MENU 2016

Report of Contributions

https://indico2.riken.jp/e/menu2016

Contribution ID: **1** Type: **not specified**

LHCb results on pentaquark search

Thursday 28 July 2016 09:15 (40 minutes)

Presenter: KUCHARCZYK, Marcin (Polish Academy)

Session Classification: Plenary

Contribution ID: **2** Type: **not specified**

Hidden charm pentaquarks

Thursday 28 July 2016 09:55 (40 minutes)

Observation of two hidden-charm pentaquark-like structures was reported by the LHCb Collaboration. Predictions and post-explanations of them will be reviewed. Further exploration of them and their partners will be discussed.

Presenter: ZOU, Bing-Song (Chinese Academy of Sciences)

Session Classification: Plenary

Contribution ID: **3** Type: **not specified**

Recent results from LEPS

Thursday 28 July 2016 11:00 (40 minutes)

Presenter: NAKANO, Takashi (RCNP)

Session Classification: Plenary

Contribution ID: **4** Type: **not specified**

Hadron spectroscopy with COMPASS

Thursday 28 July 2016 11:40 (40 minutes)

The COMPASS spectroscopy program mostly foots on the use of hadron beams. Large data samples on diffractive production using incoming pions and kaons allow new insights into the spectrum of light and strange mesons. Large data samples also require the development of new analysis methods and close cooperation with phenomenologists. We present new results on the light meson spectrum obtained from 3pi final states using data obtained on hydrogen and heavy targets. In addition, lepto-production of heavy quark systems has been studied with high energy muon beams and new results exotic, charmonium-like mesons will be presented.

Presenter: PAUL, Stephan (TU Munchen)

Session Classification: Plenary

Contribution ID: **5** Type: **not specified**

Threshold and kinematic effects for the exotic resonance-like structures

Thursday 28 July 2016 12:20 (40 minutes)

Presenter: ZHAO, Qiang (IHEP)

Session Classification: Plenary

Contribution ID: **6** Type: **not specified**

XYZ resonances at Belle

Wednesday 27 July 2016 09:15 (40 minutes)

In Belle experiment, many quarkonium-like exotic hadron candidates have been discovered, X(3872) in B meson decay, Y(4260) in initial state radiation, Zb(10610)+ and Zb(10650)+ in Upsilon(10860) decay and so on. This talk will review recent progress of relevant experimental studies as well as attempts to give a comprehensive interpretation for them.

Presenter: MIYABAYASHI, Kenkichi (Nara Women's University)

Session Classification: Plenary

Contribution ID: **7** Type: **not specified**

Progress on light meson spectroscopy at BESIII

Wednesday 27 July 2016 09:55 (40 minutes)

The BESIII experiment at the electron positron collider BEPCII in Beijing is successfully operating since 2008 and has collected large data samples in the tau-mass region, including the world's largest data samples at the J/psi and psi(2s) resonances. In particular decays of these two resonances provide a rich and clean environment to study hadrons consisting out of light quarks and search for exotics. In this presentation recent results of the light hadron physics program will be highlighted. NOTE: On behalf of the BESIII speaker bureau, I would like to submit this abstract. In case the talk is accepted by the organization committee. The BESIII speaker bureau will nominate the speaker as soon as possible. Thank you very much in advance!

Presenter: FANG, Shuangshi (Institute of Hig Energy Physis)

Session Classification: Plenary

Contribution ID: **8** Type: **not specified**

Opening address

Tuesday 26 July 2016 09:40 (20 minutes)

Presenter: EN'YO, Hideto

Session Classification: Plenary

Contribution ID: **9** Type: **not specified**

Zc(3900) from Lattice QCD simulation

Wednesday 27 July 2016 10:35 (40 minutes)

The possible exotic meson $Z_c(3900)$, found in e^+e^- reactions, is studied by the method of coupled-channel scattering in lattice QCD. The interactions among $\pi J/\psi$, $\rho\eta_c$ and $\bar{D}D^*$ channels are derived from (2+1)-flavor QCD simulations at $m_\pi = 410$-700 MeV. The interactions are dominated by the off-diagonal $\pi J/\psi$-$\bar{D}D^*$ and $\rho\eta_c$-$\bar{D}D^*$ couplings, which indicates that the $Z_c(3900)$ is not a usual resonance but a threshold cusp. Semi-phenomenological analyses with the coupled-channel interaction are also presented to confirm this conclusion.

Presenter: IKEDA, Yoichi (RCNP, Osaka University)

Session Classification: Plenary

Contribution ID: **10** Type: **not specified**

Nucleon Resonances and their Structure

Tuesday 26 July 2016 10:00 (40 minutes)

Meson-photoproduction measurements and their reaction-amplitude analyses can establish more sensitively, and in some cases in an almost model-independent way, the nucleon excitation and non-resonant reaction amplitudes. However, to investigate the strong interaction from explored –where meson-cloud degrees of freedom contribute substantially to the baryon structure –to still unexplored distance scales –where quark degrees of freedom dominate and the transition from dressed to current quarks occurs –we depend on experiments that allow us to measure observables that are probing this evolving non-perturbative QCD regime over its full range. Transition form factors are uniquely suited to trace this evolution by measuring exclusive single-meson and double-pion electroproduction cross sections off the free proton. Recent efforts try to access their isospin dependence by analyzing the cross sections off the quasi-free neutron and proton in Deuterium. In the near future, these exclusive measurements will be extended to higher momentum transfers with CLAS12 and the energy-upgraded CEBAF beam to study the strong interaction where the dressed quark degrees of freedom dominate, which in turn are responsible for the ground and excited nucleon state formations. Recent and preliminary results will highlight the status of the analyses and of their theoretical descriptions, and an experimental and theoretical outlook will outline what shall and may be achieved in the new era of the 12-GeV upgraded transition form factor program. This work is supported in part by the National Science Foundation under Grant PHY 1505615.

Presenter: GOTHE, Ralf W. (University of South Carolina)

Session Classification: Plenary

Contribution ID: **11** Type: **not specified**

How the minuscule contributes to the big picture: the neutron electric dipole moment

Wednesday 27 July 2016 11:40 (40 minutes)

A permanent electric dipole moment (EDM) of a fundamental particle violates both parity (P) and time reversal symmetry (T) and therefore combined charge and parity reversal symmetry (CP). It is a very promising place to search for physics beyond the Standard Model. One reason for this is that the Standard Model background is so small. Supersymmetric theories, for example, are already constrained by existing EDM limits. In the five decade history of these experiments numerous models have been ruled out. Searches for hadronic sector electric dipole moments are particularly sensitive to CP-violation that might contribute to generation of a matter/anti-matter asymmetry at the electroweak symmetry breaking transition. The presentation will introduce the measurement principle and major current and planned efforts to reduce the present nEDM limit of 1e-26 ecm with a special focus on the TRIUMF project.

Presenter: PICKER, Ruediger (TRIUMF)

Session Classification: Plenary

Contribution ID: **12** Type: **not specified**

Lattice result on the neutron-proton mass differences

Tuesday 26 July 2016 10:40 (40 minutes)

More than 99% of the mass of the visible universe is made up of protons and neutrons. Both particles are much heavier than their quark and gluon constituents. The existence and stability of atoms rely on the fact that the mass difference between the neutron and the proton is about 0.14%. A slightly smaller or larger value would have led to a dramatically different universe. I show how theoretical breakthroughs and high-performance computing resources have transitioned to a point where these masses, their differences and similar physics observables can be calculated accurately on space-time lattices directly from Quantum Chromodynamics.

Presenter: FODOR, Zoltan (Wuppertal)

Session Classification: Plenary

Contribution ID: **13** Type: **not specified**

Search for beyond standard model and QCD

Wednesday 27 July 2016 12:20 (40 minutes)

Current progress of lattice QCD to provide theoretical guidance for search for new physics beyond the Standard Model is reported. Focus will be on the hadronic contributions to the anomalous magnetic moment, for which new experiments are starting/planned at FNAL and J-PARC. Calculations for Electric dipole moment of nucleon are also briefly summarized.

Presenter: IZUBUCHI, Taku (RBRC)

Session Classification: Plenary

Contribution ID: **14** Type: **not specified**

Tetraquarks and the chiral phase transition

Wednesday 27 July 2016 14:15 (35 minutes)

We consider how tetraquarks can affect the chiral phase transition for light quarks coupled to SU(3) color. For two flavors the tetraquark field is an isosinglet, and its effect is minimal. For three flavors, however, the tetraquark field transforms in the same representation of chiral symmetry as the usual chiral order parameter, and so for very light quarks there may be {\it two} chiral phase transitions, both of first order.

Presenter: PISARSKI, Robert (Nuclear Theory Group, Brookhaven National Laboratory)

Session Classification: Mesons

Contribution ID: **15** Type: **not specified**

Recent developments in nucleon spin decomposition

Tuesday 26 July 2016 11:40 (40 minutes)

I review the recent progress in understanding the decomposition of the nucleon spin into the helicity and orbital angular momentum of quarks and gluons.

Presenter: HATTA, Yoshitaka (Yukawa Institute, Kyoto University)

Session Classification: Plenary

Contribution ID: **16** Type: **not specified**

Possible effect of mixed phase and deconfinement upon spin correlations in the $\Lambda\bar{\Lambda}$ pairs generated in relativistic heavy-ion collisions

Wednesday 27 July 2016 14:50 (30 minutes)

Spin correlations for the $\Lambda\Lambda$ and $\Lambda\bar{\Lambda}$ pairs, generated in relativistic heavy-ion collisions, and related angular correlations at the joint registration of space-parity nonconserving hadronic decays of two hyperons are theoretically analyzed. These correlations give important information about the character and mechanism of multiple processes, and the advantage of the $\Lambda\Lambda$ and $\Lambda\bar{\Lambda}$ systems over other ones is conditioned by the fact that the P-odd decays $\Lambda \to p + \pi^-$ and $\bar{\Lambda} \to \bar{p} + \pi^+$ serve as effective analyzers of spin states of the Λ and $\bar{\Lambda}$ particles. The correlation tensor components can be derived by the method of "moments" – as a result of averaging the combinations of trigonometric functions of proton (antiproton) flight angles over the double angular distribution of flight directions for products of two decays. The properties of the "trace" T of the correlation tensor (a sum of three diagonal components), which determines the angular correlations as well as the relative fractions of the triplet states and singlet state of respective pairs, are discussed . In the present talk, spin correlations for two identical particles ($\Lambda\Lambda$) and two non-identical particles ($\Lambda\bar{\Lambda}$) are generally considered from the viewpoint of the conventional model of one-particle sources. In the framework of this model, correlations vanish at enough large relative momenta. However, under these conditions – especially at ultrarelativistic energies – in the case of two non-identical particles ($\Lambda\bar{\Lambda}$) the two-particle annihilation sources (two-quark, i.e. quark–antiquark, and two-gluon ones) start playing a noticeable role and lead to the difference of the correlation tensor from zero. In particular, such a situation may arise, when the system passes through the "mixed phase" and – due to the multiple production of free quarks and gluons in the process of deconfinement of hadronic matter – the number of two-particle sources strongly increases.

Presenter: LYUBOSHITZ, Valery (Joint Institute for Nuclear Research (Dubna))

Session Classification: Mesons

Contribution ID: **17** Type: **not specified**

Gluon fragmentation functions in the NJL model

Wednesday 27 July 2016 15:20 (30 minutes)

We derive gluon fragmentation functions in the Nambu-Jona-Lasinio (NJL) model by approximating a gluon as a fictitious color-octet quark-anti-quark ($q\bar{q}$) pair. Gluon elementary fragmentation functions are derived from the quark and anti-quark elementary fragmentation functions for emitting specific mesons in the NJL model under the requirement that the $q\bar{q}$ pair maintains in the flavor-singlet state after meson emission. An iteration method and an inverse matrix method based on the gluon elementary fragmentation functions then yield the gluon fragmentation functions at the model scale. It is found that the resultant gluon fragmentation functions are stable with respect to variation of relevant model parameters, especially after QCD evolution to a higher scale is implemented. We show that the inclusion of the gluon fragmentation functions into the theoretical predictions from only the quark fragmentation functions greatly improve the agreement with the SLD data for the pion and kaon productions in e^+e^- annihilation. Our proposal provides a plausible construct for the gluon fragmentation functions, which are supposed to be null in the NJL model.

Presenter: YANG, Dong-Jing (National Taiwan Normal University)

Session Classification: Mesons

Contribution ID: **18** Type: **not specified**

KbarNN bound state search at J-PARC

Tuesday 26 July 2016 12:20 (40 minutes)

The possible existence of strongly-bound $\bar{K}$ nuclear-states has been widely discussed as a consequence of the strongly attractive $\bar{K}N$ interaction in I = 0 channels. Experimentally, however, available information is not sufficient to discriminate between a variety of conflicting interpretations so far. In this situation, we have performed an experimental search for the simplest kaonic nuclear bound state, $\bar{K}NN$, by the in-flight $K^- + {}^3$He reactions at 1 GeV/c (J-PARC E15). The experiment investigates the $\bar{K}NN$ state both in the formation via ${}^3\mathrm{He}(K^-, n)X$ missing-mass spectroscopy and its decay via invariant-mass spectroscopy using ${}^3\mathrm{He}(K^-, \Lambda p)n$ channel, respectively. The first physics data-taking was performed at the K1.8BR beam-line in 2013. With this data-set, we have observed a significant bump structure around the K^-pp mass-threshold in the Λp invariant-mass spectrum in the exclusive ${}^3\mathrm{He}(K^-, \Lambda p)n$ analysis [PTEP(2016)051D01]. We will discuss the possible existence of the $\bar{K}NN$ states by combining the production- and the decay-channel analyses. In addition, we will present the latest results of the second data-taking performed in 2015, where much improved data statistics of the ${}^3\mathrm{He}(K^-, \Lambda p)n$ channel was accumulated.

