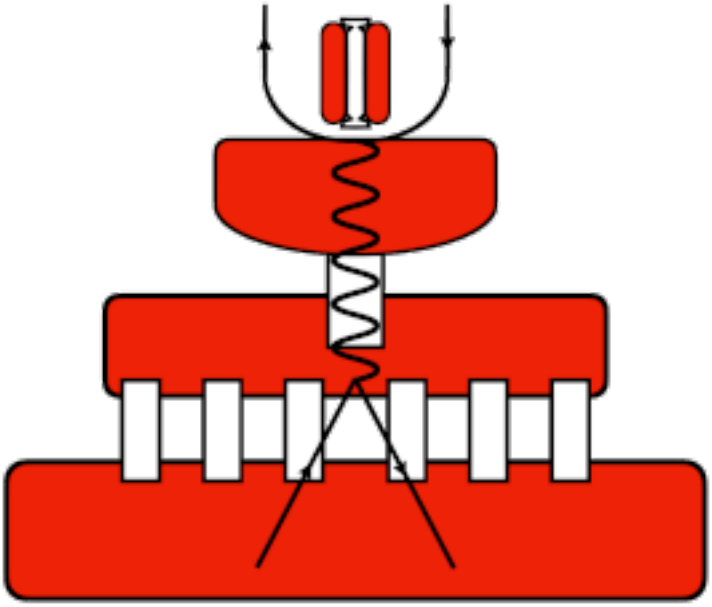
International Conference on Kaon Physics 2019



Report of Contributions

https://indico.cern.ch/e/769729

Contribution ID: **4** Type: **Talk**

On the pair correlations of neutral K, D, B and B_s mesons with close momenta produced in inclusive multiparticle processes

Tuesday 10 September 2019 17:15 (25 minutes)

The phenomenological structure of inclusive cross-sections of the production of two neutral K mesons in hadron–hadron, hadron–nucleus and nucleus–nucleus collisions is theoretically studied taking into account the strangeness conservation in strong and electromagnetic interactions. Relations for the dependence of correlations of two short-lived and two long-lived neutral kaons $K^0_S K^0_S$, $K^0_L K^0_L$ and correlations of "mixed" pairs $K^0_S K^0_L$ at small relative momenta upon the space-time parameters of the generation region of K^0 and $\bar{K}^0$ mesons
are obtained – involving the contributions of Bose-statistics and S-wave strong final-state interaction of two K^0 ($\bar{K}^0$) mesons as well as of
the K^0 and $\bar{K}^0$ mesons, and also the additional one of transitions $K^+K^- \to K^0\bar{K}^0$, and depending
upon the relative fractions of generated pairs K^0K^0, $\bar{K}^0\bar{K}^0$ and $K^0\bar{K}^0$. It is shown that under the strangeness conservation the correlation functions of the pairs $K^0_S K^0_S$ and $K^0_L K^0_L$, produced in the same inclusive process, coincide, and the difference between the correlation functions of the pairs $K^0_S K^0_S$ and $K^0_S K^0_L$ is conditioned exclusively by the production of the pairs of non-identical neutral kaons $K^0\bar{K}^0$.

For comparison, analogous correlations for the pairs of neutral heavy mesons D^0, B^0 and B^0_s, generated in multiple inclusive
processes with charm (beauty) conservation, are also theoretically analyzed – neglecting, just as for K^0 mesons, the small effects of CP violation. These correlations have the quite similar character and they are described by quite similar expressions: in particular, just as for K^0 mesons, the correlation
functions for the pairs of states with the same CP parity ($R_{SS} = R_{LL}$) and with different CP parity (R_{SL}) do not coincide, and the difference between them is conditioned exclusively by the production of pairs $D^0\bar{D}^0$, $B^0\bar{B}^0$ and $B^0_s\bar{B}^0_s$.
However, contrary to the case of K^0 mesons, here the distinction of CP-even and CP-odd states (and, hence, the experimental observation of respective pair correlations) encounters difficulties – due to the insignificant differences of their lifetimes and the relatively small probability of purely CP-even and CP-odd decay channels. Nevertheless, one may expect that this
will become accessible at future colliders.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: CPT conservation, CP and T violations

Contribution ID: **5** Type: **Poster**

On the correlations of polarizations in the system of two photons produced in hadronic decays

Tuesday 10 September 2019 17:49 (1 minute)

The theoretical study of correlations of the linear and circular polarizations in the system of two γ quanta emitted in hadronic decays (in particular – in the rare two-photon decays of the neutral kaons K_S^0 and K_L^0) has been performed. The polarization of a two-photon state is described by the one-photon Stokes parameters and by the components of the correlation "tensor" in the Stokes space. It is shown that the correlations between the Stokes parameters
in the case of the two-photon decays $\pi^0 \to 2\gamma$, $\eta \to 2\gamma$, $K_L^0 \to 2\gamma$, $K_S^0 \to 2\gamma$ and the cascade process $|0\rangle \to |1\rangle + \gamma \to |0\rangle + 2\gamma$ ($|0\rangle$ and $|1\rangle$ are states with the spin 0 and 1, respectively) have the purely quantum
character: the incoherence inequalities of the Bell type for the components of the correlation "tensor", established previously
for the case of classical "mixtures", are violated (i.e. there is always one case when the modulus of sum of two diagonal components of the correlation "tensor" exceeds unity). The general analysis of the registration procedure for the system of two correlated photons by two one-photon detectors is performed.

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Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **6** Type: **Poster**

On the spin correlations of final leptons generated in the high-energy two-photon processes $\gamma\gamma \to e^+e^-, \mu^+\mu^-, \tau^+\tau^-$

Tuesday 10 September 2019 17:48 (1 minute)

The theoretical study of spin structure for the processes of lepton pair
production by pairs of γ quanta, which may be emitted in various relativistic hadronic reactions and decays (in particular – in the rare two-photon decays of the neutral kaons K^0_S and K^0_L), is performed. For the two-photon process $\gamma\gamma \to e^+e^-$, it is shown
that in the case of unpolarized photons the final electron and positron remain unpolarized as well, but their spins prove to be strongly correlated. Explicit expressions for the components of the correlation tensor and for
the relative fractions of singlet and triplet states of the final (e^+e^-) system are derived. It is demonstrated that in the process $\gamma\gamma \to e^+e^-$ at least one of the "classical" incoherence inequalities of the Bell type for the correlation tensor components is always violated (i.e. there is always at least one case when the modulus of sum of two diagonal components exceeds unity), and, thus, spin correlations of the final electron and positron in this process have the strongly pronounced quantum character.

