahrood University of Technology)

Presenter : Ms. SATTARY NIKKHOO, Negin (INFN)

Track classification :

Contribution type : Oral

Submitted by : SATTARY NIKKHOO, Negin

Submitted on Friday 27 July 2018

Last modified on : Friday 27 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 41

Interactions of tau-neutrinos with carbon and argon

Content :

We have applied the spectral function formalism to obtain the cross section of charged-current tau-neutrinos and antineutrinos interactions with carbon and argon. Our study is focused on the kinematical region corresponding to beam energies around and above 1 GeV, in which the impulse approximation is expected to be applicable. The results include the total cross section in all relevant channels: quasi-elastic scattering, resonance production and deep inelastic scattering.
The argon results will be used to estimate the rate of appearance of tau-neutrinos in the DUNE far detector.

Primary authors : Mr. CHIRIANO, Fabrizio (La Sapienza Università di Roma)

Co-authors : BENHAR NOCCIOLI, Omar (ROMA1)

Presenter : Mr. CHIRIANO, Fabrizio (La Sapienza Università di Roma)

Track classification :

Contribution type : Oral

Submitted by : Mr. CHIRIANO, Fabrizio

Submitted on Friday 27 July 2018

Last modified on : Friday 27 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 42

Direct measurement of total reaction cross sections of low-energy radioactive ion beams on silicon with the active target technique at the EXOTIC facility at INFN-LNL

Content :

The development of Radioactive Ion Beams (RIB) has allowed studies of nuclei far from stability. This technical headway led to the discovery of nuclei with an unusual spatial extension [1]. In a simple model, these weakly bound nuclei can be described as a core, that contains most of the nucleons, to which one or two nucleons are loosely bound. Therefore the valence nucleons are outside the classically allowed region and form a sort of halo or skin around the core [2].
In this framework, total reaction cross-section (σR) measurements are of great interest for determining the nuclear size [1, 3, 4]. If σR values are extracted in a direct way, they are essentially model independent, in contrast to those found from analyses of elastic scattering data. Moreover, measured values of σR are necessary to constrain properly the imaginary part of the optical model potential employed in analyses of elastic scattering [5,6]. This is really important at Coulomb barrier energies, where strong variations of the optical potential should occur [7].
With a proton separation energy of 0.138 MeV, 8B is the most likely candidate for having a proton halo structure, despite its centrifugal and Coulomb barriers. Reactions involving 8B are very exciting both for astrophysical reasons [8] and for clarifying its proton halo nature. Many experimental findings show evidence of the latter, like the large 8B quadrupole moment [9], while measurements [10] of interaction cross section at 790 MeV/u indicated that 8B has normal size.
However, direct measurements of σR for the 8B + 28Si reaction at 20-60 MeV/u strongly indicate a halo structure [11]. According to [11], the 8B halo plays a more important role at low energies where the increased average nucleon-nucleon cross section predicted by microscopic models leads to collisions even in low-density regions.
In this context, we will perform a direct measurement of σR for the system 8B + 28Si at near-barrier energies, by employing the 8B RIB produced by our in-flight facility EXOTIC [12] and the active target technique. The 8B beam will be delivered, by employing the inverse kinematics reaction 3He(6Li, 8B)n with a 6Li primary beam, produced by the LNL Tandem accelerator. Since the 8B RIB will be produced in a cocktail beam, with 7Be and 6Li beams, the σR will be also measured simultaneously for these contaminant beams.
The proposed direct method for obtaining σR is inspired by those employed in [4, 12, 13] and in our previous experiment where 8B+28Si fusion data were obtained at near-barrier energies at EXOTIC [14], however with important modifications to face some challenging aspects: beam purity, pile-up and frame scattering rejection. The new technique has been proved to be successful in a recent test-run in identifying the incident ions and removing all possible contaminations that could compromise the measurement.
In this talk, I will give a detailed description of the experimental method to be used for such direct measurements with in-flight low-energy RIBs on active targets.

References

[1] I. Tanihata et al., Phys. Rev. Lett. 55 (1985) 2676
[2] B. Jonson, Phys. Rep. 389 (2004) 1
[3] S. Kox et al.,Phys. Rev. C35 (1987) 1678
[4] A. C. C. Villari et al.,Phys. Lett. B 268(1991)345.
[5] M. C. Mermaz, Phys. Rev. C50 (1994) 2620
[6] A. M. Sourkes et al., Phys. Rev. C13 (1976) 451
[7] G. R. Satchler, Phys. Rep. 199 (1991) 147
[8] T. Motobayashi et al., Phys. Rev. Lett. 73 (1994) 2680
[9] W. Schwab et al. , Z. Phys. A 350 (1995) 283

[10] I. Tanihata et al., Phys. Lett. B 206 (1988)592
[11] R. E. Warner et al. Phys. Rev. C 52 (1995) R1166
[12] V. Z. Maidikov et al., NPA 746 (2004) 389c; D. Pierroutsakou et al., EPJ ST 150 (2007) 47; F. Farinon et al,. NIMB 266 (2008) 4097; M. Mazzocco et al., NIM B 266 (2008) 4665; NIM B 317 (2013) 223
[13] A. Pakou et al., NPA 784 (2007) 13; A. Musumarra et al., NIM A 612 (2010) 399
[14] A. Pakou et al., Phys. Rev. C 87 (2013) 014619

Primary authors : PARASCANDOLO, Concetta (NA) ; PIERROUTSAKOU, Dimitra (NA)

Co-authors : BOIANO, Alfonso (NA) ; BOIANO, Ciro (MI) ; LA COMMARA, Marco (NA) ; LA RANA, Giovanni (NA) ; MAZZOCCO, Marco (PD) ; SORAMEL, Francesca (PD) ; ACOSTA SANCHEZ, Luis Armando (CT) ; Prof. KEELEY, Nicholas (National Centre for Nuclear Research) ; LAMIA, Livio (LNS) ; ROMANO, Stefano (LNS) ; Prof. RUSEK, Krzysztof (University of Warsaw) ; Dr. SANCHEZ-BENITEZ, Angel Miguel (Departamento de Ciencias Integradas, Universidad de Huelva, Huelva, Spain) ; SPITALERI, Claudio (LNS) ; TORRESI, Domenico (LNS) ; Dr. TUMINO, Aurora (LNS)