Presenter: SAKUMA, Fuminori (RIKEN)

Session Classification: Plenary

Contribution ID: **19** Type: **not specified**

The “K-pp”system investigated with a coupled-channel Complex Scaling Method

Tuesday 26 July 2016 14:15 (35 minutes)

In mesic nuclei, kaonic nuclei have been a hot topic for a decade. Due to so strong KbarN attraction that generates a hyperon resonance Lambda(1405), kaonic nuclei could have various interesting properties, in particular to form a dense matter. To clarify exotic nature caused by anti-kaons, the most essential kaonic nucleus “K-pp”has been studied eagerly from both theoretical and experimental sides. We have investigated the “K-pp”with a coupled-channel Complex Scaling Method + Feshbach projection, treating adequately resonance and coupled-channel natures. Using a chiral SU(3)-based KbarN interaction, we found that the “K-pp”is shallowly bound with 20-30 MeV binding energy, and that it involves the normal density of nuclear matter. Recently, we have pointed out that there could be another state with large binding energy (~80 MeV) involving huge decay width. (Double-pole structure like Lambda(1405)). We will report above-mentioned result and discuss the recent J-PARC experiments of K-pp search (E15 and E27). In addition, we will show a new study with a FULL coupled-channel Complex Scaling Method, where KbarNN, piSigmaN and piLambdaN channels are explicitly treated. Such a fully coupled-channel calculation would tell us more details on the “K-pp”nature, especially on its double pole nature.

Presenter: DOTE, Akinobu (KEK Theory Center)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **20** Type: **not specified**

Recent result of an exclusive measurement of 3He(K-, Λp)n reaction to search for KbarNN bound state at J-PARC

Tuesday 26 July 2016 14:50 (30 minutes)

As a consequence of the attractive KbarN interaction, kaonic nuclei which is bound state of anti-kaon and nucleon has been widely discussed. All theoretical studies support the existence of kaonic nuclei, however, its energy and width are widely spread depending on energy dependence of the KbarN interaction model. The investigation of such bound state would help us to understand the KbarN interaction especially in the energy region below the KbarN threshold which cannot be provided by low-energy KbarN scattering experiments or X-ray measurement from kaonic atoms. We have searched for simplest kaonic nuclear bound state, KbarNN bound state, using in-flight kaon induced reaction on helium-three target at the J-PARC. We carried out the first physics data-taking in 2013 and observed a peak structure just below the KbarNN threshold by an exclusive analysis of 3He(K-, Λp)n reaction. In that time, only simple Breit-Wigner pole structure was used to evaluate its position and width due to lack of statistics. Therefore, we performed the second physics data-taking in 2015, to conform the peak structure with higher statistics and apply more detail analysis such as studying of momentum transfer dependence. The recent results with the higher statistical data will be presented in this contribution.

Presenter: YAMAGA, Takumi (Osaka university)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **21** Type: **not specified**

Exotic baryons as a hadronic molecule in the heavy quark region

Wednesday 27 July 2016 14:15 (35 minutes)

In the hadron spectroscopy in the heavy quark region, new symmetry plays an important role. The symmetry is the heavy quark spin symmetry. It manifests the mass degeneracy of the states with different total spin, e.g. degeneracies of D and D^* mesons and Σ_c and Σ_c^* baryons. It is important to generate the exotic hadron structures found in the heavy quark region. The mass degeneracy enhances the mixing of D ($J^P = 0^-$) and D^* ($J^P = 1^-$) mesons. Therefore the pion coupling πDD^* is introduced, while the coupling πDD is forbidden. It is known that the one pion exchange potential (OPEP) is important for the binding of atomic nuclei. The attraction of the OPEP motivates us to investigate new hadron-hadron systems in the heavy quark region. In this talk, we study bound and resonant states of hadronic molecules of a heavy meson and a baryon. In addition, the mass degeneracy can appear in not only the ordinary hadrons but also hadronic molecules. It indicates the existence of partner states of the heavy quark symmetry. We also discuss the properties of the hadronic molecules in the heavy quark limit.

Presenter: YAMAGUCHI, Yasuhiro (INFN Genova)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **22** Type: **not specified**

On the structure observed in the in-flight 3He (K^- , Lambda p) n reaction at J-PARC

Tuesday 26 July 2016 15:20 (30 minutes)

Recently, a peak structure was observed near the K^- p p threshold in the in-flight 3He (K^- , Lambda p) n reaction of the E15 experiment at J-PARC. This peak could be a signal of the lightest kaonic nuclei, that is, the Kbar N N (I=1/2) state, which has been intensively studied both experimentally and theoretically in the last decade. In this contribution we theoretically investigate what is the origin of the peak structure observed in the E15 experiment at J-PARC. Since the peak exists near the K^- p p threshold, we expect two scenarios to produce the peak. One is that the Lambda(1405) is generated but it does not correlate with p, and the uncorrelated Lambda(1405)-p system subsequently decays into Lambda p. The other is that the Kbar N N quasi-bound state is indeed generated and decays into Lambda p. We calculate the Lambda p invariant mass spectrum of the reaction with these two scenarios and compare it with the experimental one to interpret the experimental peak structure.

Presenter: SEKIHARA, Takayasu (Advanced Science Research Center, JAEA)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **23** Type: **not specified**

PERSPECTIVE STUDY OF CHRMONIUM, EXOTICS AND BARYONS WITH CHARM AND STRANGENESS

Wednesday 27 July 2016 14:50 (30 minutes)

The spectroscopy of charmonium-like states together with the spectroscopy of charmed and strange baryons is discussed. It is a good testing tool for the theories of strong interactions, including: QCD in both the perturbative and non-perturbative regimes, LQCD, potential models and phenomenological models [1, 2, 3]. An understanding of the baryon spectrum is one of the primary goals of non-perturbative QCD. In the nucleon sector, where most of the experimental information is available, the agreement with quark model predictions is astonishingly small, and the situation is even worse in the strange and charmed baryon sector. The experiments with antiproton-proton annihilation and proton-proton collisions are well suited for a comprehensive spectroscopy program, in particular, the spectroscopy of exotic states and flavour baryons. Charmed and strange baryons can be produced abundantly in both processes, and their properties can be studied in detail [1, 2, 3]. This gives a possibility to get information about their structure and nucleon-hyperon and hyperon-hyperon interaction. For this purpose an elaborated analysis of charmonium, charmed hybrid and tetraquark spectrum together with spectrum of charmed and strange baryons is given. The recent experimental data from different collaborations are analyzed. A special attention was given to the recently discovered XYZ-particles. The attempts of their possible interpretation are considered [4 - 7]. Some of these states can be interpreted as higher-lying charmonium and tetraquarks with a hidden charm. It has been shown that charge/neutral tetraquarks must have their neutral/charged partners with mass values which differ by few MeV. This hypothesis coincides with that proposed by Maiani and Polosa [8]. Many heavy baryons with charm and strangeness are expected to exist. But much more data on different decay modes are needed before firmer conclusions can be made. These data can be derived directly from the experiments using a high quality antiproton beam with momentum up to 15 GeV/c and proton-proton collisions with momentum up to 20 GeV/c. References [1] W. Erni et al., arXiv:0903.3905v1 [hep-ex] (2009) 63. [2] N. Brambilla et al., European Physical Journal C 71:1534, (2011) 1. [3] J. Beringer et al., Review of Particle Physic, Physical. Review, D 86, (2012). [4] M.Yu. Barabanov, A.S. Vodopyanov, Physics of Particles and Nuclei Letters, V.8, N.10, (2011) 1069. [5] M.Yu. Barabanov, A.S. Vodopyanov, S.L. Olsen, Physics of Atomic Nuclei, V.77, N.1, (2014) 126. [6] M.Yu. Barabanov, A.S. Vodopyanov, S.L. Olsen , Physica Scripta, T 166 (2015) 014019. [7] M.Yu. Barabanov, A.S. Vodopyanov, S.L. Olsen, A.I. Zinchenko, Physics of Atomic Nuclei, V.79, N 1 (2016) 126. [8] L. Maiani, F. Piccinini, A.D. Polosa, V. Riquer, Phys. Rev. Lett. 99 (2007) 182003.

Presenter: BARABANOV, Mikhail (JINR)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **24** Type: **not specified**

A study of the H-dibaryon in holographic QCD

Wednesday 27 July 2016 15:50 (30 minutes)

We investigate the H-dibaryon (uuddss) in holographic QCD [1, 2]. Holographic QCD is derived from a QCD-equivalent D-brane system in the superstring theory via the gauge/gravity correspondence. In holographic QCD, all baryons appear as topological chiral solitons of Nambu-Goldstone bosons and (axial) vector mesons [1, 2]. In this framework, the H-dibaryon can be described as an SO(3)-type hedgehog state [3]. In this paper, we present the formalism of the H-dibaryon in holographic QCD, and investigate its properties. [1] T. Sakai and S. Sugimoto, Prog. Theor. Phys. 113 (2005) 843; 114 (2005) 1083. [2] K. Nawa, H. Suganuma and T. Kojo, Phys. Rev. D75 (2007) 086003. [3] A.P. Balachandran et al., Phys. Rev. Lett. 52 (1984) 887.

Presenter: MATSUMOTO, Kohei (Kyoto University)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **25** Type: **not specified**

Study of the Kbar-nucleus interaction by using the 12C(K-, p) reaction at J-PARC

Tuesday 26 July 2016 15:50 (30 minutes)

An interaction between Kbar and nucleus is studied by using the X-ray from the kaonic atoms for a long time. However, it is difficult to determine the Kbar-nucleus interaction by using only kaonic-atoms data because the value of shift and width of the X-ray depend not only the potential depth but also the type of theoretical model. Thus, we study the Kbar-nucleus interaction by comparing an observed missing-mass spectrum of the 12C(K-, p) reaction with the DWIA calculation. Such a study has already reported from KEK-E548 experiment. However, their spectrum was not inclusive one but semi-inclusive one, which was required at least one charged particle hit by their decay counter. Therefore, it is point out that this requirement can distort the inclusive spectrum. In our experiment, we have evaluated the real inclusive missing-mass spectrum by measuring only the K- and proton's momenta. We took this data in November 2015 as a by-product of J-PARC E05 experiment, which was a Xi-hypernuclei search experiment by using 12C(K-, K+) reaction. In this talk, we will report the preliminary analysis result of this measurement.

Presenter: ICHIKAWA, Yudai (Japan Atomic Energy Agency)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **26** Type: **not specified**

1+1 large N_c QCD and its holographic dual

Wednesday 27 July 2016 15:20 (30 minutes)

Large N_c QCD in 1+3 dimensional spacetime can be converted into its holographic dual model via gauge/gravity correspondence (called the Sakai-Sugimoto model or holographic QCD)[1]. This QCD-based model well reproduces the mass spectrum of mesons, and also explains many properties of hadron phenomenology such as anomalies, the vector meson dominance, and the Skryme model. In this paper, we consider large N_c QCD in 1+1 dimensional spacetime (called the 't Hooft model) and investigate its holographic dual. As an advantage of 1+1 large N_c QCD, we can analytically calculate the meson mass spectrum directly from the QCD Lagrangian. Furthermore, a holographic dual model of 1+1 large N_c QCD can be easily constructed by changing the dimension of D-branes of the Sakai-Sugimoto model in 1+3 QCD case. We will also compare 1+1 large N_c QCD and its holographic dual in terms of confinement and chiral symmetry breaking. [1] T.Sakai and S.Sugimoto, Prog. Theor. Phys. 113 (2005) 843; 114 (2005) 1083.

Presenter: SUGANUMA, Hideo (Kyoto Univ.)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **27** Type: **not specified**

Light-cone QCD sum rules for soft contribution to exclusive Drell-Yan process at J-PARC

Wednesday 27 July 2016 14:15 (35 minutes)

Exclusive Drell-Yan process, \pi^- p \to \mu^+ \mu^- n, may be measured using the high-intensity pion beams at J-PARC, and its QCD description is complementary to that for the deeply virtual meson production, \gamma^* p \to \pi N, at e.g., JLAB. The leading hard exclusive amplitude for exclusive Drell-Yan process was obtained by E.R. Berger, M. Diehl, and B. Pire [Phys. Lett. B523 (2001) 265] in terms of the partonic subprocess convoluted with the relevant nonperturbative functions, the nucleon generalized parton distributions (GPDs) and the pion distribution amplitudes, and, recently, subleading amplitudes, suppressed by the inverse powers of the dilepton mass Q, have also been calculated by S. V. Goloskokov and P. Kroll [Phys.Lett. B748 (2015) 323]. However, those predictions based on the QCD factorization approach still seem to have large uncertainties that originate from the treatment of the pion pole contribution arising in the relevant GPDs in the ERBL region, the parton transverse momentum to regularize the endpoint singularities, the so-called soft-overlap mechanism, etc. These effects related to "soft contribution"important at J-PARC kinematics are not directly accessible in the usual framework for QCD factorization of the hard exclusive amplitudes. We study the exclusive Drell-Yan process constructing the light-cone QCD sum rules for the corresponding exclusive amplitudes, which allow us to estimate the relevant soft contributions making use of dispersion relations and quark-hadron duality.