Analogous analysis can be wholly applied also to the two-photon processes with the generation of a muon pair and a tau-lepton pair ($\gamma\gamma \to \mu^+\mu^-, \gamma\gamma \to \tau^+\tau^-$), which become possible at considerably higher energies.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **7** Type: **Poster**

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

Tuesday 10 September 2019 17:47 (1 minute)

Spin correlations for the $\Lambda\Lambda$ and $\Lambda\bar{\Lambda}$ pairs, produced 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 – thus, the respective spin correlations can be
rather easily distinguished and studied experimentally, which is especially important for studies of multiple particle generation at modern and future ion colliders (RHIC, LHC, NICA). 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 and singlet states of respective pairs, are discussed.

In this report, spin correlations for two identical ($\Lambda\Lambda$) and two non-identical ($\Lambda\bar{\Lambda}$) particles are generally considered within the conventional model of one-particle sources, implying that correlations vanish at
enough large relative momenta. However, under these conditions (especially at
ultrarelativistic energies), for two non-identical particles ($\Lambda\bar{\Lambda}$) the two-particle – quark-antiquark and two-gluon – annihilation sources 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.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **10** Type: **Poster**

Study of the kaon electromagnetic form factors in e^+e^- annihilation and τ decays

Tuesday 10 September 2019 17:46 (1 minute)

The recent measurements of the $\tau^- toK^-K_S\nu_\tau$ decay spectral function carried out with BABAR detector is described. Combining the results on K^-K mass spectrum and measurements of $e^+e^- \to K_SK_L$ and $e^+e^- \to K^+K^-$ cross sections, the isoscalar and isovector electromagnetic kaon form factors and their relative phase are derived in a model independent way. The experimental results are compared with a fit based on the vector-meson-dominance model.

Author: Dr SEREDNYAKOV, Sergey (Novosibirsk State University)

Presenter: Dr SEREDNYAKOV, Sergey (Novosibirsk State University)

Session Classification: Poster session

Contribution ID: **11** Type: **Talk**

CPT symmetry test at KLOE-2

Tuesday 10 September 2019 16:25 (25 minutes)

The KLOE-2 experiment finished data taking in March 2018 at the upgraded e+e- DAΦNE collider of the INFN Laboratori Nazionali di Frascati, collecting more than 5 fb^{-1} at the center of mass energy of the ϕ meson. Together with the data sample collected by its predecessor KLOE, the total of almost 8 $^{-1}$ integrated luminosity represents the largest existing data sample in the world collected at an e+e- collider at the ϕ meson peak, corresponding to ˜2.4 x 10^{10} ϕ mesons produced.

KLOE-2 physics program is mainly focused on K_S rare decays as well as on kaon interferometry, fundamental symmetry tests and physics beyond the Standard Model, including searches for new exotic particles that could constitute the dark matter. The entanglement in the neutral kaon pairs produced at the DAΦNE ϕ-factory is a unique tool to test discrete symmetries and quantum coherence at the utmost sensitivity, in particular strongly motivating the experimental searches of possible CPT violating effects, which would unambiguously signal New Physics.
The lepton charge asymmetry measured in K_S semileptonic decays with 1.7 fb^{-1} of KLOE data, improving the statistical uncertainty of present result by about a factor two, will be presented together with the test of CPT in transitions in $\phi \to K_S K_L \to \pi e \nu, 3\pi^0$ and $\pi e \nu, 2\pi$ decays.

Author: Dr CZERWIŃSKI, Eryk (Jagiellonian University)

Presenter: DE LUCIA, Erika (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: CPT conservation, CP and T violations

Contribution ID: **12** Type: **Talk**

Flavour Physics and CP Violation at KLOE-2

Tuesday 10 September 2019 16:50 (25 minutes)

The KLOE-2 experiment at the upgraded e+e- DAPHNE collider of the INFN Laboratori Nazionali di Frascati completed its data taking campaign at the end of Mach 2018, collecting more than 5 fb^{-1} at the center of mass energy of the phi-meson. Together with the data set of its predecessor KLOE, the acquired data sample of 8 fb^{-1} corresponds to 2.4×10^{10} ϕ-meson produced: the largest sample ever collected at the $\phi(1020)$ at e^+e^- colliders.

KLOE-2 Collaboration activities are now focused on data reconstruction and analysis, continuing the KLOE long-standing tradition of flavour physics precision measurements in the kaon sector, to probe CKM unitarity and lepton universality, and search for Physics Beyond the Standard Model. Latest results on K_S rare decays will be presented and discussed in the framework of Flavour Physics and CP Violation tests, among these the measurement of Ks semileptonic branching ratios, using 1.7 fb^{-1} KLOE data, and the search for the pure CP-violating $K_S \to 3\pi^0$ decay with the newly acquired KLOE-2 data set.

Author: CZERWIŃSKI, Eryk (Jagiellonian University)

Presenter: SELCE, Andrea (Roma Tre Universita Degli Studi (IT))

Session Classification: CPT conservation, CP and T violations

Contribution ID: **13** Type: **Talk**

Recent results from the CMD-3 detector at the VEPP-2000 collider

Wednesday 11 September 2019 10:25 (25 minutes)

The main goal of experiments with CMD-3 is the measurement of the cross-sections and dynamics of the exclusive
modes of e+e−>hadrons reactions. In particular, these results provide important input for the hadronic vacuum polarization function
P(qˆ2), which plays a central role in various issues of QCD and Standard Model, such as hadronic tensor, running electromagnetic coupling and the calculation of the hadronic contribution to the muon anomalous magnetic moment.

The CMD-3 detector is taking data at the VEPP-2000 e+e- collider (BINP, Novosibirsk, Russia). The CMD-3
is the general purpose particle magnetic (1.3 T) detector, equipped with the tracking system, two crystal (CSI and BGO) calorimeters, liquid Xe calorimeter, TOF and muon systems.