Presenter : PARASCANDOLO, Concetta (NA)

Track classification :

Contribution type : Oral

Submitted by : PARASCANDOLO, Concetta

Submitted on Saturday 28 July 2018

Last modified on : Saturday 28 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 43

Hadronization of heavy hadrons via coalescence plus fragmentation in ultra-relativistic collisions

Content :

Ultra-relativistic heavy ion collisions at LHC and at RHIC have been designed to reach a new state of matter composed of a strongly interacting plasma of deconfined quark and gluons, the so called Quark-Gluon Plasma QGP). The process that leads to the production of hadrons formed by charm and bottom quarks is under discussion and not fully understood [1].
We present a model based on an hadronization via coalescence and fragmentation [3] and the predictions for heavy mesons and baryons spectra (D^{0}, D_{s}, Λ_{c}, B and Λ_{b}) and the related baryon over meson ratio in both RHIC and LHC energies.
The effect of the hadronization mechanism also plays an important role to describe, at the same time, the experimental data for the nuclear suppression factor R_{AA} and the elliptic flow $v_{2}(p_{T})$ of heavy hadrons [2].
We will show how our model can predict values for Λ_{c}/D^{0} and Λ_{b}/B much larger than the expectations from the simple fragmentation, and in agreement whit early data from STAR collaboration [4].
Furthermore in the same scheme, assuming that in pp collisions at the LHC top energies there can be the formation of QGP matter, we predict the baryon to meson ratio Λ_{c}/D^{0} .
The results show a considerable effect due to the fireball volume that significantly reduces the ratios, but still predict quite larger values with respect to fragmentation, in agreement with recent data from ALICE in pp collisions [5].

[1] S. Plumari, V. Minissale, S.K. Das, G. Coci and V. Greco, Eur.Phys.J. C78 (2018), no.4, 348
[2] F. Scardina, S. K. Das, V. Minissale, S. Plumari, V. Greco, Phys.Rev. C96 (2017) no.4, 044905.
[3] V. Minissale, F. Scardina, and V. Greco, Phys. Rev. C 92, 054904 (2015)
[4] STAR Collaboration, Nucl.Phys. A967 (2017) 620-623
[5] ALICE collaboration, arXiv:1712.09581

Primary authors : MINISSALE, Vincenzo (LNS)

Co-authors : Dr. PLUMARI, Salvatore (UNIVERSITY OF CATANIA, ITALY) ; COCI, Gabriele (L) ; Dr. GRECO, Vincenzo (LNS)

Presenter : MINISSALE, Vincenzo (LNS)

Track classification :

Contribution type : Oral

Submitted by : MINISSALE, Vincenzo

Submitted on Monday 30 July 2018

Last modified on : Monday 30 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 44

M.Papa1, L. Acosta2, L.Auditore3, G. Cardella1, F.Favela4, E. De Filippo1, B.Gnoffo5, G. Lanzalone5,6, C.Maiolino5, N. Martorana5,7 A.Pagano1, E.V.Pagano 1,7, S. Pirrone1, G.Politi1,7, L.Quattrocchi3, F.Rizzo5,7 P.Russotto5, A. Trifiró3, M. Trimarchi3 1 INFN Istituto Nazionale di Fisica Nucleare Catania Italy 2 Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City; 3 INFN Messina Italy, Dip. Di Scienze Fisice e della Terra, Univ. Messina 4 Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City 5 INFN Laboratori Nazionali del Sud Catania Italy 6 Facolta’ di Ingegneria e Archetettura Univ.’ Kore Enna Italy, 7-Dipartimento di Fisica e Astronomia Univ. di Catania One of the most important and intriguing problems

in studying Heavy Ion collisions at the Fermi energies is to recover information directly linked to the dynamical stage of the reaction without the blurring effects of later stages associated to the statistical decay of the hot sources. These effects can also become prominent and hard to be disentangled in case of central collisions. For observables in principle free from the statistical disturbances the obtained results can give clear information on the effective interactions governing the dynamics during the first moment of the interaction. In the last decades [1-3] it has been shown that the time derivative of the average total dipole signal obtained by measuring the charges Z and velocities of all the charged particles produced in an heavy ion collision does not depend on statistical decay processes. It rather

depends on the dynamics of the isospin equilibration processes between ions having large differences in the charge/mass ratios. In this contribution we illustrate the results of a first attempt to perform these kind of studies on the system 48Ca+27Al at 40 MeV/A performed with the multi-detector CHIMERA [4-5] at the LNS. These investigations continue with a new recent campaign of measurements taking advantage of the improved performances of the CHIMERA detector. A discussion of the contributions related to the equilibration process and associated to the neutron and pre-equilibrium gamma rays emission (detectable by means of the Chimera Cesium Iodides) will be will be also presented. REFERENCES [1] M. Papa et al., Phys. Rev. C 72, 064608 (2005), and references therein.

[2] M. Papa and G.Giuliani, J. Phys.: Conf. Ser. 312, 082034 (2011). [3] Papa M.et al, Phys. Rev. C , 91 (2015) 041601R. [4] A. Pagano,Nucl. Phys. News 22, 25 (2012); G.Cardella et al NUCLEAR PHYSICS IN ASTROPHYSICS VIII (NPA8 2017), epj web of conference 165, 01009 (2017) [5] P.Russotto et al, NIM in preparation.

Content :

M.Papa1, L. Acosta2, L.Auditore3, G. Cardella1, F.Favela4, E. De Filippo1, B.Gnoffo5, G. Lanzalone5,6, C.Maiolino5, N. Martorana5,7 A.Pagano1, E.V.Pagano 1,7, S. Pirrone1, G.Politi1,7, L.Quattrocchi3, F.Rizzo5,7 P.Russotto5, A. Trifiró3, M. Trimarchi3

1 INFN Istituto Nazionale di Fisica Nucleare Catania Italy

2 Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City; 3 INFN Messina Italy, Dip. Di Scienze Fisice e della Terra, Univ. Messina

4 Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City

5 INFN Laboratori Nazionali del Sud Catania Italy

6 Facolta' di Ingegneria e Archetettura Univ.' Kore Enna Italy,

7-Dipartimento di Fisica e Astronomia Univ. di Catania

One of the most important and intriguing problems in studying Heavy Ion collisions at the Fermi energies is to recover information directly linked to the dynamical stage of the reaction without the blurring effects of later stages associated to the statistical decay of the hot sources. These effects can also become prominent and hard to be disentangled in case of central collisions. For observables in principle free from the statistical disturbances the obtained results can give clear information on the effective interactions governing the dynamics during the first moment of the interaction. In the last decades [1-3] it has been shown that the time derivative of the average total dipole signal obtained by measuring the charges Z and velocities of all the charged particles produced in an heavy ion collision does not depend on statistical decay processes. It rather depends on the dynamics of the isospin equilibration processes between ions having large differences in the charge/mass ratios.