Presenter: TANAKA, Kazuhiro (Juntendo University)

Session Classification: Nucleon Structure

Contribution ID: **28** Type: **not specified**

Studying nucleon partonic structure with the COMPASS unpolarised Drell-Yan programme

Wednesday 27 July 2016 14:50 (30 minutes)

Since the winter of 2014, COMPASS collaboration at CERN have performed a series of Drell-Yan experiments using a high-intensity negative hadron beam with momentum 190-GeV/c impinging on a transversely polarised ammonia target and unpolarised aluminum and tungsten targets. The experiment provides the first-ever polarized Drell-Yan data, as well as greatly improved statistics for the unpolarised ones. In this talk the physics topics related to unpolarised Drell-Yan and J/psi measurements will be reviewed, especially focusing on the transverse-momentum-dependent (TMD) Boer-Mulders functions of the pions and protons measured in the unpolarised Drell-Yan process. The expected statistical accuracies will be also shown.

Presenter: SAWADA, Takahiro (Institute of Physics, Academia Sinica)

Session Classification: Nucleon Structure

Contribution ID: **29** Type: **not specified**

Study of the hadron structure using the polarised Drell-Yan process at COMPASS

Wednesday 27 July 2016 15:20 (30 minutes)

The COMPASS experiment at CERN is one of the leading experiments studying the nucleon structure. Until 2012 the Parton Distribution Functions (PDFs) and the Transverse Momentum Dependent Parton Distribution Functions (TMDs) were extensively studied at COMPASS using Semi-Inclusive Deep Inelastic Scattering (SIDIS) measurements. In 2015 the data taking was dedicated to the study of the polarised Drell-Yan (DY) process. COMPASS scattered a negative pion beam of 190 GeV/c off a transversely polarised proton target, with the goal of accessing the TMDs of both hadrons (pions and protons) without any prior knowledge on fragmentation functions. The TMDs are determined from target polarisation (in)dependent azimuthal asymmetries, which in turn are extracted from pairs of oppositely charged muons coming from the polarised DY process. Since the DY data covers the same kinematic region of the SIDIS data, COMPASS has the unique opportunity to test the sign change of the Sivers TMD as predicted by QCD. Preliminary results of the DY analysis will be presented.

Presenter: QUARESMA, Márcia (LIP)

Session Classification: Nucleon Structure

Contribution ID: **30** Type: **not specified**

Search for dark sector at BESIII

Tuesday 26 July 2016 16:50 (30 minutes)

Presenter: GUO, Yuping (Institut für Kernphysik)

Session Classification: Fundamental Symmetries

Contribution ID: **31** Type: **not specified**

Measurement of Antiquark Flavor Asymmetry in the Proton by the Drell-Yan Experiment SeaQuest at Fermilab

Wednesday 27 July 2016 15:50 (30 minutes)

The amount of u-bar and that of d-bar in the proton were assumed to be the same based on the flavor symmetry. However, the NMC experiment at CERN found, by deep inelastic muon scattering, that d-bar is dominant in the proton. The previous Drell-Yan experiment at Fermilab (E866) measured the ratio of d-bar to u-bar, namely flavor asymmetry, and showed that d-bar/u-bar is as asymmetric as 1.7 at Bjorken x ~ 0.2. The E866 experiment also indicated that d-bar/u-bar rapidly decreased at Bjorken x ~ 0.3 although the uncertainty was large. This behavior is not explained by any theories at present. The SeaQuest experiment (E906) at Fermilab aims to clarify the flavor asymmetry in that region. The ratio of d-bar to u-bar is derived from the cross section ratio of proton-deuteron to proton-proton Drell-Yan process. We use the 120-GeV proton beam extracted from Fermilab Main Injector and two targets such as liquid hydrogen and deuterium. We analyzed the data taken in 2015 and obtained the preliminary result. We found that the d-bar/u-bar doesn't decrease at Bjorken x ~ 0.3.

Presenter: NAGAI, Kei (Tokyo Institute of Technology)

Session Classification: Nucleon Structure

Contribution ID: **32** Type: **not specified**

$\bar{D}\Sigma_c^*$ and $\bar{D}^*\Sigma_c$ interactions and the LHCb hidden-charmed pentaquarks

Wednesday 27 July 2016 14:15 (30 minutes)

Recently, two hidden-charmed resonances $P_c(4380)$ and $P_c(4450)$ consistent with pentaquark states were observed at the LHCb detector. The two P_c states locate just below the $\bar{D}\Sigma_c^*$ and $\bar{D}^*\Sigma_c$ thresholds with mass of gaps about 5 and 15 MeV, respectively. Inspired by this fact we perform a dynamical investigation about the $\bar{D}\Sigma_c^*(2520)$ and $\bar{D}^*\Sigma_c(2455)$ interactions which are described by the meson exchanges. A bound state which carries spin-parity $J^P = 3/2^-$ is produced from the $\bar{D}\Sigma_c^*(2520)$ interaction, which is consistent with the $P_c(4380)$ observed at the LHCb detector. From the $D^*\Sigma_c(2455)$ interaction, a bound state with $5/2^+$ is produced, which can be related to the $P_c(4450)$. The results suggest that the $P_c(4380)$ and $P_c(4450)$ are good candidates of $\bar{D}\Sigma_c^*(2520)$ and $\bar{D}^*\Sigma_c(2455)$ molecular states, respectively.

Presenter: HE, Jun (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: Pentaquarks

Contribution ID: **33** Type: **not specified**

Understanding the nature of the heavy pentaquarks and searching for them in pion-induced reactions

Wednesday 27 July 2016 14:45 (30 minutes)

The LHCb collaborations recently reported the observations of two resonance-like structures, which could be the long-searching-for pentaquark states. When studying these heavy pentaquark candidates, usually one will confront two issues, i.e., what their underlying structures are and how to search for them in experiments. We indicated that these resonance-like peaks may be resulted from some kinematic threshold effects, in particular the triangle singularity mechanism. The triangle singularity mechanism is a highly process-dependent mechanism, which is very different from other dynamic mechanisms. This may bring ambiguities on our understanding of the nature of those exotic states. We therefore needs different kinds of processes to check this mechanism. The piN scattering into J/psi-pion-proton could be a promising reaction to search for the heavy pentaquark or the effects induced by the triangle singularity mechanism. The forthcoming J-PARC pion-induced experiment may offer us a good opportunity to check different kinematic or dynamic mechanisms and clarify the ambiguities.

Presenter: LIU, Xiao-Hai (Tokyo Institute of Technology)

Session Classification: Pentaquarks

Contribution ID: **34** Type: **not specified**

Search for K+ to pi+ nu nu at NA62

Tuesday 26 July 2016 17:20 (30 minutes)

K+->pi+nunu is one of the theoretically cleanest meson decay where to look for indirect effects of new physics complementary to LHC searches. The NA62 experiment at CERN SPS is designed to measure the branching ratio of this decay with 10% precision. NA62 took data in pilot runs in 2014 and 2015 reaching the final designed beam intensity. The quality of data acquired in view of the final measurement will be presented.

Presenter: MINUCCI, Elisa (Louvain University)

Session Classification: Fundamental Symmetries

Contribution ID: **35** Type: **not specified**

Pc(4450) and triangle singularity

Wednesday 27 July 2016 15:15 (30 minutes)

We want to discuss the Pc(4450) structure observed by the LHCb Collaboration in the J/psi proton final states. We want to point out that it is located exactly at the chi_{c1}-proton threshold, and coincides with the leading Landau singularity of the triangle loop Lambda(1890)-chi_{c1}-proton. We also discuss how to distinguish a genuine resonance from the kinematical singularity.

Presenter: GUO, Feng-Kun (Institute of Theoretical Physics, CAS)

Session Classification: Pentaquarks

Contribution ID: **36** Type: **not specified**

Searches for lepton number violation and resonances in the K+- −>pi mu mu decays at the NA48/2 experiment

Tuesday 26 July 2016 17:50 (30 minutes)

The NA48/2 experiment at CERN collected a large sample of charged kaon decays into final states with multiple charged particles in 2003-2004. A new upper limit on the rate of the lepton number violating decay K+- −> pi-+ mu+- mu+- obtained from this sample is reported: 8.6 × 10^−{11} at 90% CL, which improves by more than an order of magnitude upon the previous measurements. Searches for two-body resonances in the K+- −>pi mu mu decays (including heavy neutral leptons and inflatons) in the accessible range of masses and lifetimes are also presented.

Presenter: ZINCHENKO, Andrey (Joint Institute for Nuclear Research)

Session Classification: Fundamental Symmetries

Contribution ID: **37** Type: **not specified**

Recent results from WASA-at-COSY

Friday 29 July 2016 09:15 (40 minutes)

Detector system WASA-at-COSY has been operated at the Cooler Synchrotron COSY in the years from 2006 till 2015. In this presentation we will report on recent results of the analyses of the meson production reactions in deuteron-deuteron and nucleon-nucleon collisions with spin-polarized and unpolarized beams, as well as results of analyses of hadronic and leptonic decays of ground state neutral mesons. We will emphasize evidences for the existence of the dibaryon state in the proton-neutron system.

Presenter: MOSKAL, Pawel (Jagiellonian University)

Session Classification: Plenary

Contribution ID: **38** Type: **not specified**

Formation of possible eta'(958)-nucleus bound states and eta'N interaction

Friday 29 July 2016 09:55 (40 minutes)

In this talk, we shed light upon the mass of the eta' in nuclear matter in the context of partial restoration of chiral symmetry, pointing out that the U_A(1) anomaly effects causes the mass difference of eta'-eta necessarily through the chiral symmetry breaking. As a consequence, the mass of the eta' is expected to be reduced by order of 100 MeV in nuclear matter. We propose several reactions for the formation of the eta'-meson bound states and discuss the experimental feasibilities.

Presenter: NAGAHIRO, Hideko (Nara Women's University)

Session Classification: Plenary

Contribution ID: **39** Type: **not specified**

XYZ States at BESIII

Tuesday 26 July 2016 16:50 (30 minutes)

Presenter: WANG, Bin (IHEP)

Session Classification: Mesons

Contribution ID: **40** Type: **not specified**

Probing $Y(4260)$ as the $D_1\bar{D}+c.c.$ hadronic molecule state in e^+e^- annihilations

Tuesday 26 July 2016 17:20 (30 minutes)

During the past decade, a large number of the so-called X, Y, Z states have been observed in the heavy flavor sector, as have become candidates for exotic hadrons which may contain more complicated quark-gluon structures than the conventional quark model picture. Among all those exotic candidates, the $Y(4260)$ is undoubtedly one of the most mysterious states and has initiated a lot of experimental and theoretical studies since its observation by BaBar Collaboration in the $J/\psi\pi\pi$ channel in 2005. I will discuss our recent works in probing $Y(4260)$ as the $D_1\bar{D}+c.c.$ hadronic molecule state using the non-relativistic effective field theory. This study shows that the $Y(4260)$ contains predominantly a $\bar{D}D_1+c.c.$ molecular component and its decays into the $\bar{D}D^*\pi+c.c.$ channel should have a nontrivial lineshape. It also provides a natural explanation for the production of $Y(4260)$ in e^+e^- annihilations in the same framework and allows us to predict the $Y(4260)$ leptonic decay width of which the upper limit is about 500 eV.

Presenter: XUE, Si-Run (Institute of High Energy Physics, Chinese Academy of Sciences)

Session Classification: Mesons

Contribution ID: **41** Type: **not specified**

Heavy-quark spin symmetry partners of the X(3872) molecule.

Tuesday 26 July 2016 17:50 (30 minutes)

Heavy quark spin symmetry (HQSS) partners of the X(3872) 1++ molecule are discussed in a coupled-channel approach with non-perturbative pions. In the strict heavy-quark limit the 1++ molecular state has three degenerate partner states with the 1+-, 0++ and 2++ quantum numbers. In the presence of pions this result is shown to be correct only if all allowed coupled-channel transitions between the DD, DD*and D*D* channels governed by the one-pion exchange potential are included. On the contrary, neglecting some of the coupled-channel transitions leads to a severe violation of HQSS and yields regulator-dependent results for the partner states. Deviations from the heavy-quark limit predictions are investigated for the 2++ partner state of the X(3872).