First round of data taking with the CMD-3 detector at the VEPP-2000 e+e- collider was performed in 2011-2013 with
about 60 1/pb integrated luminosity in the energy range from 0.32 to 2.0 GeV in c.m. Amount of collected data exceeds
all previous experiments. The beam energy was continuously measured concurrently with the data taking using a Compton
backscattering system.

Here we present the survey of new and published analysis results, including precise measurement of e+e−>pi+pi- reaction,
as well as other hadron final states with up to six pions or states include two kaons.

At the end of 2016 the VEPP-2000 collider resumed operations after upgrade of the injection system, and a performance close
to the project luminosity of 10ˆ32 cm-2s-1 at 2 GeV has been demonstrated. First preliminary results of new 2017 run are also
presented.

Authors: Dr LUKIN, Peter (BudkerINP and Novosibirsk State University); Mr RYZHENENKOV, Artem (Budker Institute of Nuclear Physics and Novosibirsk State University)

Presenter: Mr RYZHENENKOV, Artem (Budker Institute of Nuclear Physics and Novosibirsk State University)

Session Classification: ElectroWeak - Standard Model

Contribution ID: **15** Type: **Talk**

The studies of kaonic atoms at DAFNE collider: from SIDDHARTA to SIDDHARTA-2

Thursday 12 September 2019 16:40 (20 minutes)

The interaction of antikaons with nucleons and nuclei in the low-energy regime represents an active research field in hadron physics and offers a unique tool to understand the low energy kaon-nucleus interaction at threshold. The lightest atomic systems, namely the kaonic hydrogen and the kaonic deuterium, provide the isospin dependent kaon-nucleon scattering lengths by measuring the X-rays emitted during their de-excitation to the 1s level. The most important experimental information missing in the field of the low-energy antikaon-nucleon interactions is the experimental determination of the hadronic energy shift and width of kaonic deuterium. The kaonic deuterium X-ray measurement will be realized by the new SIDDHARTA-2 experiment. The experimental challenge of the kaonic deuterium measurement is the very small X-rays yield, the even larger width (compared to kaonic hydrogen) and the difficulty to perform X-rays spectroscopy with weak signals in the high radiation environment of DAFNE. The SIDDHARTINO setup was installed in DAFNE in Spring 2019 for kaonic helium test run, followed by the kaonic deuterium measurement with the SIDDHARTA-2 setup in 2020.

Author: Dr SIRGHI, Diana Laura (INFN-LNF)

Presenter: Dr SIRGHI, Diana Laura (INFN-LNF)

Session Classification: Hyperons and Nuclei

Contribution ID: **17** Type: **Talk**

The Belle II experiment: first results and prospects

Friday 13 September 2019 09:00 (25 minutes)

The Belle II experiment at the SuperKEKB energy-asymmetric e^+e^- collider is a substantial upgrade of the B factory facility at the Japanese KEK laboratory. The design luminosity of the machine is 8×10^{35} cm^{-2}s^{-1} and the Belle II experiment aims to record 50 ab^{-1} of data, a factor of 50 more than its predecessor. With this data set, Belle II will be able to measure the Cabibbo-Kobayashi-Maskawa (CKM) matrix, the matrix elements and their phases, with unprecedented precision and explore flavor physics with B and charmed mesons, and τ leptons. Belle II has also a unique capability to search for BSM rare decays and forbidden modes From February to July 2018, the machine has completed a commissioning run. Regular operations, with full detector, have started in March 2019 achieved a peak luminosity of 1×10^{34} cm^{-2}s^{-1}, and Belle II has recorded a data sample of about 7 fb^{-1}.. In this presentation, we will review the status of the Belle II detector, the results from the early data, and the prospects for the study of rare decays, in the quest of uncovering New Physics.

Presenter: KROKOVNY, Pavel (Budker Institute of Nuclear Physics (RU))

Session Classification: Present and Future of Flavor Physics

Contribution ID: **18** Type: **Talk**

Dark Sector Physics with Belle II

Friday 13 September 2019 12:00 (20 minutes)

The Belle II experiment at the SuperKEKB energy-asymmetric e^+e^- collider is a substantial upgrade of the B factory facility at the Japanese KEK laboratory. The design luminosity of the machine is 8×10^{35} cm^{-2}s^{-1} and the Belle II experiment aims to record 50 ab^{-1} of data, a factor of 50 more than its predecessor. From February to July 2018, the machine has completed a commissioning run; regular operation of SuperKEKB has started in March 2019: the machine has achieved a peak luminosity of 10^{34} cm^{-2}s^{-1}, and Belle II has recorded a data sample of about 7 fb^{-1}. Already this early data set with specifically designed triggers offers the possibility to search for a large variety of dark sector particles in the GeV mass range complementary to LHC and dedicated low energy experiments; these searches will benefit from more data in the process of being accumulated. This talk will review the state of the dark sector searches at Belle II with a focus on the discovery potential of the early data, and show the first results

Presenter: CORONA, Luigi (INFN - National Institute for Nuclear Physics)

Session Classification: New Physics

Contribution ID: **19** Type: **Talk**

Anomalies in B (semi)leptonic decays at B factories

Wednesday 11 September 2019 09:30 (30 minutes)

The Belle II experiment at the SuperKEKB energy-asymmetric e^+e^- collider is a substantial upgrade of the B factory facility at the Japanese KEK laboratory. The design luminosity of the machine is 8×10^{35} cm^{-2}s^{-1} and the Belle II experiment aims to record 50 ab^{-1} of data, a factor of 50 more than its predecessor. From February to July 2018, the machine has completed a commissioning run; regular operation of SuperKEKB has started in March 2019: the machine has achieved a peak luminosity of 10^{34} cm^{-2}s^{-1}, and Belle II has recorded a data sample of about 7 fb^{-1}. In this presentation we show first results from studying missing energy signatures, such as leptonic and semileptonic B meson decays based on early Belle II data. We report first studies on re-measuring important standard candle processes, such as the abundant inclusive $B \to X\ell\nu$ and $B \to D^*\ell\nu$ decays. Furthermore, we will also present an overview of the semileptonic B decays that will be measured in the upcoming years at Belle II and discuss prospects for important B-anomalies like R(D) and R(D*), as well as other tests of lepton flavor universality.