In this contribution we illustrate the results of a first attempt to perform these kind of studies on
the system 48Ca+27Al at 40 MeV/A performed with the multi-detector CHIMERA [4-5] at the LNS.

These investigations continue with a new recent campaign of measurements taking advantage of the improved performances of the CHIMERA detector. A discussion of the contributions related to the equilibration process and associated to the neutron and pre-equilibrium gamma rays emission (detectable by means of the Chimera Cesium Iodides) will be will be also presented.

REFERENCES

[1] M. Papa et al., Phys. Rev. C 72, 064608 (2005), and references therein.

[2] M. Papa and G.Giuliani, J. Phys.: Conf. Ser. 312, 082034 (2011).

[3] Papa M.et al, Phys. Rev. C , 91 (2015) 041601R.

[4] A. Pagano,Nucl. Phys. News 22, 25 (2012); G.Cardella et al NUCLEAR PHYSICS IN ASTROPHYSICS VIII (NPA8 2017), epj web of conference 165, 01009 (2017)

[5] P.Russotto et al, NIM in preparation.

Primary authors : PAPA, Massimo (CT)

Co-authors :

Presenter : PAPA, Massimo (CT)

Track classification :

Contribution type : --not specified--

Submitted by : PAPA, Massimo

Submitted on Monday 30 July 2018

Last modified on : Monday 30 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 45

Comparative analysis of tidal deformation in neutron stars

Content :

The information on tidal deformation extracted from the gravitational wave signal emitted from coalescing neutron stars provides a measurement on the star radii, which are in turn determined by the equation of state (EoS) of matter in the star interior.
We have carried out a calculation of the Love numbers, the quantities routinely used to parametrize tidal deformation, comparing three EoS obtained from different models of strong interaction dynamics.

Primary authors : Mr. SABATUCCI, Andrea (Sapienza)

Co-authors : BENHAR NOCCIOLI, Omar (ROMA1)

Presenter : Mr. SABATUCCI, Andrea (Sapienza)

Track classification :

Contribution type : Oral

Submitted by : Mr. SABATUCCI, Andrea

Submitted on Monday 30 July 2018

Last modified on : Monday 30 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 46

Gamma rays as probe of fission and quasi-fission dynamics in the reaction 32S + 197Au near the Coulomb barrier

Content :

Compound nucleus fission and quasi-fission are both binary decay channels whose common properties make the experimental separation between them difficult. A way to achieve this separation could be to probe the angular momentum of the binary fragments. This method can be tested by detecting gamma rays in coincidence with the two fragments. As a case study, the reaction 32S + 197Au near the Coulomb barrier has been performed at the Tandem ALTO facility at IPN ORSAY. ORGAM and PARIS, two different gamma detectors arrays, were coupled with the CORSET detector, a two-arm time-of-flight spectrometer. Time of flight data were analyzed to reconstruct the mass-energy distribution of the primary binary fragments coupled with the gamma multiplicity and spectroscopic analysis. Preliminary results on this method will be shown.

Primary authors : PULCINI, Alessandro (NA) ; VARDACI, Emanuele (NA)

Co-authors : QUERO, Daniele (NA)

Presenter : PULCINI, Alessandro (NA)

Track classification :

Contribution type : Oral

Submitted by : PULCINI, Alessandro

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

In the search of fusion reactions between heavy ions aimed at producing superheavy elements it is crucial to estimate the fusion cross section. The compound nucleus (CN) eventually formed after fusion evolves toward fission (a binary reaction) or the production of an evaporation residue. The fusion cross section is the sum of the cross sections of these two channels. For the case of the massive nuclei necessary for the search of superheavy elements, the evaporation residues cross section is negligible with respect to fission cross section. Therefore it is sufficient to select and count the fission events to estimate the fusion cross section. When massive nuclei are involved, at energies around the Coulomb barrier, because of the substantial increase of the Coulomb repulsion, the quasi-fission mechanism (QF) happens to be the most important process counteracting complete fusion (CF) [1]. QF gives rise to a binary reaction, namely a mass distribution very similar to the one produced in fission but without the formation of a compound nucleus. The common properties in the mass distribution between QF and compound nucleus fission (FF) make the selection of the pure FF events difficult. While in the asymmetric region of the mass distribution it is usually possible to disentangle, to some extent, the component of QF and asymmetric fission modes, in the symmetric region the two components are overlapped. This overlap constitutes an inescapable problem when FF cross section has to be estimated.

The search for a possible pathway to disentangle the two process starts from the identification of an additional observable or a new set of observables. The known

differences between these two processes can help us finding the way: on one side there is CN fission, a slow process passing through an equilibrium stage; on the other side there is quasi-fission, a faster process with considerable mass transfer and energy dissipation, strongly governed by shell effects [2]. It is reasonable to think that for the slower process the whole orbital angular momentum is transferred into internal degrees of freedom of the compound nucleus and so the two fragments following FF can reach spins higher than those of the fission-like fragments produced by quasi-fission. A possible way to probe angular momentum of the two fragments is to detect gamma rays. Information about angular momentum can be extracted from discrete gamma transitions as well as from gamma multiplicity, Mγ, that is the average number of gamma emitted per event. Moreover, with discrete gamma rays it is possible to identify the fragment's charge.
To explore the concept described above, the reaction 32S + 197Au, at the energy near the Coulomb barrier, Elab = 166 MeV, was performed at the Tandem ALTO accelerator at IPN Orsay (France). This reaction is characterized by a large fusion-fission cross section, and a negligible contribution from QF. The mass-TKE distribution is therefore characterized by a dominating component from fusion-fission process and the population of high angular momentum regions of the nuclei detected in coincidence with the mass symmetric fragments would therefore be not polluted with components from processes of nearby time scale. Two processes with different time scale, FF and quasi-elastic, have been compared to test this method and the results will be shown.