Presenter: BARU, Vadim (Ruhr University Bochum)

Session Classification: Mesons

Contribution ID: **42** Type: **not specified**

Z_c(3900): theory, experiment, lattice

Tuesday 26 July 2016 18:20 (30 minutes)

In this talk we report on two recent works about the Zc(3900) resonance. A coupled channel T-matrix is used in the description of the D*D and J/\psi\pi spectra in which the Zc(3900) peak has been seen. The data can be well reproduced in two different scenarios, in which the Zc(3900) is a resonance or a virtual state. We also put this coupled channel T-matrix in a finite box, with the aim of comparing with recent lattice QCD simulations.

Presenter: ALBALADEJO, Miguel (IFIC, Valencia)

Session Classification: Mesons

Contribution ID: **43** Type: **not specified**

Baryon Spectroscopy: Recent Results from ELSA

Friday 29 July 2016 11:00 (40 minutes)

The nucleon excitation scheme has been under intensive investigation with meson photoproduction experiments during the last few years world wide. Currently, a lot of new experimental results are coming out from the CLAS experiment at Jlab, the Crystal Barrel experiment at the ELSA accelerator in Bonn and the Crystal Ball experiment at the MAMI accelerator in Mainz. These experiments focus on the investigation of single and double polarization observables for different meson production reactions using longitudinally and transversely polarized targets, linearly and circularly polarized photon beams as well as the polarization of the recoil protons. The new data sets provide stringent constraints for partial wave analyses of meson photoproduction off the nucleon and will lead to an unique determination of the contributing resonances. The new experimental results will be presented and the impact of the new results to the nucleon excitation spectrum will be discussed.

Presenter: BECK, Reinhard (Bonn)

Session Classification: Plenary

Contribution ID: **44** Type: **not specified**

Meson productions in neutrino-nucleon scattering

Tuesday 26 July 2016 16:50 (35 minutes)

We discuss our dynamical coupled-channels (DCC) model for neutrino-nucleon interaction in the resonance region where single- and double-pion productions are dominant. Our DCC model is based on meson-exchange non-resonant mechanisms, and excitaions of nucleon resonances. By solving a set of coupled-channels scattering equation, we obtain amplitudes for meson productions such as pi N, pi pi N, eta N, K Sigma and K Lambda. The DCC model has been well tested by a large amount of data for meson productions induced by pion, photon and electron. We extend the DCC model to describe the neutrino-induced processes. Developing the axial-current is a crucial part of the extension. We present and discuss results of our calculations for the neutrino-induced meson production cross sections. We also compare our results with available experimental data.

Presenter: NAKAMURA, Satoshi (Osaka University)

Session Classification: Baryons

Contribution ID: **45** Type: **not specified**

Empirical parametrizations of the resonance transition amplitudes based on the Siegert's theorem

Tuesday 26 July 2016 17:25 (30 minutes)

The Siegert's theorem states that in a g*N -> N* transition, where N and N*are respectively the nucleon and a nucleon resonance, the electric amplitude, E (defined by the transverse amplitudes) and the scalar amplitude, S, are related in the pseudo-threshold limit by E ~ w/q*S, where w and q are the photon energy and momentum. The pseudo-threshold limit is the limit where q ->0, when the nucleon and the resonance are both at rest. The explicit form of the electric amplitude E and the coefficients depend on the resonance angular momentum-parity state. Some empirical parametrizations of the g*N -> N* transition amplitudes, violate the Siegert's theorem. We will discuss in particular the results for the g*N -> N(1535), and g* N -> Delta and g* N -> N(1520) transition amplitudes. Empirical parametrizations of the data consistent with the Siegert's theorem will be presented, and compared with alternative parametrizations. The physics associated with the parametrizations at low Q^2 will be discussed. Finally new parametrizations will be proposed for large Q^2, compatible with the existent data and with the behavior expected from perturbative QCD.

Presenter: RAMALHO, Gilberto (International Institute of Physics)

Session Classification: Baryons

Contribution ID: **46** Type: **not specified**

Baryon Spectroscopy with Electromagnetic Probes

Friday 29 July 2016 11:40 (40 minutes)

Knowing the structure of excited baryons is an important gateway to probing non-perturbative QCD. The CLAS system at Jefferson Lab has delivered a wealth of precise photo- and electroproduction information about light-quark baryon structure. Examples from photoproduction of strange baryons that lead to insight about the non-strange N*spectrum will be discussed. Examples from electroproduction of various N* states that lead to insight about their internal structure will be discussed.

Presenter: SCHUMACHER, Reinhard (Carnegie Mellon University)

Session Classification: Plenary

Contribution ID: **47** Type: **not specified**

Modern dynamical coupled-channels calculations for extracting and understanding the nucleon spectrum

Friday 29 July 2016 12:20 (40 minutes)

We present an overview of the recent progress in the spectroscopic study of nucleon resonances within the dynamical coupled-channels analysis of meson-production reactions off the nucleon target, with emphasis on the role of dynamical effects arising from multichannel reaction processes in understanding the mass spectrum, internal structure, and production mechanism of nucleon resonances.

Presenter: KAMANO, Hiroyuki (KEK)

Session Classification: Plenary

Contribution ID: **48** Type: **not specified**

Two-Photon Exchange Effects and $\Delta(1232)$ Deformation

Tuesday 26 July 2016 17:55 (30 minutes)

Presenter: ZHOU, Hai-Qing (Department of Physics,Southeast University)

Session Classification: Baryons

Contribution ID: **49** Type: **not specified**

Few-body approach for structure of light kaonic nuclei

Tuesday 26 July 2016 16:50 (30 minutes)

The structure of the light antikaon-nuclear quasi-bound states is investigated with correlated Gaussian method. We perform full three- to seven-body calculations for the systems which consist of an antikaon (anti-K) and a few nucleons (N) such as anti-KNN, anti-KNNN, anti-KNNNN and anti-KNNNNNN systems without any many-body approximation and investigate how the nuclear structure is changed by injected anti-kaon. Two types of the anti-KN interaction models are considered: and energy-dependent interaction based on chiral SU(3) effective field theory, and an energy-independent phenomenological interaction. These two models have different pole structure of the Lambda(1405) that implies different property in the light kaonic nuclei. We investigate how the difference of the interaction appears in the structure of the light kaonic nuclei. As a remarkable result of this investigation, it is found that the anti-KNNNNNN ground state has the different spin corresponding to the difference between these two models

Presenter: OHNISHI, Shota (Hokkaido University)

Session Classification: Few body Systems

Contribution ID: **50** Type: **not specified**

Model-independent determination of the compositeness of near-threshold quasibound states.

Tuesday 26 July 2016 17:20 (30 minutes)

Understanding of the structure of exotic hadrons is an important topic of the current hadron physics. The existence of many exotic hadrons, especially the XYZ particles, indicates that the internal structure of hadrons can be more complicated than the ordinary hadrons described by qqbar or qqq. For a stable shallow bound state, Weinberg has derived the model-independent relation between the compositeness and the observables. To study the structure of the exotic hadrons, we focus on this model-independent determination of the compositeness. Though the internal structure of the bound state is directly related to the experimental observables, the relation cannot be applied when the state has a finite decay width or the CDD pole lies as near threshold as the pole of the state. To settle these problems, using the nonrelativistic effective field theory, we extend the model-independent weak-binding relation to be applicable for the unstable quasibound state with including the CDD pole contribution. Finally we apply the generalized relation to Lambda(1405) and scalar mesons, and discuss their internal structures from the experimental observables.

Presenter: KAMIYA, Yuki (Yukawa Institute for Theoretical Physics, Kyoto University)

Session Classification: Few body Systems

Contribution ID: **51** Type: **not specified**

Opportunities for Electroweak & Beyond The Standard Model Physics with the US Electron Ion Collider

Friday 29 July 2016 14:15 (35 minutes)

The Electron Ion Collider was recently accepted by the US Nuclear Science community as their high priority new facility to be built after the completion of FRIB (currently being built at the Michigan State University). The principle physics program of the EIC is aimed at understanding the role of gluons in QCD: structure and dynamics of partons in nucleons and nuclei. This program can be achieved in the center mass energy range of the machine between 40-140 GeV (10-20 times larger than the previous fixed target polarized beam experiments) and with luminosities reaching a few times 10^{33} cm^{-2} sec^{-1} (~100 times that of HERA) . However if all the accelerator physics advances planned in the technical design of this machine are realized, then the luminosity in the excess of 10^{34} cm^{-2}sec^{-1} will be possible. I will review the Electroweak and Beyond the Standard Model physics programs that might become possible at the future EIC. I will review preliminary experimental conditions and accelerator designs, and present opportunities for future collaboration on this topic.

Presenter: DESHPANDE, Abhay (Stony Brook University)

Session Classification: Fundamental Symmetries

Contribution ID: **52** Type: **not specified**

Three-nucleon reactions with chiral forces

Tuesday 26 July 2016 17:50 (30 minutes)

Comparison of theoretical predictions based on a nucleon-nucleon potential with data for elastic nucleon-deuteron scattering and nucleon induced deuteron breakup reveals the importance of the three-nucleon force (3NF). Inclusion of semi-phenomenological 3NF models into calculations in many cases improves the data description. However, some serious discrepancies remain even when 3NF is included. At energies above ~100 MeV current 3NF's only partially improve the description of data for cross section and spin observables in elastic Nd scattering and breakup. The complex angular and energy behavior of analyzing powers, spin correlation and spin transfer coefficients fails to be explained by standard nucleon-nucleon interactions alone or combined with current models of 3NF's. One of the reasons for the above disagreements could be a lack of consistency between 2N and 3N phenomenological potentials used or/and omission of important terms in the applied 3NF. The Chiral Effective Field Theory approach provides consistent two- and three-nucleon forces. First results obtained with chiral forces up to N3LO order of chiral expansion for elastic Nd scattering and breakup will be presented together with examples of gamma reactions with 3N bound states.

Presenter: WITALA, Henryk (Jagiellonian University)

Session Classification: Few body Systems

Contribution ID: **53** Type: **not specified**

Charm Physics at BESIII

Friday 29 July 2016 14:50 (30 minutes)

The BESIII Experiment at the Beijing Electron Positron Collider (BEPCII) accumulated the world's largest e+e- collision samples at 3.773 and 4.009 GeV. In this talk, we will report the recent results on charm decays, including semi-leptonic decays, determination of CKM elements |Vcs(d)|, Dalitz plot decays of Ksπ+π0， KsK+K-.

Presenter: FANG, Yi (Institute of High Energy Physics)

Session Classification: Fundamental Symmetries

Contribution ID: **54** Type: **not specified**

Search for tetraneutron by pion double charge exchange reaction at J-PARC

Tuesday 26 July 2016 18:20 (30 minutes)

Very recently, four candidates of the tetraneutron state were observed in the 4He(8He,8Be) reaction at RIBF [1]. While the experiment will be continued aiming at higher statistics, the confirmation of such an exotic state with a different reaction is important. We propose a pion DCX (double charge exchange) reaction to populate a tetraneutron state via the 4He(pi-,pi+) reaction. In order to overcome a very low formation cross section, a high-intensity pion beam at the HIHR beamline, planned to be constructed in J-PARC, will be utilized. In this contribution, we will discuss the experimental concept. [1] K. Kisamori et al. Phys. Rev. Lett. 116, 052501 (2016).

Presenter: FUJIOKA, Hiroyuki (Kyoto University)

Session Classification: Few body Systems

Contribution ID: **55** Type: **not specified**

Anomalies in electroweak penguins at LHCb

Friday 29 July 2016 15:20 (30 minutes)

Rare electroweak penguin processes provide a rich platform to search for new physics. Some deviations have recently been found between the rate and angular distribution of these processes measured by the LHCb experiment and theoretical predictions. In addition, LHCb has seen hints of lepton universality breaking in these rare processes. This talk will review these measurements and put them in the context of search for new physics.

Presenter: CHRZASZCZ, Marcin (University of Zurich/ Institute of Nuclear Physics in Krakow)

Session Classification: Fundamental Symmetries

Contribution ID: **56** Type: **not specified**

Test Fundamental Symmetries via Precision Measurements of pi0, eta and eta'Decays

Friday 29 July 2016 15:50 (30 minutes)

Light neutral meson decays provide a unique laboratory to probe fundamental QCD symmetries. A comprehensive Primakoff experimental program at Jefferson Laboratory (JLab) is aimed at gathering high precision measurements on the two-photon decay widths and the transition form factors at low four-momentum transfer squares of pi0, eta and eta'via the Primakoff effect. Completed experiments on the pi0 radiative decay width at JLab 6 GeV, and planned measurements of eta and eta'at JLab 12 GeV will provide sensitive probes to test the chiral anomaly and to study the origin and dynamics of chiral symmetry breaking in the confinement QCD. A preliminary result of the pi0 radiative decay width and the status of planned eta and eta'measurements will be presented.