Author: GLAZOV, Alexander (DESY)

Presenter: GLAZOV, Alexander (DESY)

Session Classification: ElectroWeak - Standard Model

Contribution ID: **20** Type: **Talk**

Studies of low-energy K^- hadronic intearctions with light nuclei by AMADEUS

Thursday 12 September 2019 17:00 (20 minutes)

The AMADEUS collaboration aims to study the K^- hadronic interaction with light nuclei in the low-energy regime with high precision. The main goal is to provide information on the KbarN interaction in nuclear medium, fundamental for the understanding of the non-perturbative QCD in the strangeness sector, with implications going from nuclear physics to astrophysics. Hyperon-nucleon/nuclei (YN) and hyperon-pion (Yπ) correlation studies are performed with the aim to explore the possible existence of deeply bound kaonic states in nuclei and the properties of hyperon resonances in nuclear environment. AMADEUS takes advantage of the DAΦNE collider, which provides a unique source of monochromatic low-momentum kaons (p_K ~ 127 MeV/c). As a first step, we explore the hadronic interaction of the negative kaons in the materials of the KLOE detector, which is used as large acceptance and resolution active target, providing a high statistic sample of K^- nuclear absorption on H, ^{4}He, ^{9}Be and ^{12}C nuclei.

Author: Dr DEL GRANDE, Raffaele (INFN-LNF)

Presenter: Dr DEL GRANDE, Raffaele (INFN-LNF)

Session Classification: Hyperons and Nuclei

Contribution ID: **21** Type: **Talk**

Measurement of the branching fractions $BF(\tau^- \to K^- n\pi^0 \nu_\tau)$, $n = 0, 1, 2, 3$, and $BF(\tau^- \to \pi^- n\pi^0 \nu_\tau)$, $n = 3, 4$.

Thursday 12 September 2019 14:05 (25 minutes)

We report the measurements of the branching fractions of the decays $\tau^- \to K^- n\pi^0 \nu_\tau$, $n = 0, 1, 2, 3$, and $\tau^- \to \pi^- n\pi^0 \nu_\tau$, $n = 3, 4$. The measurements are based on a data sample of 435 million tau pairs produced in e^+e^- collisions at and near the Y(4S) peak and collected with the $BABAR$ detector in 1999–2008. Additional systematic studies have been completed after the presentation of the preliminary results. Most measurements are substantial improvements over previous measurements and $BF(\tau^- \to \pi^- 4\pi^0 \nu_\tau)$ is measured for the first time. These measurements improve the determination of $|V_{us}|$ from the branching fraction $BF(\tau^- \to X_s \nu_\tau)$ computed as the sum of all measured exclusive modes, with a method based on finite-energy QCD sum rules.

Author: ANULLI, Fabio (Sapienza Universita e INFN, Roma I (IT))

Presenter: OBERHOF, Benjamin

Session Classification: Other rare decays

Contribution ID: **22** Type: **Talk**

"Recent results from "OKA"setup at U-70 synchrotron. "

Thursday 12 September 2019 10:50 (25 minutes)

During last years quite significant statistics of kaon decays has been accumulated by "OKA"setup which is working in the 20 GeV/c RF-separated secondary K^+ beam of the U-70 synchrotron. About 7 billions of kaon decays have been detected. Results on several radiative decays have been obtained.
On the selected ˜100K of $K_{\mu 2\gamma}$ decays with $25 < E^*_\gamma < 150$ MeV, an analysis of the Dalitz plot density has been performed and a destructive interference between the inner Bremsstrahlung (IB) and the structure dependent (SD-) term has been observed. From that, the difference of the vector and axial constants $F_V - F_A$ has been measured $F_V - F_A = 0.134 \pm 0.021(stat) \pm 0.027(syst)$. It differs by 2.3σ from the Chiral Perturbation Theory prediction $F_V - F_A = 0.054$.
On the same statistics, a clean sample of about 450 events of $K^+ \to \pi^+\pi^-\pi^+\gamma$ decay with the energy of the photon in the kaon rest frame greater than 30 MeV has been selected. The branching fraction for this decay has been measured to be $(0.71 \pm 0.05) \times 10^{-5}$. The measured energy spectrum of the decay photon has been compared to the prediction of the chiral perturbation theory to $O(p^4)$. A search for an up-down asymmetry of the photon with respect to the hadronic system decay plane is also performed.
More than 19000 events of the decay $K_{e3\gamma}$ have been selected with the background of ˜2600 events. The branching ratio for the decay with the cuts $E*_\gamma > 30$MeV; and $\theta^* > 20°$,
normalised to the Ke3 decay is $R = (0.6 \pm 0.010(stat) \pm 0.016(syst)) \times 10^{-2}$ is in an exellent agreement with the CHPT O(p4) predictions $R = (0.59 \pm 0.005) \times 10^{-2}$.

Author: OBRAZTSOV, Vladimir (Institute for High Energy Physics of NRC Kurchatov Institute (R)

Presenter: OBRAZTSOV, Vladimir (Institute for High Energy Physics of NRC Kurchatov Institute (R)

Session Classification: Rare and forbidden Kaon decays - 2

Contribution ID: **23** Type: **Talk**

Status and perspectives of Lepton Flavour Violation experiments with muons.

Thursday 12 September 2019 14:55 (25 minutes)

Lepton flavour violation effects are predicted in several extensions of the Standard Model (SM), including supersymmetric versions of Grand Unification Theories, at a measurable level. Since the SM background, even including neutrino oscillations and mixing, is completely negligible the observation of such effects would be a strong evidence for New Physics beyond the SM, while a non observation with high precision experiments would put severe constraints on possible SM extensions. In this talk we review the present status and the future perspectives of the lepton flavour violation experiments involving muons and discuss the sensitivity improvements which could be obtained from new high intensity machines coupled with high resolution detectors.