[1] Itkis M G, Vardaci E, Itkis I M, Knyazheva G N and Kozulin E M 2015 Nucl. Phys. A 944 204
[2] Kozulin E M et al. 2014 Phys. Rev. C 89 014614

Status : SUBMITTED

Track judgments :

Abstract ID : 47

Propagation of charm and bottom in QGP with a Boltzmann approach: transport coefficients and elliptic flow

Content :

One of the major proposals of Heavy-Ion Collisions (HICs) conducted at Relativistic Heavy-Ion Collider (RHIC) and Large Hadron Collider (LHC) facilities aim to explore the phase of deconfined quarks and gluons, namely the Quark-Gluon Plasma (QGP).
Heavy quarks (HQs), mainly charm and bottom, represent an essential probe for studying the properties of the QGP [1].
Due to their large mass $M_{c,b} \gg \Lambda_{QCD}$, they are created at early stages of HICs and propagate through the entire space-time evolution of the QGP retaining most of their initial characteristics [3].
We discuss the dynamics of HQs in the QGP by means of a relativistic Boltzmann approach [1]. Within this model, we take into account non-perturbative interaction through a quasi-particle prescription in which light partons are dressed with thermal masses and the temperature dependence of the strong coupling is tuned to lattice QCD thermodynamics [4].
This feature, along with the hadronization mechanism for HQs [2], is a fundamental ingredient for describing simultaneously the nuclear suppression factor $R_{AA}(p_T)$ and the elliptic flow $v_2(p_T)$ of \emph{D} mesons measured experimentally both at RHIC and LHC energies [5][6].
In the same framework, we present predictions for \emph{B} mesons that allow to constrain the estimation of space-diffusion coefficient D_s in the limit of larger M/T where the dynamics of HQs becomes independent from the transport scheme, whether it is Boltzmann or Langevin [1].

[1] F. Scardina, S. K. Das, V. Minissale, S. Plumari, V. Greco, Phys.Rev. C96 (2017) no.4,044905.
[2] S. Plumari, V. Minissale, S.K. Das, G. Coci and V. Greco, Eur. Phys. J. C 78 (2018) no.4, 348.
[3] A. Andronic et al., Eur. Phys. J. C76 (2016) no.3, 107
[4] S. K. Das, F. Scardina, S. Plumari, V. Greco, Phys. Lett. B747 (2015) 260.
[5] STAR Collaboration, Phys. Rev. Lett. 118, (2017) 212301.
[6] ALICE Collaboration, JHEP 09 (2012) 112 and ALICE Collaboration, arxiv:1804.09083

Primary authors : Mr. COCI, Gabriele (University of Catania - INFN LNS)

Co-authors : PLUMARI, Salvatore (LNS) ; MINISSALE, Vincenzo (LNS) ; Dr. GRECO, Vincenzo (LNS)

Presenter : Mr. COCI, Gabriele (University of Catania - INFN LNS)

Track classification :

Contribution type : Oral

Submitted by : COCI, Gabriele

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 48

CHARACTERIZATION OF THREE GEM CHAMBERS FOR THE SBS FRONT TRACKER AT JLAB HALL A

Content :

A new Large-Acceptance Forward Angle Spectrometer (Super Bigbite Spectrometer-SBS [1]) is under development for the upcoming experiments in Hall A at the Thomas Jefferson National Accelerator Facility (Virginia-USA) [2], where a longitudinally polarized (up to 85%) electron beam up to 12 GeV energy is now available. The excellent beam intensity (up to 100 μA), combined with innovative polarized targets, will provide luminosity up to 10 39 /(s·cm 2), opening interesting opportunities to investigate unexplored aspects of the inner structure of the nucleons [3].
In one of the most demanding configuration, the new spectrometer will consist of a dipole magnet, one front charged particle tracker, two identical proton polarimeters with related trackers and a segmented hadron calorimeter [1].
The front tracker, placed just after the dipole magnet, consists of up to six layers of large area GEM (Gas Electron Multiplier) chambers (40x150 cm 2); each chamber is made by three adjacent GEM modules of 40x50 cm 2 active rectangular area (18 modules as a total) [4].
To satisfy the main requirements for the SBS tracking system, we have chosen the GEM technology in order to optimize gain (~105), spatial resolution (~80 μm), high hit rate (~100 MHz/cm2), high radiation hardness and cost/performance [5].
We present the main features of the SBS front tracker and its GEM detectors and, finally, we will discuss the first results of the tracker commissioning at JLab.

References

[1] “The Super-Bigbite Spectrometer for Jefferson Lab Hall A”, 20 Gennaio 2010, https://userweb.jlab.org/~mahbub/HallA/SBS/SBS-CDR_New.pdf.
[2] Accelerator Science. Website of the Jefferson Lab, http://www.jlab.org/accelerator-science.
[3] B. Wojtsekhowski; “Nucleon form factors program with SBS at JLab”; arXiv:1401.0859v3 [nuclex]; 17 Mar 2014.
[4] V. Bellini et al; “GEM tracker for high luminosity experiments at the JLab Hall A”; JINST 7 C05013; 2012.
[5] F. Mammoliti et al; “GEM tracker for high-luminosity experiments at the JLab Hall A”; Radiation Effects and Defects in Solids 171 (2016) 775; https://doi.org/10.1080/1042150.2016.1263633.