Presenter: GAN, Liping (University of North Carolina Wilmington)

Session Classification: Fundamental Symmetries

Contribution ID: **57** Type: **not specified**

Hadron Physics at KLOE and KLOE-2

Friday 29 July 2016 14:15 (35 minutes)

The KLOE experiment has collected 2.5 fb-1 at the peak of the phi resonance at the e+e- collider DAPHNE in Frascati. A new beam crossing scheme, allowing for a reduced beam size and increased luminosity, is currently operating at DAPHNE. The upgraded detector, named KLOE-2, has already collected 2.0 fb-1 in these new operating conditions, aiming to reach at least 5 fb-1 in the next two years. The physics program is mainly focused on the study of low energy hadron decays as well as on neutral kaon interferometry, test of discrete symmetries, and search for physics beyond the Standard Model. The analysis of KLOE data is still in progress. The large data sample of light meson available provides precision mesurements on decay dynamics, transition from factors and searches of new physics. Recent results on V->Pgamma*Dalitz decays and eta->pi+pi-pi0 dynamics will be presented. The analysis of the phi->eta e+e- channel provides the most precise measurement of the transition form factor (TFF), while for the phi->pi0 e+e- decay the TFF has been measured for the first time. The Dalitz plot density of the eta->3pi decay is sensitive to all cubic terms of the polynomial expansion in the normalized dimensionless variables X and Y, providing an improvement of a factor two on the statistical uncertainty of all parameters with respect to earlier experiments and smaller systematic uncertainties. Perspectives on hadron phisics with KLOE-2 data will be also presented. In particular, the new four stations installed to tag electrons and positrons from the reaction e+e- -> e+e-gamma*gamma -> e+e-X, will give the opportunity to investigate gamma-gamma physics at the phi resonance. Single pseudoscalar production will improve the determination of the two-photon decay widths of these mesons. An accuracy of 1% for the pi0 is reachable with 5 fb-1, matching the current theory precision. With the same amount of data, the measurement of the pi0 -> gamma gamma* TFF in the space-like region with 5-6% accuracy could be reached in a region not yet exploited of the low momentum transfer.

Presenter: BLOISE, Caterina (INFN)

Session Classification: Mesons

Contribution ID: **58** Type: **not specified**

Interference effect between ϕ and Λ(1520) production channels in the γp⟶K+K-p reaction near threshold

Tuesday 26 July 2016 16:50 (30 minutes)

The ϕ-$\Lambda(1520)$ interference effect in the $\gamma p \to K^+K^-p$ reaction has been measured for the first time in the energy range from 1.673 to 2.173 GeV at LEPS/SPring-8. The relative phases between ϕ and $\Lambda(1520)$ production amplitudes were obtained in the kinematic region where the two resonances overlap. The measurement results support strong constructive interference when K^+K^- pairs are observed at forward angles, but destructive interference for proton emission at forward angles. Furthermore, the observed interference effect does not account for the $\sqrt{s} = 2.1$ GeV bump structure in forward differential cross sections for ϕ photoproduction. This fact suggests possible exotic structures such a hidden-strangeness pentaquark state, a new Pomeron exchange and rescattering processes via other hyperon states.

Presenter: RYU, Sun Young (Research Center for Nuclear Physics, Osaka University)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **59** Type: **not specified**

Unitary dispersive approach for the three pion light meson decays

Friday 29 July 2016 14:50 (30 minutes)

I will focus my talk on our recent studies of three-body final state interactions [*]. We considered the decays eta/ω/$\varphi \longrightarrow 3\pi$ in the dispersive frameworks that are based on the main constraints of the S-matrix theory, namely unitarity, analyticity, and crossing symmetry. Our results indicated that the final state interactions may be sizable. In my talk, the Dalitz plot distributions and integrated decay widths will be presented as well the comparison with the recent WASA-at-COSY and KLOE data. As a further application of the formalism, I will also discuss the electromagnetic transition form factors of ω/$\varphi \longrightarrow \pi 0\gamma*$ and extraction of the Q-value for eta $\longrightarrow 3\pi$. []* Phys.Rev. D92 (2015) no.5, 054016 , Phys.Rev. D91 (2015) no.9, 094029 , Eur.Phys.J. A51 (2015) no.10, 135

Presenter: DANILKIN, Igor (Johannes Gutenberg-Universitaet Mainz)

Session Classification: Mesons

Contribution ID: **60** Type: **not specified**

Status and prospects of LEPS2 solenoid spectrometer

Tuesday 26 July 2016 17:20 (30 minutes)

A high intensity GeV gamma beam line, LEPS2, was constructed at SPring-8 in Japan in 2013. The LEPS2 beam line provides a highly polarized photon beam up to 3 GeV with one order higher intensity than that of LEPS1 facility. We are constructing a 4π solenoidal spectrometer which can detect both of charged particles and photons. The LEPS2 solenoid spectrometer consists of a time projection chamber, silicon strip detectors, drift chambers, resistive plate chambers, Cherenkov counters, and electro-magnetic calorimeters. In this talk, the physics programs and status of development of LEPS2 spectrometer are reported.

Presenter: NIIYAMA, Masayuki (Kyoto Univ.)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **61** Type: **not specified**

Study of vector and tensor meson decay constants in light-front quark model

Friday 29 July 2016 15:20 (30 minutes)

We study the decay constants (f_M) of the Charmful and beautifu vector and tensor mesons in the light front quark model. Here, we tried two different distribution amplitudes to study the decay constants. With the known pseudoscalar meson decay constants of f_D, f_{D_s}, f_B and f_{B_s} as the input parameters to determine the light-front wave functions, we obtain that $f_{D^*,D_s^*,B^*,B_s^*} = (252.0^{+13.8}_{-11.6}, 318.3^{+15.3}_{-12.6}, 201.9^{+43.2}_{-41.4}, 244.2 \pm 7.0)$ and $f_{D_2^*,D_{s2}^*,B_2^*,B_{s2}^*} = (143.6^{+24.9}_{-21.8}, 209.5^{+29.1}_{-24.2}, 80.9^{+33.8}_{-27.7}, 109.7^{+15.7}_{-15.0})$.

Presenter: LIH, Chong-Chung (szmc)

Session Classification: Mesons

Contribution ID: **62** Type: **not specified**

On the near-threshold incoherent ϕ photoproduction on the deuteron: any trace of a resonance?

Tuesday 26 July 2016 17:50 (30 minutes)

We study the near-threshold incoherent ϕ photoproduction on the deuteron based on a model of $\gamma N \to \phi N$, consisting of Pomeron, (π, η) exchanges, and a $J^P = 3/2^-$ resonance, which describes the low energy \gamma p \to \phi p$LEPSdatawell, includingthepeakintheforwarddifferentialcrosssection.T$ N \to \phi N$amplituderetainedthroughoutthecalculation.TheFermimotionandfinal-stateinteractions(FSI)areal$ $nucleoninteraction.Thecouplingsoftheresonancetoγnandϕnchannelsareestimatedwiththehelpofaconst$ $scatteringresultsandthedata.Theoff-shellrescatteringisfoundtobeimportantasitcancelsoutalargeportionofthe$ $shellcontribution.Thediscrepanciesatlowmomentumtransferregionmightberelatedtothebinningsizeofthedata.N$ p \to \phi p$ data from CLAS.

Presenter: KISWANDHI, Alvin (Department of Physics, STKIP Surya)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **63** Type: **not specified**

Extraction of the $\pi^+\pi^-$ subsystem in Diffractively Produced $\pi^-\pi^+\pi^-$ at COMPASS

Friday 29 July 2016 15:50 (30 minutes)

The COMPASS experiment at CERN has collected a very large data set of 50 million diffractively produced $\pi^-\pi^+\pi^-$ events using a 190 GeV/c negatively charged hadron beam. The partial-wave analysis (PWA) of these high-precision data reveals previously unseen details. The PWA, which is currently limited by systematic uncertainties, is based on the isobar model, in which multi-particle decays are described as a chain of subsequent two-body decays. In this approach, fixed amplitudes for the intermediate two-pion resonances have to be assumed. These isobar amplitudes are usually parametrized e.g. by Breit-Wigner amplitudes, which enter as prior knowledge, thus increasing systematic uncertainties. We present a novel method, which allows to extract isobar amplitudes directly from the data in a more model-independent way. The focus lies especially on the scalar $\pi^+\pi^-$ subsystem, where in a previous analysis a signal in the $\pi^-\pi^+\pi^-$ sample for a new axial-vector state $a_1(1420)$ in the $f_0(980)\pi$ decay mode was found.

Presenter: KRINNER, Fabian (Technische Universität München Physik Department E18)

Session Classification: Mesons

Contribution ID: **64** Type: **not specified**

Recent results on charmed baryons at Belle

Friday 29 July 2016 14:15 (35 minutes)

The Charmed baryon is a unique system, considered as a bound state of a charm quark and a light di-quark due to the suppression of the color spin interaction of the heavy charm quark. Belle experiment has led the charmed baryon spectroscopy with the world highest integrated luminosity e^+e^- collision data provided by KEKB accelerator. In this talk, we present the latest results on charmed baryons from Belle including absolute branching fraction of $\Lambda_c \to pK^-\pi^+$, first observation of doubly Cabbibo suppressed decay of Λ_c^+, precise measurement of the mass and width of excited Ξ_c baryons, and those decays into ΛD final states.

Presenter: KATO, Yuji (KMI, Nagoya University)

Session Classification: Baryons

Contribution ID: **65** Type: **not specified**

Exotic-hadron signature by constituent-counting rule in perturbative QCD

Tuesday 26 July 2016 14:15 (35 minutes)

There have been reports on exotic-hadron candidates, especially tetraquark and pentaquark hadrons, in the last several years. However, it is not easy to determine whether they are in fact exotics by low-energy experiments on global properties such as masses, decay widths, spins, and parities. It could be appropriate to determine their internal configurations by high-energy reactions because quark and gluon degrees of freedom become apparent. There is a constituent-counting rule suggested in perturbative QCD for hard exclusive reactions to count the number of elementary constituents. The rule could be used for finding the number of constituents in exotic hadrons. It is expected that the number is four and five for tetraquark and pentaquark hadrons, respectively. We proposed this idea in 2013 and have been investigating future possibilities, for example, Lambda(1405) production at the high-momentum beamline of J-PARC [1]. We also analyzed available data on hard hyperon productions including Lambda(1405) in hadron and charged-lepton reactions [1]. We found that the ground Lambda production is consistent with the three-quark nature. However, it is difficult to determine the number of constituents for Lambda(1405) because the current data are not accurate enough and they are within a limited energy range. Nevertheless, we reported an interesting tendency that Lambda(1405) looks like pentaquark at low energies but it seems be a three-quark baryon at high energies. The energy dependence could be important for probing the internal configuration, especially if it is a mixture of three-quark and five-quark states. Future JLab and J-PARC experiments could clarify this issue of internal configurations for Lambda(1405) by the constituent counting rule. Reference: [1] W.-C. Chang, S. Kumano, T. Sekihara, Phys.Rev. D93 (2016) 034006; H. Kawamura, S. Kumano, T. Sekihara, Phys. Rev. D88 (2013) 034010; H. Kawamura, S. Kumano, Phys. Rev. D89 (2014) 054007.

Presenter: KUMANO, Shunzo (KEK)

Session Classification: Nucleon Structure

Contribution ID: **66** Type: **not specified**

Λc decays at BESIII

Friday 29 July 2016 14:50 (30 minutes)

The BESIII detector accumulated 567 pb-1 data at the center-of-mass energy of 4.599 GeV, which is the world's largest e+e- collision sample at the Lambda_c pair threshold. By analyzing this data sample, we report the determinations of the absolute branching fractions of the Λc semi-leptonic decay and 12 hadrnoic decays.The precisions of these absolute branching fractions for these decays are improved significantly.

Presenter: SONG, Weimin (IHEP)

Session Classification: Baryons

Contribution ID: **67** Type: **not specified**

New Deeply Virtual Compton Scattering results from Jefferson Lab

Tuesday 26 July 2016 14:50 (30 minutes)

The understanding of Quantum Chromodynamics (QCD) at large distances still remains one of the main outstanding problems of nuclear physics. Investigating the internal structure of hadrons provides a way to probe QCD in the non-perturbative domain and can help us unravel the spatial extensions of nature's building blocks. Deeply Virtual Compton Scattering (DVCS) is the easiest reaction that accesses the Generalized Parton Distributions (GPDs) of the nucleon. GPDs offer the exciting possibility of mapping the 3-D internal structure of protons and neutrons by providing a transverse image of the constituents as a function of their longitudinal momentum. A vigorous experimental program is currently pursued at Jefferson Lab (JLab) to study GPDs through DVCS. New results from Hall A and Hall B recently published will be shown and discussed. Special attention will be devoted to the applicability of the GPD formalism at the moderate values of momentum transfer (Q2) available at JLab. We will conclude with a brief overview of additional DVCS experiments under analysis and planned with the future Upgrade of JLab to 12 GeV, which will allow the full exploration of the valence-quark structure of nucleons and nuclei and promises the extraction of full "tomographic" images.

Presenter: MUNOZ CAMACHO, Carlos (IPN-Orsay, CNRS/IN2P3)

Session Classification: Nucleon Structure

Contribution ID: **68** Type: **not specified**

Experimental investigation for diquark degrees of freedom in a charmed baryon at J-PARC

Friday 29 July 2016 15:20 (30 minutes)

The concept of diquark degrees of freedom is expected to be essential to describe hadrons in the excited states as well as in the ground states. Since the spin-dependent interaction between quarks is inversely proportional to the masses of the quarks, the extraction of a light-qq correlation from baryons with one heavy quark is easier than from those with only light flavors. J-PARC E50 experiment is designed to study a light diquark in a charmed baryon. The experiment will be carried out at J-PARC high momentum beam line using 20 GeV/c pion beam. Charmed baryons are identified by means of the missing mass of the $p(pi^-, D^{*-})$ reaction. The properties of the light diquark are derived from the systematic measurement of the level structure, production rates and decay branching ratio of charmed baryons. R&D of detectors and a read out system for a high event rate environment, where various reaction channels including both charm and strange sectors can be studied, is in progress. In this contribution, an overview of the physics program and the experimental setup of J-PARC E50 will be presented.