Author: CEI, Fabrizio (University of Pisa)

Presenter: CEI, Fabrizio (University of Pisa)

Session Classification: Other rare decays

Contribution ID: **24** Type: **Talk**

Kaons @ LHCb

Thursday 12 September 2019 10:05 (25 minutes)

Rare decays are fundamental probes for physics beyond the Standard Model, and the expanding LHCb programme on strange physics provides unique and complementary information with respect to the beauty and charm sectors. Recent results of rare kaon decays at LHCb will be presented as well as prospects for strange physics with the LHCb Upgrade.

Presenter: DETTORI, Francesco (Universita e INFN, Cagliari (IT))

Session Classification: Rare and forbidden Kaon decays - 1

Contribution ID: **25** Type: **Talk**

Rare decays at LHCb

Thursday 12 September 2019 13:40 (25 minutes)

Rare decays are very sensitive probes for phenomena beyond the Standard Model, complementary to direct searches. In the Standard Model, rare decays are loop suppressed and may receive significant contributions from new particles, if these exist. Particularly interesting are b->sll transitions, which allow tests of lepton universality to be performed. Very rare decays such as B(s)->ll are furthermore helicity suppressed and constitute powerful probes for new (pseudo) scalar particles. Recent results of rare b-hadron decays at LHCb will be presented.

Author: LHCB COLLABORATION

Presenter: RAMOS PERNAS, Miguel (Universidade de Santiago de Compostela (ES))

Session Classification: Other rare decays

Contribution ID: **26** Type: **Talk**

CP violation in beauty and charm at LHCb

Tuesday 10 September 2019 16:00 (25 minutes)

Precision measurements of CP violating observables in the decays of b and c hadrons are powerful probes to search for physics beyond the Standard Model. The most recent results on CP violation in the decay, mixing and interference of both b and c hadrons obtained by the LHCb Collaboration with Run I and years 2015-2016 of Run II are presented, including the first observation of CP violation in the charm system. In particular world best constraints and world first measurements are provided for CKM elements, unitarity angles and charm parameters. We also discuss prospects for future sensitivities.

Author: LHCB COLLABORATION

Presenter: ROMERO, Marcos (Universidade de Santiago de Compostela (ES))

Session Classification: CPT conservation, CP and T violations

Contribution ID: **27** Type: **Talk**

Semileptonic Hyperon Decays at LHCb

Thursday 12 September 2019 16:20 (20 minutes)

Semileptonic Hyperon Decays (SHD) are interesting decays that allow to test LFV with operators not accesible to kaon decays. In this talk we will discuss the prospects of LHCb to improve the existing measurement of muonic SHD's

Author: LHCB COLLABORATION

Presenter: BREA RODRIGUEZ, Alexandre (Universidade de Santiago de Compostela (USC), IGFAE)

Session Classification: Hyperons and Nuclei

Contribution ID: **28** Type: **Talk**

Search for Ks->mumu at LHCb

Tuesday 10 September 2019 12:20 (30 minutes)

Ks->mumu is a FCNC-type decay that is very suppressed in the SM and whose properties make it very sensitive to BSM physics, independently from other similar decays, such as Kl->mumu. In this talk we will present the latest search for this channel at LHCb, which provides the world-best sensitivity and improves very significantly previous results.

Author: LHCB COLLABORATION

Presenter: RAMOS PERNAS, Miguel (Universidade de Santiago de Compostela (ES))

Session Classification: Hot topics

Contribution ID: **29** Type: **Talk**

Evidence for $\Sigma^+ \to p\mu^+\mu^-$ decays at LHCb

Thursday 12 September 2019 16:00 (20 minutes)

A search for the very rare $\Sigma^+ \to p\mu^+\mu^-$ performed within the LHCb experiment is presented. An evidence for this decay was seen by the HyperCP collaboration, with the invariant mass of the dimuon pairs surprisingly found peaking at 214 MeV/c2, leading to the hypothesis of an intermediate (unknown) particle mediating this decay (known as HyperCP anomaly).
Thanks to the copious production of Σ hyperons at LHC and to the acceptance for relatively long lived particles the LHCb experiment is able to search for these decays.
A strong evidence for the Sigma->p mu mu decay is presented and a measurement of its branching fraction performed relative to the Sigma-> p pi0 decay. No peaking structure is observed in the dimuon invariant mass, putting a stringent limits on the existence of the putative particle and pointing to a resolution of the HyperCP anomaly. Prospects for observing the decay at Standard Model level with Run 2 data and for additional observables are also shown.

Author: LHCB COLLABORATION

Presenter: DETTORI, Francesco (Universita e INFN, Cagliari (IT))

Session Classification: Hyperons and Nuclei

Contribution ID: **30** Type: **Poster**

Construction of the double-side readout calorimeter for $K_L \to \pi^0\nu\bar{\nu}$ search

Tuesday 10 September 2019 17:45 (1 minute)

We are searching for the decay $K_L \to \pi^0\nu\bar{\nu}$ at the KOTO experiment in J-PARC. The standard model prediction for the branching ratio (BR) is $(3.0 \pm 0.3) \times 10^{-11}$. In 2018 KOTO achieved the best upper limit to date of BR$< 3.0 \times 10^{-9}(90\%$ C.L.), improving by an oder of magnitude the previous limit by KEK E391a. The experimental signature is two photons from the π^0. To detect this simple signature, the KOTO detector consists of a cesium iodide (CsI) calorimeter and hermetical veto counters in a high vacuum environment. The calorimeter is made of 50-cm-long CsI crystals stacked in a cylinder of 1.9 m diameter. Each crystal is read out with a PMT on its back side.

For the next step, we have updated the calorimeter to reduce one of the major backgrounds caused by a neutron generating two clusters in the calorimeter. Because neutrons tend to generate scintillation showers deeper in the calorimeter, the updated calorimeter reads out the scintillation lights from the front side and the back side of the crystals—the time difference between the front and back readout helps in separating photons from neutrons.

To implement a double side readout, we have installed 4000 silicon photomultipliers˜(SiPMs) on the front surface of crystals in addition to PMTs on the back surface. The construction was carried out on-site without disassembling the stack of crystals in the detector from September to December 2018. I will report the special techniques we used to glue the SiPMs on the CsI crystals to keep UV transparency, mechanical robustness, radiation tolerance, and vacuum resistance.