Primary authors : Dr. RE, Leonard (INFN Catania)

Co-authors : BELLINI, Vincenzo (CT) ; BRIO, Vanessa (CT) ; CISBANI, Evaristo (ROMA1) ; COLILLI, Stefano (ROMA1) ; GIULIANI, Fausto (Roma1) ; GRIMALDI, Antonio (CT) ; LIBRIZZI, Francesco (CT) ; LUCENTINI, Maurizio (ROMA1) ; MAMMOLITI, Francesco (CT) ; MUSICO, Paolo (GE) ; NOTO, Francesco (CT) ; PERRINO, Roberto (LE) ; PETTA, Catia Maria Annunziata (CT) ; RUSSO, Marco (CT) ; SALEMI, Giuseppe (CT) ; SANTAVENERE, Fabio (Roma1) ; SAVA, Giuseppe (CT) ; SCILIBERTO, Domenico (INFN Catania) ; SPURIO, Alessandro (ROMA1) ; SUTERA, Concetta Maria (CT) ; TORTORICI, Francesco (CT)

Presenter : Dr. RE, Leonard (INFN Catania)

Track classification :

Contribution type : Oral

Submitted by : Mr. RE, Leonard

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 49

IMFs production in the reactions 78,86Kr+40,48Ca at 10 AMeV

Content :

IMFs production in the reactions
78,86Kr+40,48Ca at 10 AMeV

B.Gnoffo1,2, S. Pirrone1, G. Politi1,2, E. De Filippo1, P.Russotto3,
M.Trimarchi1,4, L. Auditore1,4, C. Beck5, G.Cardella1, F. Favela1,
G. Lanzalone3,6, N.S. Martorana2,3, A.Pagano1, E.V. Pagano3, M. Papa1
, E. Piasecki7, L. Quattrocchi1,2, F. Rizzo2,3, A. Trifirò1,4.

1)INFN, Sezione di Catania, Catania, Italy
2)Dipartimento di Fisica e Astronomia,Università di Catania, Catania, Italy
3)INFN, Laboratori Nazionali del Sud, Catania, Italy
4)Dipartimento di Scienze Matematiche e Informatiche,Scienze Fisiche e
Scienze della Terra, Università di Messina, Messina, Italy
5)Institute Pluridisciplinaire Hubert Curien, Universite de Strasbourg,
CNRS-IN2P3, Strasbourg, France
6)Università degli Studi di Enna,"Kore", Enna, Italy
7)Heavy Ion Laboratory, University of Warsaw, Warsaw, Poland

The reactions 78Kr+40Ca and 86Kr+48Ca have been realized at
10 AMeV at Laboratori Nazionali del Sud in Catania with the
4π multidetector CHIMERA.
The reaction mechanisms involved in these collisions populate
a wide range of the mass region from light charge particles up
to fission fragments and evaporation residues; between these
two extremes a strong production of Intermediate Mass
Fragments (Z>=3) has been observed.
Fusion-fission like processes and the break-up of the Projectile-Like
(PLF) into two fragments following more violent deep inelastic
collision, are the two principal processes through
which the IMFs are produced.
A selection method has been developed, in order to
discriminate among the different reaction mechanisms that
populate the same region of the phase-space.
The isospin degree of freedom plays a crucial role, in particular
in fission-like processes, in which the production cross sections
of each single Z are systematically higher for the system
78Kr+40Ca respect to 86Kr+48Ca one.
Besides the PLf break-up mechanism shows a most probable
PLF aligned break-up, along the direction of the PLF-TLF
separation axis, with the light fragment emitted in the backward
part, suggesting dynamical-non equilibrium effects.

Primary authors : GNOFFO, Brunilde (CT)

Co-authors :

Presenter : GNOFFO, Brunilde (CT)

Track classification :

Contribution type : Oral

Submitted by : GNOFFO, Brunilde

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

The list of Co-Authors and relative affiliations is inside the abstract -content

Status : SUBMITTED

Track judgments :

Abstract ID : 50

The NArCos Project: Status and Perspectives

Content :

E.V. Pagano1, E. De Filippo2, P. Russotto1, L. Auditore2, G. Cardella2, E. Geraci2,3, B. Gnoffo2,3, C. Guazzoni4, G. Lanzalone1,5, C. Maiolino1, N.S. Martorana1,3, A. Pagano2, M. Papa2, T. Parsani4, S. Pirrone2, G. Politi2,3, F. Porto1,3, L. Quattrocchi2,3, F. Rizzo1,3, A. Trifirò2,6, M. Trimarchi2,6
1) INFN, Laboratori Nazionali del Sud, Catania, Italy
2) INFN, Sezione di Catania, Catania, Italy
3) Dipartimento di Fisica e astronomia, Università di Catania, Catania, Italy
4) INFN, Sezione di Milano, Politecnico, Milano, Italy
5) Università degli studi di Enna"Kore", Enna, Italy
6) Dipartimento di scienze matematiche e informatiche, scienze fisiche e scienze della terra, Università di Messina, Messina, Italy

With the advent of the new facility for radioactive ion beams, in particular for the neutron rich ones with respect to the stable beams, it is necessary to develop neutron detection systems fully integrated with the charged particle detection. It is argued that, the integration of neutron signal, especially for neutron rich beams is an important experimental progress in order to study the properties of exotic nuclear matter. For this reason, new detectors using new materials have to be built. In this contribution, the NArCoS (Neutron Array for Correlation Studies) project, having the purpose to realize a new detector prototype for neutrons and charged particles, will be presented with particular emphasis to physical motivations and first experimental tests.

Primary authors : PAGANO, Emanuele Vincenzo (LNS)

Co-authors : DE FILIPPO, Enrico (CT) ; RUSSOTTO, Paolo (LNS) ; AUDITORE, Lucrezia (ME) ; CARDELLA, Giuseppe (CT) ; GNOFFO, Brunilde (CT) ; GUAZZONI, Chiara (MI) ; LANZALONE, Gaetano (LNS) ; MAIOLINO, Concettina (LNS) ; MARTORANA, Nunzia Simona (LNS) ; Mr. PAGANO, Angelo (CT) ; PAPA, Massimo (CT) ; PARSANI, Tommaso (MI) ; PIRRONE, Sara (CT) ; POLITI, Giuseppe (CT) ; QUATTROCCHI, Lucia (CT) ; Prof. RIZZO, Francesca (LNS) ; TRIFIRO, Antonio (ME) ; TRIMARCHI, Marina (CT)

Presenter : PAGANO, Emanuele Vincenzo (LNS)

Track classification :

Contribution type : Oral

Submitted by : PAGANO, Emanuele Vincenzo

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 51

On the nature of the low-energy E1 strength in 68Ni

Content :

N.S. Martorana (a;b), G. Cardella (c), E.G. Lanza (c), L. Acosta (d),
M. V.Andrés (e), L. Auditore (f;c), F. Catara (c), E.De Filippo (c), F. Favela (c), B.Gnoffo (b;c), G. Lanzalone (g;a), C. Maiolino (a), A. Pagano (c), E.V. Pagano (a), M. Papa (c), S. Pirrone (c), G. Politi (b;c), F. Porto (a), L. Quattrocchi (c), F. Rizzo (a;b), P. Russotto (a), D. Santonocito (a), A. Trifirò (f;c), M. Trimarchi (f;c), A. Vitturi (h).