Presenter: TAKAHASHI, Tomonori (RCNP, Osaka University)

Session Classification: Baryons

Contribution ID: **69** Type: **not specified**

Precision spectroscopy of deeply bound pionic states in 121, 116Sn

Friday 29 July 2016 14:15 (30 minutes)

We report our recent experiment of the pionic 121, 116Sn atom using missing-mass spectroscopy of the 122, 117Sn(d, 3He) reaction near the charged pion emission threshold. An established approach for quantitative evaluation of the chiral symmetry breaking in finite density is study of pion-nucleus interaction through the experimental measurement of pionic atoms. So far the 1s pionic states in 205Pb and 115, 119, 123Sn have been discovered at GSI. The deduced chiral order parameter was compared with that of the vacuum, which was deduced from the pionic hydrogen and deuterium, and partial chiral restoration was suggested. However, the evaluation still had large systematic and statistical errors. For the further study of the symmetry breaking in medium, we performed precision spectroscopy of deeply bound pionic states in 121, 116Sn at RIKEN, RI Beam Factory in June 2014. The current status of the analysis will be reported.

Presenter: NISHI, Takahiro (RIKEN Nishina center)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **70** Type: **not specified**

Estimate on spin asymmetry for Drell-Yan process at Fermilab with tensor-polarized deuteron

Tuesday 26 July 2016 15:20 (30 minutes)

The polarized deuteron has new structure functions in charged-lepton deep inelastic scattering due to its spin-one nature, and they are b1, b2, b3, and b4. The twist-two structure functions b1 and b2 are expressed by tensor-polarized parton distribution functions in the deuteron [1]. There is an approved experiment at JLab to measure them and it is expected to start in 2019. On the other hand, the Drell-Yan process for unpolarized proton - tensor-polarized deuteron is possible and its measurement is now under consideration at Fermilab. It is expected to provide crucial information on tensor-polarized antiquark distributions. Since the distributions are small quantities, it is important to estimate the tensor-polarized spin asymmetry theoretically to find feasibility of the experiment for an actual proposal at Fermilab. In this talk, I show our estimate on the spin asymmetry for the proton-deuteron Drell-Yan process with tensor-polarized deuteron [2]. References: [1] P. Hoodbhoy, R. L. Jaffe, and A. Manohar, Nucl. Phys. B 312, (1989) 571; S. Kumano, J. Phys. Conf. Ser. 543 (2014) 012001. [2] S. Kumano and Qin-Tao Song, research in progress.

Presenter: SONG, Qin-Tao (High Energy Accelerator Research Organization(KEK), Sokendai)

Session Classification: Nucleon Structure

Contribution ID: **71** Type: **not specified**

Spectroscopy of pionic atoms via (p, 2He) reaction

Friday 29 July 2016 14:45 (30 minutes)

Spectroscopy of pionic atoms enables us to investigate partial restoration of chiral symmetry at finite density.It is theoretically known that the isovector potential parameter of parameter of the pion-nucleus interaction is related to the chiral condensate.Past experiments with the (d,3He) reaction at GSI showed an evidence of partial restoration of chiral symmetry. For the further study of pionic atoms, we are planning to perform a spectroscopy of pionic atoms via the (p, 2He) reaction at RCNP. In the experiment, a proton beam of 392 MeV impinges on a target and two protons are analyzed by the Grand Raiden spectrometer.Thanks to the high-resolution spectrometer and good beam properties, we will have a chance to achieve the highest resolution of 200 keV (FWHM). In this contribution, the overview of the experiment and preliminary results of feasibility studies will be discussed.

Presenter: WATANABE, Yuni (University of Tokyo)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **72** Type: **not specified**

Formation of deeply bound pionic atoms and pion properties in nuclei

Friday 29 July 2016 15:15 (30 minutes)

We study theoretically the formation of deeply bound pionic atoms to deduce precisely the pion properties in nuclei from the observables. It is important to know the pion properties in nuclei since they are believed to provide valuable information on the aspects of the symmetry of strong interaction at finite density. In this presentation, we show the theoretical formation spectra of deeply bound pionic atoms in the various cases. We consider the pionic atom formation on the even-even and neutron-odd nucleus targets. We also show the angular dependence of the formation spectra in the (d,3He) reactions. Based on these theoretical results, we have found that we can perform the systematic observation of several deeply bound states for various nuclei. Actually, these observations have been performed in the experiments at RIBF/RIKEN.

Presenter: IKENO, Natsumi (Tottori University)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **73** Type: **not specified**

Consistency check of charged hadron multiplicities and fragmentation functions in SIDIS

Tuesday 26 July 2016 15:50 (30 minutes)

We derived the conditions on certain combinations of integrals of the fragmentation functions of pion using HERMES data for the sum of the charged pion multiplicities from semi-inclusive deep-inelastic scattering (SIDIS) off the deuteron target. In our derivation the nucleon parton distribution functions (PDFs) are assumed to be isospin SU(2) symmetric. Similar conditions have also been obtained for the fragmentation functions (FFs) of kaon by the sum of charged kaon multiplicities as well. We have chosen several FFs to study the impact of those conditions we have derived.Among those FFs, we find that the fragmentation functions produced by the nonlocal chiral-quark model (NLχQM) constantly satisfy the conditions. Furthermore, the ratios of the strange PDFs $S(x, Q^2)$ and the non-strange PDFs $Q(x, Q^2)$ extracted from the charged pion and kaon multiplicities differ from each other significantly. Finally, we demonstrate that the HERMES pion multiplicity data are unlikely to be compatible with two widely-used PDFs, namely CTEQ6L and leading order NNPDF3.0.

Presenter: KAO, Chung-Wen (Chung-Yuan Christian University)

Session Classification: Nucleon Structure

Contribution ID: **74** Type: **not specified**

Study of the d(γ, K+)ΣπN reaction at LEPS

Friday 29 July 2016 16:50 (30 minutes)

The production mechanism of a \Sigma \pi pair from a deuteron target gives us an essential information on the interaction between \Lambda(1405) and nucleon. J-PARC E27 group studied the d(\pi+, K+)X reaction, and reported a large mass shift in the hyperon resonance region. Checking the spectrum using the other reaction is helpful to reveal the source of the large shift. We measured the d(gamma, K+)\Sigma \pi reaction using the \gamma beam with the energy of 1.5 − 2.4 GeV at LEPS, and investigated the shape of the invariant mass spectrum of \Sigma \pi. We applied a Fermi motion correction technique, and compared the spectrum of \Sigma \pi from a deuterium target with the one of a hydrogen target data. Our results can be interpreted with the quasi-free reactions, and the large mass shift in the hyperon resonance region which was seen in d(\pi+, K+)X reaction was not observed. The quantitative evaluation against to the large mass shift was performed using a statistical method. The details of the analysis and the results are reported in this contribution.

Presenter: TOKIYASU, Atsushi (Tohoku Univeristy)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **75** Type: **not specified**

Spectroscopic experiment of Λ(1405) via in-flight d(K-n) reaction at J-PARC K1.8BR

Friday 29 July 2016 17:20 (30 minutes)

Λ(1405) is the lightest among negative parity baryon excitation states, which is hardly explained by a simple quark model. Since the Λ(1405) is located just below the KbarN threshold, there is a longstanding argument if it is a KbarN bound state. A chiral unitary model claims that the Λ(1405) consists of two states (KbarN state and Σπ state). According to the model, a pole position of the KbarN state is located at 1426-16i MeV, which is closer to the KbarN threshold. Experimental study of KbarN coupled to the Λ(1405) is desired. We investigate Λ(1405) spectrum shape directly generated in KbarN⟶Σπ by d(K-,n) reaction, where forward scattered neutron is measured. The (K-,n) reaction populates the isospin state of not 0 but also 1. We identify the three decay mode of the Λ(1405), Σ-π+, Σ+π-, and Σ0π0 so that isospin amplitude of I=0, 1 and their interference term in the spectrum are decomposed. In this contribution, we will present the preliminary result of the E31 first physics run to observe separated Σ±π∓ and Σ0π0 spectrum, which is scheduled in this coming June.

Presenter: KAWASAKI, Shingo (RCNP)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **76** Type: **not specified**

The $\Lambda_b \to J/\psi K^0 \Lambda$ and Λ_b into $J/\psi \eta \Lambda$reactions and a hidden-charm pentaquark state with strangeness

Tuesday 26 July 2016 14:15 (30 minutes)

We study the Λ_b ⟶ J/ψ K0 Λ reaction considering both the K0 Λ interaction with its coupled channels and the J/ψΛ interaction. The latter is described by taking into account the fact that there are predictions for a hidden-charm state with strangeness that couples to J/ψΛ. By using the coupling of the resonance to J/ψΛ from these predictions we show that a neat peak can be observed in the J/ψΛ invariant mass distribution, rather stable under changes of unknown magnitudes. In some cases, one finds a dip structure associated to that state, but a signal of the state shows up in the J/ψ spectrum. The same is done by studying the related Λ_b ⟶ J/ψηΛ rreaction, by combining the ηΛ and J/ψ Λ interactions.

Presenter: OSET, Eulogio (IFIC, Univversity of Valencia)

Session Classification: Pentaquarks

Contribution ID: **77** Type: **not specified**

Construction and application of the KbarN local potential based on chiral unitary approach

Friday 29 July 2016 17:50 (30 minutes)

Aiming at quantitative studies of Kbar nuclei, we construct the reliable KbarN local potential. Based on the chiral coupled-channel approach, the chiral unitary approach, we establish a new construction method which respects the behavior of the scattering amplitude in the complex energy plane. This method is employed to the recent experimental data of the energy shift of the kaonic hydrogen by SIDDHARTA. The high precision measurement reduces the uncertainty of the KbarN scattering amplitude below the KbarN threshold, and enables the quantitative discussion about the systems with Kbar and nucleons. As the first application of the new local potential, we calculate the spacial structure of the Lambda(1405), and the K^-p correlation function in the relativistic heavy ion collisions.

Presenter: MIYAHARA, Kenta (Kyoto university)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **78** Type: **not specified**

Exotic pentaquark spectroscopy

Tuesday 26 July 2016 14:45 (30 minutes)

We study the possibility that at least one of the two pentaquark structures recently reported by LHCb, can be described as a compact pentaquark state, and we give predictions for new channels that can be studied by the experimentalist if this hypothesis was correct. We use very general arguments dictated by symmetry considerations, in order to describe pentaquark states within a symmetry approach. A complete classification of all possible states and quantum numbers, that can be useful both to the experimentalists, for new finding, or to theoretical model builders are given, without the introduction if any particular dynamical model. Some prediction are finally given using a simple mass formula. We reproduce the mass and the quantum numbers of the lightest pentaquark state reported by LHCb (JP = 3/) state, with a parameters free mass formula fixed on known well established baryons. We predicted the other pentaquark resonances (giving their masses, and suggesting possible decay channels) which belong to the same multiplet of the discovered one, as in Santopinto, Giachino (INFN, Genoa). hep-ph:1604.03769 In the second part of the talk will be reviewed some intresting results on Heavy quarkonium hybrids, Phys.Rev. D78 (2008) 056003) with the identification of the Y(4260) as an hybrid state. Finally some results for the baryon spectroscopy and structure within an Interacting quark diquark model for baryons (Santopinto,Phys.Rev. C72 (2005) 022201) will be discussed.

Presenter: SANTOPINTO, Elena (INFN)

Session Classification: Pentaquarks

Contribution ID: **79** Type: **not specified**

¥$barKN$ interaction in the Skyrme model

Friday 29 July 2016 18:20 (30 minutes)

We study the ¥$barKN$ system in the Skyrme model in a method based on the bound state approach of Callan-Klebanov but with the kaon around the physical nucleon of the rotating hedgehog. This corresponds to the variation after projection which is opposite to the variation before projection. The new method is considered to be more suited to the study of the weakly interacting ¥$barKN$ system forming a loosely bound state corresponding to ¥$Lambda(1405)$. We have found a bound state with binding energy of order ten MeV, consistent with the observed state. We also discuss the ¥$barKN$ interaction which consists of an attraction in the middle range and of a repulsion in the short range.