Author: KOTERA, Katsushige (Osaka University)

Presenter: KOTERA, Katsushige (Osaka University)

Session Classification: Poster session

Contribution ID: **31** Type: **Talk**

Isospin breaking corrections to eps'/eps

Wednesday 11 September 2019 12:10 (30 minutes)

We present an updated analysis of isospin-violating contributions to eps'/eps in the framework of chiral perturbation theory, taking advantage of the different improvements in the determination of quark masses and nonperturbative parameters. The role of the different pieces entering into the analysis is carefully assessed.

Authors: RODRÍGUEZ SÁNCHEZ, Antonio (Lund University); CIRIGLIANO, Vincenzo (Los Alamos National Laboratory); GISBERT MULLOR, Hector (University of Valencia - IFIC); PICH, Antonio (IFIC, U. Valencia -.)

Presenter: RODRÍGUEZ SÁNCHEZ, Antonio (Lund University)

Session Classification: Epsilon'/Epsilon

Contribution ID: **32** Type: **Poster**

Neutron rejection performance of the upgraded KOTO CsI calorimeter

Tuesday 10 September 2019 17:44 (1 minute)

We are searching for the $K_L \to \pi^0\nu\bar{\nu}$ decay at the J-PARC KOTO experiment. This decay mode is highly suppressed in the Standard Model and its branching ratio is predicted to be $(3.0 \pm 0.3) \times 10^{-11}$ with small theoretical uncertainties. This decay mode is thus sensitive to new physics beyond the Standard Model.
The signature of the signal events is two photons from a π^0 decay and no other detected particles.One of the main background sources is caused by the beam halo neutron producing a hadronic shower in the CsI calorimeter and new neutron from this shower interacting at another position of the CsI calorimeter.To suppress this neutron backgrounds, we installed MPPCs (silicon photo sensor) on the upstream surface of CsI calorimeter in 2018.Neutrons and photons can be distinguished by using timing difference of the MPPC signal from upstream and the PMT signal from downstream. I will present the performance of the neutron background reduction with the upgraded CsI calorimeter.

Author: Ms OSUGI, Mayu (Osaka University, Japan)

Presenter: Ms OSUGI, Mayu (Osaka University, Japan)

Session Classification: Poster session

Contribution ID: **33** Type: **Talk**

Calorimeter upgrade of the KOTO experiment with both-end readout of CsI crystals using MPPCs

Friday 13 September 2019 09:45 (20 minutes)

We are searching for the decay $K_L \to \pi^0\nu\overline{\nu}$ in the KOTO experiment at J-PARC. The signal is identified by detecting two photons from the π^0 decay with a calorimeter composed of undoped CsI crystals. The main background "hadron cluster background"comes from neutrons generating two clusters in the calorimeter: a neutron in the beam halo hits the calorimeter to generate the first cluster, and a secondary neutron escaping the first cluster generates the second separated cluster. In order to reduce this background, we upgraded the calorimeter to have both-end readout by attaching MPPCs on the upstream face of each CsI crystal on top of the original PMT attached on the downstream face. The background can be rejected exploiting the timing difference between the MPPC and PMT, since neutrons tend to interact deeper inside the crystals. We installed the MPPCs in 2018, and evaluated the performance with data taken in 2019. I will present the newly developed technologies and the performance of the background rejection with the upgraded calorimeter.

Author: NANJO, Hajime (Osaka University)

Presenter: NANJO, Hajime (Osaka University)

Session Classification: Present and Future of Flavor Physics

Contribution ID: **34** Type: **Talk**

KLEVER: An experiment to measure BR($K_L \to \pi^0\nu\bar{\nu}$) at the CERN SPS

Friday 13 September 2019 10:05 (25 minutes)

Precise measurements of the branching ratios (BRs) for the flavor-changing neutral current decays $K \to \pi\nu\bar{\nu}$ can provide unique constraints on CKM unitarity and, potentially, evidence for new physics. It is important to measure both decay modes, $K^+ \to \pi^+\nu\bar{\nu}$ and $K_L \to \pi^0\nu\bar{\nu}$, since different new physics models affect the rates for each channel differently. The NA62 experiment at the CERN SPS is currently collecting data and will measure BR($K^+ \to \pi^+\nu\bar{\nu}$) to within 10%. We are designing the KLEVER experiment to measure BR($K_L \to \pi^0\nu\bar{\nu}$) to ∼20\% using a high-energy neutral beam at the CERN SPS starting in LHC Run 4. The boost from the high-energy beam facilitates the rejection of background channels such as $K_L \to \pi^0\pi^0$ by detection of the additional photons in the final state. On the other hand, the layout poses particular challenges for the design of the small-angle vetoes, which must reject photons from K_L decays escaping through the beam pipe amidst an intense background from soft photons and neutrons in the beam. We present findings from our design studies, with an emphasis on the challenges faced and the potential sensitivity for the measurement of BR($K_L \to \pi^0\nu\bar{\nu}$).

Author: MOULSON, Matthew (INFN e Laboratori Nazionali di Frascati (IT))

Presenter: MOULSON, Matthew (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: Present and Future of Flavor Physics

Contribution ID: **35** Type: **Talk**

Search for the $K_L \to \pi^0\gamma$ decay in the KOTO experiment

Thursday 12 September 2019 11:15 (25 minutes)

$K_L \to \pi^0\gamma$ is forbidden by the standard model
because this decay mode threatens the Lorentz invariance and gauge principle.
There have been various experimental tests of the Lorentz invariance
using optical cavities, however, experimental tests in the high energy
regime are also useful probes of New Physics.
In spite of its interesting opportunity,
neither $K_L \to \pi^0\gamma$ nor $K_S \to \pi^0\gamma$
have not been measured experimentally.
We searched for the $K_L \to \pi^0\gamma$ decay using data
recorded from 2016 to 2018 at the J-PARC proton beam facility.
The expected signal sensitivity is approximately 10^{-7}.
We are planning to open the signal box, and will report on the estimation of the level of backgrounds
together with the preliminary result of the branching fraction for the $K_L \to \pi^0\gamma$ decay.