(a) LNS-INFN, Catania, Italy
(b) Dipartimento di Fisica e Astronomia, Università degli Studi di Catania
(c) INFN-Sez. Catania, Catania, Italy
(d) Instituto de Fisica, Universidad Nacional Autònoma de Mèxico, Mexico City, Mexico
(e) Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain
(f) Dipartimento MIFT, Messina, Italy
(g) Facoltà di Ingegneria e Architettura, Università Kore, Enna, Italy
(h) Dipartimento di Fisica e Astronomia, Università G. Galilei and INFN-Sezione di Padova, Padova, Italy.

We report on results about the study of the low-energy E1 strength, known as Pygmy Dipole Resonance (PDR). The study of the PDR and the knowledge about its structure are very important also due to the connection with the Equation of state of nuclear matter (EoS), making this mode a valid further tool to constrain it [1-4]. Moreover, the PDR is connected also to the r- process, responsible for the nucleo-synthesis of elements heavier that iron [5]. Due to the properties of its transition densities this mode can be populated by both isoscalar and isovector probes [6]. Several experiments, with both the probes, have been performed on stable nuclei [1, 3] and on unstable nuclei [7].
At INFN-LNS we have carried out an experiment, using the unstable projectile 68Ni at 28 MeV/A, with the aim to study for the first time the PDR on the 68Ni using an isoscalar target of 12C. We
produced the 68Ni by exploiting the projectile In Flight Fragmentation method in the dedicated FRIBs transport line. The CHIMERA multidetector [8] and the FARCOS array [9] were used to detect reaction products. The results about the gamma-decay channel of the Pygmy Dipole Resonance [10]
will be discussed in details, moreover the preliminary results about the study of the neutron decay channel will be presented.

References
[1] N. Paar et al., Rep. Prog. Phys. 70, 691 (2007).
[2] A. Bracco et al., Eur. Phys. J. A 51, (2015).
[3] A. Klimkiewicz et al., Phys. Rev. C 76, 051603(R) (2007).
[4] J. Piekarewicz et al., Phys. Rev. C 73, 044325 (2006).
[5] S. Goriely and E. Khan, Nucl. Phys. A 706, 217 (2002).
[6] E. G. Lanza et al., Phys. Rev. C 84, 064602 (2011).
[7] O. Wieland et al., Phys. Rev. Lett. 102, 092502 (2009).
[8] A. Pagano et al., Nucl. Phys. A 734, 504 (2004).
[9] E.V. Pagano et al., EPJ Web of Conf. 117, 10008 (2016).
[10] N.S. Martorana et al., Phys. Lett B 782, 112-116 (2018).

Primary authors : MARTORANA, Nunzia Simona (LNS)

Co-authors :

Presenter : MARTORANA, Nunzia Simona (LNS)

Track classification :

Contribution type : Oral

Submitted by : MARTORANA, Nunzia Simona

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 52

Study of Giant Resonances with active targets

Content :

The presence of coherent motions of particles in many-body systems, i.e. collective motions, is a common feature in several branches of physics. In atomic nuclei, a particular case of nuclear collective motion is represented by giant resonances (GR), which are the subject of this presentation. These resonance states play a key role in the understanding of nuclear structure because of their connection with the bulk properties of atomic nuclei. Different types of giant resonances exist depending on how spatial (L), spin (S) and isospin (I) degrees of freedom are involved. The isoscalar giant monopole resonance (ISGMR) measures the collective response of the nucleus to density fluctuations (DeltaI, DeltaS, DeltaL=0). The ISGMR is particularly interesting for its connection with the incompressibility of the nucleus KA, which, in turn, can be linked to the incompressibility of nuclear matter Kinf, an important ingredient of the nuclear matter equation-of-state (EOS). The EOS, essentially, describes the binding energy per nucleon as a function of nuclear density and isospin asymmetry and it plays an important role in the description of heavy-ion nuclear collisions, the collapse of the heavy stars in super novae explosion and the description of neutron stars.
In order to improve our understanding of this nuclear mechanism, new experimental data in unstable neutron-rich nuclei far from the stability are needed. Measuring the ISGMR along an isotopic chains (including stable and unstable nuclei) one could better determine the asymmetric term of the nuclear incompressibility, a poorly-known contribution depending on the neutron-proton asymmetry. In addition, studying neutron-rich nuclei one could also prove the existence of the predicted soft monopole strength.
However, the measurement of giant resonances in unstable nuclei is a challenging task and specific instruments are needed. The reaction mechanism used to excite the ISGMR is the inelastic scattering of the nuclei of interest on an hadron isoscalar probe, typically an alpha particle. The use of an active target coupled with silicon detectors allows to measure the scattered alpha particles at forward angles (where the maximum of the cross section is located), characterized by a small kinetic energy. Beams at around 50 AMeV could be delivered, for instance, by the superconducting cyclotron of Laboratori Nazionali del Sud (LNS,Catania,Italy) and Grand Accelerateur National d'Ions Lourds (GANIL, Caen, France). A proposal to study ISGMR in Ni isotopes was already submitted in GANIL. In addition, the (alpha,alpha') reaction can be also used to excite isoscalar dipole states (L=1, I=0) around the neutron separation energy. These states, also called pygmy dipole resonance (PDR), are of great interest for the impact on astrophysical phenomena, such as r-process nucleosynthesis and the symmetry energy in the EOS. The nature of the PDR is largely debated and new data could help to understand better this phenomenon. SpecMAT, an active target placed in a high magnetic field and coupled with scintillation detectors, could be a powerful detector to study PDR in unstable nuclei by using (alpha,alpha') reaction. Possible laboratories where the study of PDR could be performed are SPES (INFN Legnaro laboratory, Italy) and HIE-ISOLDE (CERN) where 10 MeV/u exotic beams will be available.
In this contribution, the use of active targets to study ISGMR and PDR will be shown. In particular, future possible experiments that could be performed at LNL and LNS will be reported.