Presenter: EZOE, Takashi (RCNP, Osaka university)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **80** Type: **not specified**

Photoproduction of η and η' mesons on proton and neutron

Friday 29 July 2016 16:50 (30 minutes)

New high-precision total and differential cross sections for η and η' photoproduction on the proton obtained by the A2 Collaboration at the Mainz Microtron are presented. The total cross section for η photoproduction demonstrates a cusp at the energy W$\sim$1.9~GeV. Furthermore, we present a new version of the ηMAID model for η and η' photoproduction. The model includes 23 nucleon resonances parameterized with Breit-Wigner shapes. The background is described by vector and axial-vector meson exchanges in the t channel using the Regge phenomenology. Parameters of the resonances were obtained from a fit to the new experimental data of the A2 Collaboration and available data from CBELSA/TAPS, CLAS, and GRAAL Collaborations for η and η' photoproduction on protons and neutrons. Dominant role of $1/2^-$ resonances is discussed. The cusp is explained as a threshold effect due to the opening $\eta' p$ decay channel of the $N(1895)1/2^-$ resonance.

Presenter: KASHEVAROV, Victor (Institut für Kernphysik, Universität Mainz)

Session Classification: Mesons

Contribution ID: **81** Type: **not specified**

ccbar pentaquarks by a quark model

Tuesday 26 July 2016 15:15 (30 minutes)

Recent LHCb experiments show us that there are two resonances in the N-J/Psi channel, whose spin and parity are most probably (3/2- 5/2+). In this work, we will show that there is a state which gains a large attraction from the color-magnetic interaction in the uudccbar I(JP)=1/2(3/2-) channel, which appears as a resonance in the Lambda_c Dbar* channel, when one employs a quark model. We also found that there is an equally or more attractive state in the channel with strangeness, udsccbar, I(JP)=0(1/2-). We would like to discuss the possibility to find it as a resonance in the Lambda-J/Psi or Lambda-etac channels.

Presenter: TAKEUCHI, Sachiko (Japan College of Social Work)

Session Classification: Pentaquarks

Contribution ID: **82** Type: **not specified**

Excitation spectra of carbon nuclei near eta' emission threshold

Friday 29 July 2016 17:20 (30 minutes)

We conducted measurement of excitation spectra in 12C(p,d) reactions near the eta' emission threshold. We employed a 2.5 GeV proton beam accelerated by the synchrotron SIS-18 of GSI impinging on a carbon target. The emitted deuterons at 0 degree were momentum-analyzed by the fragment separator FRS used as a high-resolution spectrometer. We achieved an extremely good statistical sensitivity with a sufficiently good energy resolution. We give a presentation on the analysis status and the preliminary results of the experiment.

Presenter: ITAHASHI, Kenta (RIKEN)

Session Classification: Mesons

Contribution ID: **83** Type: **not specified**

ηn scattering length from the reaction $\gamma d \to p\eta n$ at $E_\gamma \sim 0.9$ GeV

Friday 29 July 2016 17:50 (30 minutes)

A new η photoproduction experiment is planned for the determination of the η-n low-energy scattering parameters at the Research Center for Electron Photon Science (ELPH), Tohoku University. The emitted proton is measured at 0 degrees for the $\gamma d \to petan$ reaction at $E_\gamma \sim 0.9$ GeV, which gives the zero relative momentum between the η meson and the neutron. Two photons from the η-meson are measured using an electromagnetic calorimeter, FOREST. The detection of the η meson is expected to select the condition $\eta n \to \eta n$. Prospects of the planned experiment to determine the ηn scattering length will be discussed.

Presenter: ISHIKAWA, Takatsugu (Research Center for Electron Photon Science, Tohoku University)

Session Classification: Mesons

Contribution ID: **84** Type: **not specified**

Electromagnetic Transition Form Factor of the η Meson with WASA-at-COSY

Friday 29 July 2016 18:20 (30 minutes)

We present a study of the Dalitz decay η ⟶ ɣe + e − . The aim is to determine the transition form factor of the η meson. The transition form factor describes the electromagnetic structure of the meson. The transition form factor is determined by comparing the experimental e + e − invariant mass distribution with QED. The analysis uses proton-proton reaction at 1.4 GeV.The data has been collected with the WASA detector at COSY (Forschungszentrum Juelich, Germany). Preliminary results of the analysis will be shown.

Presenter: GOSWAMI, Ankita (Indian Institute of Technology Indore)

Session Classification: Mesons

Contribution ID: **85** Type: **not specified**

Study of three-body charmonium decays at BABAR

Friday 29 July 2016 16:50 (30 minutes)

We study the reaction e+ e− -> gamma_ISR J/psi, where J/psi -> pi+ pi- pi0, J/psi -> K+ K- pi0, and KS K+ pi- using events obtained from the Initial State Radiation process. We measure the relative J/psi branching fraction and perform a Dalitz plot analysis of both J/psi decay modes using an isobar and a Veneziano model. We present also an analysis of the process gamma gamma -> K anti-K pi. We observe the decays eta_c -> K_S K+- pi-+ and eta_c -> K+ K- pi0 and perform a Dalitz analysis of both eta_c decay modes. We also extract the mass dependent K_pi S-wave amplitude and phase using a model-independent partial wave analysis approach.

Presenter: SOFFER, Abner (Tel Aviv University)

Session Classification: Mesons

Contribution ID: **86** Type: **not specified**

First Measurements of Timelike Form Factors of Lambda, Sigma, Cascade, and Omega Hyperons at Q^2 = 14 GeV^2, and Evidence for Diquark Correlations

Tuesday 26 July 2016 14:15 (35 minutes)

Form factors for timelike momentum transfers, determined by hadron-antihadron formation in e+e- annihilation, provide information about spin correlations between the hadron pair produced, information complementary to that provided by spacelike form factors determined by electron scattering from hadronic targets. Timelike form factors at large momentum transfers have only been so far measured for one baryon, the proton. We have now made the first measurements of timelike form factors of the hyperons, Lambda, Sigma, Cascade, and Omega at the large momentum transfer of Q^2 = 14 GeV^2. The measurements reveal the variation of these form factors as successively one, two, and three of the up and down quarks in the proton are replaced by the strange quark. Among the interesting observations is evidence for Diquark Correlations in Lambda and Sigma zero hyperons anticipated by Wilczek and colleagues.

Presenter: SETH, Kamal (Northwestern University)

Session Classification: Baryons

Contribution ID: **87** Type: **not specified**

Recent results of bottomonium(-like) spectroscopy at Belle

Friday 29 July 2016 17:20 (30 minutes)

Belle experiment at KEKB e^+e^- collider accumulated data at the energy points around ¥$Upsilon(10860)$ and ¥$Upsilon(11020)$ as well as at ¥$Upsilon(nS)$ $(n = 1, 2, 3)$ resonances. These datasets provide an ideal place to perform bottomonium spectroscopy and search for exotic hadron states in bottomonia decays. In this talk, recent Belle results in the spectroscopy of bottomonium(-like) systems are to be presented.

Presenter: KWON, Youngjoon (Yonsei University)

Session Classification: Mesons

Contribution ID: **88** Type: **not specified**

The Bc->J/psi KD weak decay and its relation with the D*s0(2317)

Friday 29 July 2016 17:50 (30 minutes)

We study the presence of the the D*s0(2317) resonance in the weak decay process: Bc->J/psi KD. We assume a weak interaction mechanism in which the b quark decays into a c anti-c (J/psi) and anti-s via a W meson. In this process the c anti-s pair hadronizes and the possible final configurations considered are KD and eta Ds. We compute the interaction of these two meson channels in the chiral unitary approach. Then we consider the D*s0(2317) as mainly a KD molecular state, and we fit the parameters of the theory in order to get a bound state pole in the S-matrix at the experimental mass of the D*s0(2317). We also consider the possibility of an additional q anti-q component in the D*s0(2317), introducing a CDD pole in the potential that describes the interaction. In these possible scenarios we predict the ratio of the invariant mass distribution (Bc->J/psi KD)/(Bc->D*s0(2317)). In all cases the invariant mass distribution peaks very close to the KD threshold suggesting the presence of the D*s0(2317) resonance. Based on "D*s0(2317)+ in the decay of Bc into J/ ψ DK". Phys. Rev. D 93 (2016) no.5, 054028

Presenter: FERNANDEZ-SOLER, PEDRO (IFIC - Instituto de Física Corpuscular (CSIC and University of Valencia))

Session Classification: Mesons

Contribution ID: **89** Type: **not specified**

Neutral pion form factor measurement by the NA62 experiment

Tuesday 26 July 2016 14:50 (30 minutes)

The NA62 experiment at CERN collected a large sample of charged kaon decays with a highly efficient trigger for decays into electrons in 2007. The kaon beam represents a source of tagged neutral pion decays in vacuum. A measurement of the electromagnetic transition form factor slope of the neutral pion in the time-like region from ~1 million fully reconstructed pi0 Dalitz decay is presented.

Presenter: GAMBERINI, Enrico (University of Ferrara)

Session Classification: Baryons

Contribution ID: **90** Type: **not specified**

Open charm contributions to the E1 transitions of ψ(3686) and ψ(3770) → γχ_cJ

Friday 29 July 2016 18:20 (30 minutes)

The E1 transitions of ψ(3686) and ψ(3770) → γχ_cJ are investigated in a non-relativistic effective field theory (NREFT) where the open charm effects are included systematically as the leading corrections. It also allows a self-consistent inclusion of the S-D mixing in the same framework. It shows that the open charm contributions are essential for understanding the significant deviations of the non-relativistic leading order calculations from the experimental data.

Presenter: CAO, Zheng (Institute of High Energy Physics, Chinese Academy of Sciences)

Session Classification: Mesons

Contribution ID: **91** Type: **not specified**

Progress on the baryon spectroscopy at BESIII

Tuesday 26 July 2016 15:20 (30 minutes)

Based on the large samples of J/ψ and ψ(2s) events accumulated at the BESIII detector, the recent results on baryon spectrosocopy will be presented, including the PWA of ψ(2S)−>p pbar pi0, p pbar eta. Also the perspectives on the baryon spectroscopy at BESIII will be discussed.

Presenter: ZHANG, Jingqing (Institute of high energy physics, CAS)

Session Classification: Baryons

Contribution ID: **92** Type: **not specified**

The Proton Radius (PRad) Experiment at Jefferson Lab

Friday 29 July 2016 16:50 (30 minutes)

The proton charge radius (Rp) is one of the most fundamental quantities in physics. Precision knowledge of its value is critically important for both nuclear and atomic physics –especially for the spectroscopy of atomic hydrogen. Recent high precision measurements of Rp using the muonic hydrogen atom demonstrated up to eight standard deviation smaller value than the accepted average from all previous experiments performed with different methods. This fact triggered the well known "proton charge radius puzzle"in hadronic physics. The PRad collaboration at Jefferson Lab for the last four years developed a novel magnetic-spectrometer-free e-p scattering experiment to address this puzzle. This experiment is currently schedule to run in May and June of this year. The specifics of the method, the experimental characteristics of the setup together with the upcoming run status will be presented in this talk.

Presenter: GASPARIAN, Ashot (North Carolina A&T State University)

Session Classification: Nucleon Structure

Contribution ID: **93** Type: **not specified**

Octet Baryon Quark Flavor Distribution Functions

Friday 29 July 2016 17:20 (30 minutes)

Octet Baryon Quark Flavor Distribution Functions We investigate the quark flavor distribution functions of the octet baryons. In particular, the valence and sea quark flavor distribution functions of the scalar density matrix elements of octet baryons have been computed explicitly. The implications of chiral symmetry breaking and SU(3) symmetry breaking have been discussed in detail for the sea quark asymmetries, fraction of a particular quark (antiquark) present in a baryon, flavor structure functions and the Gottfried integral. The meson-baryon sigma terms have also been calculated. The future experiments for octet baryons can provide important constraints to describe the role of non-valence (sea) degrees of freedom.

Presenter: DAHIYA, Harleen (Dr. B.R. Ambedkar National Institute of Technology Jalandhar)

Session Classification: Nucleon Structure

Contribution ID: **94** Type: **not specified**

Measurements of baryon form factors at BESIII

Friday 29 July 2016 17:50 (30 minutes)

The momentum transfer dependence of the electromagnetic form factors is an important probe of the structure of hadrons at different scales. Using data samples collected with the BESIII detector at the BEPCII collider, we study the process of e+e- -> p bar{p} at 12 center-of-mass energies from 2232.4 to 3671.0 MeV. The Born cross section at these energy points are measured as well as the corresponding effective electromagnetic form factors. Furthermore, the ratio of electric to magnetic form factors, |G_{E}|=|G_{M}| and |G_{M}| are measured at the ceter-of-mass energies where the data samples are the largest. We also report preliminary results of e+e- ->lammda bar{lammda}, which is analysed with the same method. Moreover, future prospects of the measurement of baryon electromagnetic form factors from a unique high luminosity data scan by BESIII, will be given.

Presenter: ZHANG, Bingxin (Institute of High Energy Physics)

Session Classification: Nucleon Structure

Contribution ID: **95** Type: **not specified**

New Measurements of Hyperon Production From Charmonium States

Tuesday 26 July 2016 15:50 (30 minutes)

Hyperon production in e+e- annihilation provides a clean laboratory for the production of baryons and strangeness in hadronization, and can provide insight into the structure of different hyperons by comparing their production rates. Using 52 pb-1, 805 pb-1, and 586 pb-1 of e+e- annihilation data taken at the psi(2S), psi(3770), and psi(4160) resonances, respectively, with the CLEO-c detector, we measure for the first time the inclusive decays of these charmonium states to the Lambda0, Sigma+, Sigma0, Cacade-, Cascade0, Omega- hyperons. The implications of these measurements on hadronization at these energies and on the structure of these hyperons will be discussed.