Author: Dr SHIMIZU, Nobuhiro (Osaka University)

Presenter: Dr SHIMIZU, Nobuhiro (Osaka University)

Session Classification: Rare and forbidden Kaon decays - 2

Contribution ID: **36** Type: **Talk**

A future KL->pi0 nu nu experiment at J-PARC

Friday 13 September 2019 10:30 (25 minutes)

A next-generation experiment at J-PARC to measure the branching ratio of $K_L \to \pi^0\nu\overline{\nu}$ is being considered. The currently-running experiment in the Hadron Experimental Facility (HEF) at J-PARC, the KOTO experiment, will reach a sensitivity level below 10^{-10} in 3-4 years but will take a much longer time toward the Standard Model (SM) sensitivity (3×10^{-11}). It is desirable to have a new experiment that can observe $O(100)$ SM events and measure the branching ratio of $K_L \to \pi^0\nu\overline{\nu}$. Such an experiment, so-called KOTO step-2, is being discussed as a part of the HEF extension project, which is one of the proposed KEK/J-PARC future plans. A beam line with a smaller production angle and a larger detector, accommodated in the extended facility, will provide a higher kaon flux and a larger detection acceptance, and thus a better sensitivity.
In this talk, the outline and status of the project will be introduced.

Author: NOMURA, Tadashi (KEK)

Presenter: NOMURA, Tadashi (KEK)

Session Classification: Present and Future of Flavor Physics

Contribution ID: **37** Type: **Poster**

A new charged particle detector for the KOTO experiment at J-PARC.

Tuesday 10 September 2019 17:43 (1 minute)

The KOTO experiment at J-PARC is searching for the $K_L \to \pi^0\nu\bar{\nu}$ decay, which is one of the most sensitive probes to new physics beyond the Standard Model. Its signature is a pair of photons from a π^0 decay without any additional activity in a hermetic detector system surrounding the decay region. In order to detect this highly suppressed decay, expected at the 3×10^{-11} level, it is important to reject background events related to other kaon decay modes. Recently, KOTO achieved an experimental sensitivity of 1.3×10^{-9} and upgraded some detector systems for further improvements. The Downstream Charged Veto(DCV) is one of them, designed to further reject background events related to $K_L \to \pi^+\pi^-\pi^0$ decay. To detect charged pions, the DCV is composed of two plastic scintillator pipes read out by MPPCs through wavelength shifting fibers. It is placed inside the beam pipe where is the limited space. The First beam commissioning was finished on April 2019. We will present the fabrication process and performance of the DCV.

Author: KIM, HongMin (Chonbuk National University)

Presenter: KIM, HongMin (Chonbuk National University)

Session Classification: Poster session

Contribution ID: **38** Type: **Poster**

Normalization Studies on the 2016-2018 Data for the KOTO Experiment

Tuesday 10 September 2019 17:41 (1 minute)

The KOTO experiment at the J-PARC research facility in Tokai, Japan aims to observe and measure the rare decay of the neutral kaon, $K_L^0 \to \pi^0\nu\bar{\nu}$. This decay has a Standard Model (SM) predicted branching ratio (BR) of $(3.00 \pm 0.30) \times 10^{-11}$ [1]. While this decay is extremely rare, it is one of the best decays in the quark sector to probe for new physics beyond the SM due to small theoretical uncertainties. In 2018, KOTO set a new experimental limit of BR($K_L^0 \to \pi^0\nu\bar{\nu}$) $< 3.0 \times 10^{-9}$ from data collected in 2015, improving the best experimental upper limit by an order of magnitude [2]. From 2016 to 2018, KOTO collected around 1.5 times more data than in 2015, and the analysis of this dataset is currently underway. A critical part of this analysis includes a detailed study of the normalization modes, $K_L^0 \to 3\pi^0$, $K_L^0 \to 2\pi^0$, and $K_L^0 \to 2\gamma$, which are used to calculate the K_L flux and kinematic and veto cut efficiencies. This poster will focus on the 2016-2018 data and the details of the normalization mode studies.

References:
[1] A. Buras et al., JHEP, vol. 1511, no. 033 (2015)
[2] J. K. Ahn et al., Phys. Rev. Lett. vol. 122, p. 021802 (2019)

Author: HUTCHESON, Melissa (University of Michigan)

Presenter: HUTCHESON, Melissa (University of Michigan)

Session Classification: Poster session

Contribution ID: **39** Type: **Poster**

Results on the search for the $K_L \to \pi^0\nu\bar{\nu}$ decay with the KOTO detector at J-PARC

Tuesday 10 September 2019 17:42 (1 minute)

The KOTO experiment was designed to observe and study the $K_L \to \pi^0\nu\bar{\nu}$ decay at J-PARC. The Standard Model (SM) prediction for the process is (3.0±0.3) x 10^{-11} with small uncertainties. This unique golden decay is an ideal candidate to probe for new physics and can place strict constraints on beyond the standard model (BSM) theories. The previous experimental upper limit of the branching ratio (BR) was set by the KEK E391a collaboration as BR 2.6 x 10^{-8}.

The signature of the decay is a pair of photons from the π^0 decay and no other detected particles, and a large discernible transverse momentum. For the measurement of the energies and positions of the photons, KOTO uses a Cesium Iodide (CSI) electromagnetic calorimeter as the main detector, and hermetic veto counters to guarantee that there are no other detected particles. KOTO's initial data was collected in 2013 and achieved a similar sensitivity to the E391a result. We completed hardware upgrades and had the first major physics runs in 2015. I will present KOTO's results from the physics runs in 2015 were we set a new upper limit of BR $<$ 3.0 x 10^{-9} at 90\%(C.L.).

Author: BECKFORD, Brian (University of Michigan)

Presenter: BECKFORD, Brian (University of Michigan)

Session Classification: Poster session

Contribution ID: **40** Type: **Poster**

The Data-Acquisition System with Cluster-Finding Trigger at the J-PARC KOTO Experiment

Tuesday 10 September 2019 17:40 (1 minute)

The J-PARC KOTO experiment aims to search the rare kaon decay $K_L^0 \to \pi^0\nu\bar{\nu}$, which breaks CP in the FCNC process. It is sensitive to the new physics beyond the Standard Model because of the small theoretical uncertainty. The signature of $K_L^0 \to \pi^0\nu\bar{\nu}$ is two photon clusters on the CsI calorimeter from the pion without any hit in other detector components. To collect $K_L^0 \to \pi^0\nu\bar{\nu}$ with that signature, the two-level trigger system is introduced. The custom-designed ADCs continuously sample and digitize the analog pulses from nearly 4000 channels for each $8\ ns$. The first level trigger is determined by the combination of energy sum in the CsI calorimeter and other detector parts in veto. The clustering bits generated in each ADC are then sent to a custom-designed module for counting the number of clusters, which is the condition for the second level trigger. The architecture and the performance of this system after the commission from 2017 will be presented.