Primary authors : CERUTI, Simone (MI)

Co-authors :

Presenter : CERUTI, Simone (MI)

Track classification :

Contribution type : Oral

Submitted by : CERUTI, Simone

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 53

Study of 12C excited states decay populated through the collisions 12C + 24Mg at 35 AMeV and 48Ca +27Al at 40 AMeV.

Content :

Study of 12C excited states decay populated through the collisions 12C + 24Mg at 35 AMeV and 48Ca +27Al at 40 AMeV.

L. Quattrocchi1,2, M. Papa1 , L. Acosta2,3, L. Auditore1,4, G. Cardella1 , A. Chbihi5 , E. De Filippo1 ,F. Favela1 , B. Gnoffo1 , G. Lanzalone6,9, I. Martel7 , N. S. Martorana2,6, A. Pagano1, E.V. Pagano2,6, S. Pirrone1 , G. Politi1,2, F. Porto2,6, F. Rizzo2,6, P. Russotto1 , A. Trifirò1,4, M. Trimarchi1,4, G. Verde1,8, M. Veselsky10

1) INFN, Sezione di Catania, Catania Italy
2) Università di Catania, Dip. di Fisica e Astronomia, Catania, Italy
3) Instituto de Fìsica, Universidad Nacional Autònoma de México, México City, Mexico
4) Dip. Di Scienze MIFT, Università degli Studi di Messina, Messina, Italy
5) GANIL, CEA-IN2P-CNRS, Caen, France
6) INFN, Laboratori Nazionali del Sud , Catania Italy
7) Departamento de Fìsica Aplicada, Universitad de Huelva, Huelva, Spain
8) IPN Orsay, Orsay, France
9) Università Kore, Enna, Italy
10)Slovak Academy of Sciences, Bratislava, Slovakia

The systems 12C + 24Mg at 35 AMeV of incident energy have been studied, using the forward part of CHIMERA array, in order to explore the competition between sequential and direct decay mechanisms of Hoyle state (7.65 MeV of excitation energy) produced in 12C quasi-projectile. The analysis has evidenced an important component of simultaneous breakup in three alpha particles. We have also studied the Hoyle state decay populated through 48Ca +27Al reaction at 40 AMeV. In this case the state seems to decay with purely sequential mechanisms, entirely passing through the ground state of 8Be. With the aim to explore the reasons of these discrepancies, dedicated simulations, that reproduce involving processes, have been developed.
The results of these studies suggest that the decay modes of Hoyle state could depend on the formation mechanisms and/or on differences between structures of reaction partners.

Primary authors : QUATTROCCHI, Lucia (CT)

Co-authors :

Presenter : QUATTROCCHI, Lucia (CT)

Track classification :

Contribution type : --not specified--

Submitted by : QUATTROCCHI, Lucia

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :
the list of co-author and relative affiliations are inside of Abstract content

Status : SUBMITTED

Track judgments :

Abstract ID : 54

Studio dello scattering elastico 20Ne + 76Ge a 306 MeV nel contesto del progetto NUMEN

Content :

Alessandro Spatafora for the NUMEN collaboration

Il progetto NUMEN intende studiare le reazioni di doppio scambio di carica (Double Charge Exchange, DCE) al fine di ricavare importanti informazioni sugli elementi di matrice nucleare (Nuclear Matrix Elements, NME) di grande interesse scientifico nell'ambito della struttura nucleare e della fisica del doppio decadimento beta senza neutrino (0vbb). A Novembre 2017 ai Laboratori Nazionali del Sud-INFN è stato svolto l'esperimento che ha consentito di avviare lo studio sperimentale del DCE e di un ampio network di reazioni
prodotte in seguito alla collisione di un fascio di 20Ne a 306 MeV di energia incidente su un target di 76Ge. In questo contesto di ricerca è indispensabile lo sviluppo di un nuovo approccio teorico allo studio delle reazioni di DCE che permetta di estrarre dalle sezioni d'urto sperimentali informazioni quantitative sui NME. Nella descrizione del meccanismo di reazione, un punto importante riguarda la trattazione del potenziale ottico che descrive il moto relativo dei nuclei coinvolti nella reazione. Una via di accesso privilegiata è rappresentata dalla determinazione della distribuzione angolare della sezione d'urto differenziale per i processi di scattering elastico, argomento che verrà presentato alla conferenza. Nell'esperimento si è ottenuta una misura accurata della distribuzione angolare della sezione d'urto differenziale in un ampio range angolare (4° < theta_cm < 25°).
L'analisi dei dati è stata effettuata attraverso diversi approcci: lo studio, nel contesto teorico del Modello Ottico, ha permesso l'individuazione di due potenziali di double folding (M3Y ed SPP) in grado di garantire una buona descrizione dell'andamento sperimentale; la trattazione esplicita di alcuni stati del model space è stata invece introdotta tramite l'implementazione di calcoli realizzati secondo il metodo dei canali accoppiati (coupled channels) ed in approssimazione Distorted Wave Born Approximation (DWBA), tramite l'utilizzo del software FRESCO.

Primary authors : SPATAFORA, Alessandro (LNS)

Co-authors :

Presenter : SPATAFORA, Alessandro (LNS)

Track classification :

Contribution type : --not specified--

Submitted by : SPATAFORA, Alessandro

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 55

Net Baryon Charge Fluctuations in PNJL model with 2+1 flavours

Content :

My work is focused on the study of the phase diagram of Quantum-Chromo Dynamics (QCD), aiming at the determination of the chemical freeze-out parameters of the Quark Gluon Plasma (QGP) formed in relativistic heavy-ion collisions. From lattice-QCD we know that at vanishing/small baryon chemical potential the phase transition is a cross-over, while at higher chemical potentials, it is argued that the transition is of first order, ending with a critical point. Unfortunately, lattice-QCD simulations cannot be extended to the region of high chemical potentials, due to sign problem, which prevents the Monte-Carlo sampling of gauge field configurations. The goal of my work is the determination of the transition parameters and, possibly, the recognition of the critical end point. For this purpose we use the effective Nambu-Jona-Lasinio with Polyakov Loop (PNJL) model with 2+1 flavours. In the Mean Field Approximation it is possible to obtain the thermodynamics quantities (i.e. pressure and quark density) and the fluctuations of conserved charges, in particular the generalized quark susceptibilities. The quark susceptibilities are useful to identify the parameters and the order of the phase transition.