Presenter: DOBBS, Sean (Northwestern University)

Session Classification: Baryons

Contribution ID: **96** Type: **not specified**

Non-dipolar Wilson links for parton densities

Friday 29 July 2016 18:20 (30 minutes)

We propose a new definition of a transverse-momentum-dependent wave function with simpler soft subtraction. The un-subtracted wave function involves two pieces of non-light-like Wilson links oriented in different directions, so that the rapidity singularity appearing in usual k_T factorization is regularized, and the pinched singularity from Wilson-link self-energy corrections is alleviated to a logarithmic one. In particular no soft function is needed, when the two pieces of Wilson links are orthogonal to each other. We show explicitly at one-loop level that the simpler definition with the non-dipolar Wilson links exhibits the same infrared behavior as the one with the dipolar Wilson links. The non-dipolar Wilson links are also introduced to the quasi-parton distribution function (QPDF) with an equal-time correlator in the large momentum limit, which can remove the involved linear divergence, and allow perturbative matching to the standard light-cone parton distribution function. The latter can then be extracted reliably from Euclidean lattice data for the QPDF with the non-dipolar Wilson links.

Presenter: LI, Hsiang-nan (Academia Sinica)

Session Classification: Nucleon Structure

Contribution ID: **97** Type: **not specified**

The phi meson in nuclear matter and the strangeness content of the nucleon

Tuesday 26 July 2016 14:15 (35 minutes)

In this presentation, recent results about the behavior of the phi meson in nuclear matter will be presented [1,2,3]. Furthermore, the relation between the phi meson spectral function and QCD condensates, in particular the strange quark condensate, will be discussed. We find a strong correlation between a possible mass shift of the phi-meson in nuclear matter and the strangeness content of the nucleon, which is proportional to the strange sigma term, sigma_{sN}=m_s*<N|bar[s}s|N>. Depending on the value of sigma_{sN}, the phi-meson could moreover receive both a positive or negative mass shift at normal nuclear matter density. Our findings are relevant for the interpretation of the past E325 experiment at KEK and the future E16 experiment to be carried out at the J-PARC facility. [1] P. Gubler and K. Ohtani, Phys. Rev. D 90, 094002 (2014). [2] P. Gubler and W. Weise, Phys. Lett. B 751, 396 (2015). [3] P. Gubler and W. Weise, arXiv:1602.09126 [hep-ph], to be published in NPA.

Presenter: GUBLER, Philipp (ECT*)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **98** Type: **not specified**

Systematic study of the vector meson spectral modification in the nuclear medium at J-PARC

Tuesday 26 July 2016 14:50 (30 minutes)

The spontaneous breaking of chiral symmetry is considered to be the origin of hadron mass. An order parameter of chiral symmetry breaking is a quark anti-quark condensate, but it is not observable. Instead, the spectral function of vector mesons is predicted to be changed in a hot and/or dense medium through the restoration of chiral symmetry. The J-PARC E16 experiment is proposed to study the spectral modification of vector meson in nuclei as a dense medium. The mass spectrum of φ meson is measured using p+A⟶φ⟶e+e- reactions at J-PARC high-momentum beam line. The high precision measurement with high statistics enables to investigate dependence of spectral modification on the size of target nuclei, and also on the momentum of φ mesons systematically. The spectrometer is designed to keep a good mass resolution as 5 MeV at φ meson and enough electron- identification capability in a high counting rate environment expected at J-PARC. The detectors have been developed and sufficient performances are achieved for the experiment. The details of physics goal and preparation status of J-PARC E16 experiment are presented.

Presenter: KOMATSU, Yusuke (RIKEN)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **99** Type: **not specified**

Phi mesons in cold nuclear matter with chirally-based resonant phi-N interactions

Tuesday 26 July 2016 15:20 (30 minutes)

The phi-meson properties in cold nuclear matter are revisited by implementing resonant phi-N interactions as described in chirally-based approaches including the unitarization of scattering amplitudes. Several N*-like states are dynamically generated in these models around 2 GeV, immediately above the phi N threshold. We find that these states give a sizable contribution to the phi collisional self-energy at finite nuclear density, on top of (and with similar strength as) the widely studied medium effects from the K Kbar cloud. Depending on model details of the phi N dynamics (position of the resonances and strength of the coupling) we report a phi broadening up to about 40-50 MeV – again, to be added to the K Kbar in-medium decay width – and an attractive optical potential at threshold of about 30 MeV at normal matter density. The phi spectral function develops a double peak structure as a consequence of the mixing of resonance-hole modes with the phi quasi-particle peak. The former points in the direction of making up for missing absorption as usually reported in phi nuclear production experiments. The relevance of these novel aspects of the phi dynamics in a baryonic medium is also discussed in connection with recent HADES observations of deep sub-threshold phi (and cascade, Ξ) production.

Presenter: HILLER BLIN, Astrid (IFIC/CSIC/Universidad de Valencia)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **100** Type: **not specified**

Dilepton results from HADES using Au+Au data at 1.23 AGeV

Tuesday 26 July 2016 15:50 (30 minutes)

The HADES experiment at GSI was designed to investigate the properties of hadrons inside dense nuclear matter. The latter is created in heavy-ion collisions at energies of 1-2 AGeV. HADES is currently the only running experiment that studies the region in the QCD phase diagram of very high net-baryon densities and low temperatures. Similar conditions are also present in one of the most fascinating objects of the universe: the neutron stars. Therefore, HADES has also the potential to improve our knowledge concerning the properties of such stars. The best probes that one can use to investigate a strongly interacting baryon-rich medium are the dileptons emerging from virtual photon decays. Since electromagnetic probes decouple from the dense interaction region once they are produced, their phase space distributions carry information about the temperature and structure of the dense QCD medium. In this talk we present preliminary dilepton results from the Au+Au data of HADES at 1.23 AGeV. A comparison with the dilepton mass distributions obtained from lighter collision systems will be provided. The analysis methods and future prospects will also be discussed.

Presenter: FRANCO, Celso (LIP-Lisbon)

Session Classification: Meson-Nucleon Interactions

Contribution ID: **101** Type: **not specified**

Review on recent results from RHIC polarized collider; unexpected forward neutron asymmetry

Saturday 30 July 2016 09:15 (40 minutes)

The polarized proton-proton collider at RHIC provides an unique opportunity to study the spin structure of proton. In this talk, I will present recent study high-lights in longitudinal and transverse spin structure of proton at RHIC. The RHIC spin program lately executed the transversely polarized proton-nucleus collision at high energy. We observed strikingly strong atomic mass number dependence in the observed asymmetry of a forward neutron production. I will discuss about the mechanism of the asymmetry.

Presenter: NAKAGAWA, Itaru (RIKEN)

Session Classification: Plenary

Contribution ID: **102** Type: **not specified**

The exclusive Drell-Yan process and deeply virtual pion production

Saturday 30 July 2016 09:55 (40 minutes)

After a brief introduction in the handbag approach, generalized parton distributions (GPDs) and hard subprocesses deeply virtual leptoproduction of pions will be discussed in some detail. It will be shown that a leading-twist analysis of this process fails drastically. A successful interpretation of the experimental data on pion production is however achieved by treating the pion-pole contribution non-perturbatively (i.e. replacing the perturbative pion electromagnetic form factor by the experimental one) and by taking into account the transversity GPDs which feed the amplitudes for transversely polarized photons and represent a twist-3 effect. Next it will be reported on an analysis of the exclusive pion-induced Drell-Yan process. The same GPDs contribute to it as for pion leptoproduction and the corresponding subprocesses are $s - u$ crossed. In the light of the results on pion leptoproduction the four partial cross sections ($d\sigma_L$, $d\sigma_T$, $d\sigma_{LT}$, $d\sigma_{TT}$) of the Drell-Yan process are therefore evaluated by treating the pion-pole contribution non-perturbatively and taking into account contributions from transversely polarized photons. The results obtained this way are substantially larger than predictions to leading-twist accuracy.

Presenter: KROLL, Peter (Universitaet Wuppertal)

Session Classification: Plenary

Contribution ID: **103** Type: **not specified**

Review of TMD measurements

Saturday 30 July 2016 11:00 (40 minutes)

The investigation of the partonic degrees of freedom beyond collinear approximation and towards a 3D description of the hadron structure in the momentum space has been gained increasing interest in the last decade. In the recent years, several first measurements has been made which provide new insights on the parton dynamics within the nucleon or during fragmentation, e.g. related to orbital motion and spin-orbits effects, that may eventually shed light on peculiar aspects of the quark confinement. Complementary information has been gathered from various reactions, from deep-inelastic experiments to electron and hadron colliders. A compendium of the most interesting results and an outlook of incoming measurements will be discussed.

Presenter: CONTALBRIGO, Marco (INFN Ferrara)

Session Classification: Plenary

Contribution ID: **104** Type: **not specified**

Review of GPD and TMD

Saturday 30 July 2016 11:40 (40 minutes)

Presenter: QIU, Jianwei (BNL)

Session Classification: Plenary

Contribution ID: **105** Type: **not specified**

Electron-Ion Collider

Saturday 30 July 2016 12:20 (40 minutes)

Our understanding of the theory of strong interaction, quantum chromo-dynamics (QCD), has advanced enormously in the past decades. Both experimentally and theoretically, perturbative regime in QCD has been explored and understood at precision. At the same time, lattice QCD calculations have begun to yield many quantitative results on properties of hadrons. The experimental understanding of how nucleons and nuclei are formed from their constituent quarks and gluons and their interactions, has also made progress via new experiments and theoretical frameworks such as GPDs and TMDs. However, it has been clear for some time that a new experimental facility is needed in order to quantify the role of quantum fluctuations and gluons in nuclear physics and to bring the understanding of nucleon and nuclear structure and dynamics to a new level. The Electron-Ion Collider (EIC) being proposed in the US and selected as the Nuclear Physics facility with highest priority for new construction in the US is such a facility. I will discuss the physics to be explored at EIC and how they set the parameters of EIC and its detectors. I will also outline the current status of the EIC project.

Presenter: YOSHIDA, Rik (Jefferson Lab)

Session Classification: Plenary

Contribution ID: **106** Type: **not specified**

Physics program with CLAS12

Saturday 30 July 2016 14:15 (40 minutes)

Presenter: DE VITA, Raffaella (INFN Genova)

Session Classification: Plenary

Contribution ID: **107** Type: **not specified**

The Belle II experiment

Saturday 30 July 2016 14:55 (40 minutes)

The Belle experiment was successfully running in KEK, Tsukuba, Japan until 2010. Now the detector is being upgraded and should start its operation in 2018. The talk is about the detector, SuperKEKB accelerator and physics at the Belle II experiment.

Presenter: LIVENTSEV, Dmitri (VPI/KEK)

Session Classification: Plenary

Contribution ID: **108** Type: **not specified**

The PANDA experiment at FAIR

Saturday 30 July 2016 15:35 (40 minutes)

The physics of strong interactions is undoubtedly one of the most challenging areas of modern science. Quantum Chromo Dynamics is reproducing the physics phenomena only at distances much shorter than the size of the nucleon, where perturbation theory can be used yielding results of high precision and predictive power. At larger distance scales, however, perturbative methods cannot be applied anymore, although spectacular phenomena - such as the generation of hadron masses and color confinement - occur. The antiProton ANnihilations at DArmstadt (PANDA) collaboration has the ambition to address key questions in this field by exploiting a cooled beam of antiprotons at the High-Energy Storage Ring (HESR) at the future Facility for Antiproton and Ion Research (FAIR) combined with a state-of-the-art and versatile detector. In this presentation, I will address some of the highlights of the physics program of PANDA in connection to the ongoing technological developments for FAIR.

Presenter: MESSCHENDORP, Johan (KVI-CART/University of Groningen)

Session Classification: Plenary

Contribution ID: **109** Type: **not specified**

Physics in J-PARC Hadron-hall extension

Saturday 30 July 2016 16:40 (40 minutes)

The Hadron Experimental Facility (HEF) of the Japan Proton Accelerator Research Complex (J-PARC) provides the world highest intensity hadron beams, such as kaons, pions, and so on, for various experimental researches in particle and nuclear physics. Currently, HEF operates two charged and one neutral secondary beam lines, K1.8, K1.1, and K0, sharing secondary beams produced at a primary target, T1. In addition, a high-momentum beam line is being constructed, which is branched from the primary beam line to deliver a fraction of the primary proton beam. We have a plan to extend HEF and construct a several new beam lines, which would enhance physics opportunities at HEF. I will introduce a floor plan of extended HEF and physics scopes.

Presenter: NOUMI, Hiroyuki (Research Center for Nuclear Physics, Osaka University)

Session Classification: Plenary

Contribution ID: **110** Type: **not specified**

Closing

Saturday 30 July 2016 18:00 (20 minutes)

Session Classification: Plenary

Contribution ID: **111** Type: **not specified**

Summary

Saturday 30 July 2016 17:20 (40 minutes)

Presenter: IMAI, Kenichi (JAEA)

Session Classification: Plenary