Primary authors : Mr. MOTTA, Mario (INFN Torino)

Co-authors : Prof. ALBERICO, Wanda (Università degli Studi di Torino)

Presenter : Mr. MOTTA, Mario (INFN Torino)

Track classification :

Contribution type : --not specified--

Submitted by : MOTTA, Mario

Submitted on Tuesday 31 July 2018

Last modified on : Tuesday 31 July 2018

Comments :

I'm Mario Motta the PhD Student of Prof. Wanda Alberico

Status : SUBMITTED

Track judgments :

Abstract ID : 56

Quark-gluon correlations in the twist-3 TMD using Light-Front Wave Functions.

Content :

Higher-twist transverse-momentum dependent parton distributions (TMDs) go beyond the parton model description of a proton as they describe correlations between quarks and gluons. Higher-twist TMDs, however, turn out to be very elusive objects, as they are difficult to extract from experimental data. Twist-3 distributions can be decomposed as a sum of different contributions. In general, these contributions are separated into two different types: lower-twist (i.e. twist-2) contributions and pure twist-3 contributions. Most of the phenomenological parameterizations and models rely on the so called Wandzura-Wilczeck (WW) approximation, that set to zero the pure twist-3 contributions.
The WW approximation, however, remove the richness of the twist-3 distributions. I will show how the quark-gluon correlations (pure twist-3 contributions) entering the T-even chiral-odd distribution e(x,k⊥) can be calculated by using the formalism of light-front wave functions (LFWFs). The LFWFs that are considered include an intrinsic, non-perturbative gluon contribution that is fundamental in order to compute the pure twist-3 contributions.
The parametrization of the LFWFs is chosen by the comparison with the distribution amplitudes of the proton. The parameters of the LFWFs are fitted on the MMHT2014 parametrization for the valence-quark and gluon contributions to the unpolarized parton distribution f1(x). With these fit parameters, I will show predictions of the pure twist-3 contributions, and I will compare the results for e(x) to a recent extraction, obtained from the analysis of preliminary data of the beam asymmetry for di-hadron semi-inclusive deep inelastic scattering at CLAS 6 GeV.

Primary authors : RODINI, Simone (PV)

Co-authors : PASQUINI, Barbara (PV)

Presenter : RODINI, Simone (PV)

Track classification :

Contribution type : Oral

Submitted by : RODINI, Simone

Submitted on Thursday 30 August 2018

Last modified on : Thursday 30 August 2018

Comments :

Status : SUBMITTED

Track judgments :

Abstract ID : 57

Preliminary results coupling SMF and BLOB with Geant4

Content :

Reliable nuclear fragmentation models are of utmost importance in hadrontherapy, where MCs are used to compute the input parameters of the treatment planning software, to validate the deposited dose calculation, to evaluate the biological effectiveness of the radiation, to correlate the β+ emitters production in the patient body with the delivered dose, and to allow a non-invasive treatment verification.
Despite of its large use, the models implemented in Geant4 have shown severe limitations in reproducing the measured secondary yields in ions interaction below 100 MeV/A, in term of production rates, angular and energy distributions [1,2,3].
For this reason, we coupled SMF (Stochastic Mean Field) [4] and BLOB (Boltzmann-Langevin One Body) [5], two dedicated models for such interactions, with Geant4 and its de-excitation phase.
We will present the preliminary results obtained in calculating double-differential cross sections and angular distributions of the secondary fragments produced in the 12C fragmentation at 62 MeV/A on thin carbon target obtained with these models and Geant4.
Both, SMF and BLOB are semiclassical one-body approaches to solve the Boltzmann-Langevin equation. They include an identical treatment of the mean-field propagation, on the basis of the same effective interaction, but they differ in the way fluctuations are included.
In particular, while SMF employs a Uehling-Uhlenbeck collision term and introduces fluctuations as projected on the density space, BLOB introduces fluctuations in full phase space through a modified collision term where nucleon-nucleon correlations are explicitly involved. Both of them, SMF and BLOB, have been developed to simulate the heavy ion interactions in the Fermi-energy regime. We will show their capabilities in describing 12C fragmentation foreseen their implementation in Geant4.

[1] B. Braunn et al. “Comparisons of hadrontherapy-relevant data to nuclear interaction codes in the Geant4 toolkit,” J. Phys.: Conf. Ser., 2013, vol. 420, p. 012163
[2] M. De Napoli et al. “Carbon fragmentation measurements and validation of the Geant4 nuclear reaction models for hadrontherapy,” Phys. Med. Biol., 2012, vol. 57, no. 22, pp. 7651–7671.
[3] J. Dudouet et al. “Benchmarking geant4 nuclear models for hadron therapy with 95 MeV/nucleon carbon ions,” Phys. Rev. C, 2014, vol. 89, no. 5, p. 054616.
[4] M. Colonna et al. “Fluctuations and dynamical instabilities in heavy-ion reactions,” Nucl. Phys., 1998, vol. A642, p. 449
[5] P. Napolitani and M. Colonna “Bifurcations in Boltzmann-Langevin one body dynamics for fermionic systems”, 2013, Phys. Lett. B vol. 726, pp. 382-386

Primary authors : MANCINI TERRACCIANO, Carlo (ROMA1)

Co-authors : Dr. CACCIA, Barbara (ISS) ; CIRRONE, Giuseppe (LNS) ; COLONNA, Maria (LNS) ; DOTTI, Andrea (SLAC National Accelerator Laboratory) ; Dr. NAPOLITANI, Paolo (IPN) ; Dr. PANDOLA, Luciano (LNS)

Presenter : MANCINI TERRACCIANO, Carlo (ROMA1)

Track classification :

Contribution type : Oral

Submitted by : MANCINI TERRACCIANO, Carlo

Submitted on Thursday 30 August 2018

Last modified on : Thursday 30 August 2018

Comments :

Status : SUBMITTED

Track judgments :