Author: Mr LIN, Chieh (National Taiwan University)

Presenter: Mr LIN, Chieh (National Taiwan University)

Session Classification: Poster session

Contribution ID: **41** Type: **Talk**

Search for the rare decay $K_L \to \pi^0\nu\bar{\nu}$ at J-PARC KOTO experiment

Tuesday 10 September 2019 11:20 (30 minutes)

The KOTO experiment aims to observe the CP-violating rare decay, $K_L \to \pi^0\nu\bar{\nu}$, at J-PARC.
We will present the new analysis result of $K_L \to \pi^0\nu\bar{\nu}$ search in the KOTO experiment.
In this analysis we used the data set collected in 2016, 2017 and 2018.
The data was taken with a new trigger system and a new barrel photon veto detector which had been installed just before the 2016 run to suppress $K_L \to 2\pi^0$ background.
This data set has 1.5 times the statistics of the 2015 physics run used to set the best upper limit to-date for the branching fraction of the decay, $K_L \to \pi^0\nu\bar{\nu}$.
From the 2015 analysis we learned the importance of understanding the neutron-induced backgrounds and reducing the signal loss due to accidental hits triggering the veto detectors.
Since then we have developed new analysis methods to reduce the neutron-induced backgrounds by collecting larger neutron-enriched control samples, and to improve on the identification of accidentals by analyzing the time evolution of the waveform recorded in veto detectors.
In this talk, the analysis result using these new analysis methods will be presented.

Author: Mr SHINOHARA, Satoshi (Osaka University)

Presenter: Mr SHINOHARA, Satoshi (Osaka University)

Session Classification: Hot topics

Contribution ID: **43** Type: **Talk**

Status and Prospect of KOTO Step-I

Friday 13 September 2019 09:25 (20 minutes)

KOTO (step-I) is the first experiment with the designed sensitivity of $O(10^{-11})$ to probe for new physics through the rare $K_L^0 \to \pi^0\nu\bar{\nu}$ decay. In 2018-2019, there were critical changes in the detector and the data acquisition system that further improved the research potential of KOTO. One of the significant changes in the detector was the dual-sided readout system of the CsI calorimeter to measure shower depth. This change not just suppressed the neutron background of the $K_L^0 \to \pi^0\nu\bar{\nu}$ analysis, but potentially enabled KOTO to perform other rare-decay searches. Another change along with the detector was the newly designed trigger system, which opened up the bandwidth of data-collection for diverse research topics. This talk will cover the status and prospect of the analysis program in KOTO step-I.

Author: Dr TUNG, Yu-Chen (University of Chicago)

Presenter: Dr TUNG, Yu-Chen (University of Chicago)

Session Classification: Present and Future of Flavor Physics

Contribution ID: **44** Type: **Talk**

Recent progress in kaon 4-body semileptonic decays

Tuesday 10 September 2019 14:50 (25 minutes)

I will report on recent studies of the decays Kˆ+->piˆ+piˆ0eˆ+eˆ- and K_S->piˆ+piˆ-eˆ+eˆ-, focusing on their role as chiral tests. I will discuss how a precise enough measurement of any of these decay modes at CERN would help to complete the experimental determination of the NLO chiral counterterms involved in radiative kaon decays. I will also comment on the existing theoretical estimates for these counterterms and to what extent they are compatible with the present experimental numbers.

Author: Dr CATA, Oscar

Co-authors: Dr D'AMBROSIO, Giancarlo; Dr CAPPIELLO, Luigi

Presenter: Dr CATA, Oscar

Session Classification: Semileptonic and 4 bodies kaon decays and CKM matrix

Contribution ID: **45** Type: **Talk**

Light HNLs in beam dump experiments.

Friday 13 September 2019 11:15 (25 minutes)

Heavy neutral leptons (HNLs) with masses below the electroweak scale offer a testable explanation for observed masses and mixings of active neutrinos. Moreover, at the same time, they could be responsible for the generation of the baryon asymmetry of the Universe.
We describe production and decay channels of such HNLs. We demonstrate that some additional information (Dirac vs Majorana nature, CP violating phase) can be inferred if such particles will be detected in beam dump experiments.

Author: TIMIRYASOV, Inar (EPFL)

Presenter: TIMIRYASOV, Inar (EPFL)

Session Classification: New Physics

Contribution ID: **46** Type: **Talk**

Latest measurement of $K^+ \to \pi^+ \nu\bar{\nu}$ with the NA62 experiment at CERN

Tuesday 10 September 2019 11:50 (30 minutes)

The decay $K^+ \to \pi^+ \nu\bar{\nu}$, with a very precisely predicted branching ratio of less than 10-10, is one of the best candidates to reveal indirect effects of new physics at the highest mass scales. The NA62 experiment at the CERN SPS is designed to measure the branching ratio of the $K^+ \to \pi^+ \nu\bar{\nu}$ with a decay-in-flight technique. NA62 took data so far in 2016-2018. Statistics collected in 2016 allowed NA62 to reach the Standard Model sensitivity for $K^+ \to \pi^+ \nu\bar{\nu}$, entering the domain of 10-10 single event sensitivity and showing the proof of principle of the experiment. Thanks to the statistics collected in 2017, NA62 surpasses the present best sensitivity. The analysis strategy is reviewed and the preliminary result from the 2017 data set is presented.

Author: RUGGIERO, Giuseppe (Lancaster University (GB))

Presenter: RUGGIERO, Giuseppe (Lancaster University (GB))

Session Classification: Hot topics

Contribution ID: **47** Type: **Talk**

Searches for lepton flavour and lepton number violation in K+ decays with the NA62 experiment

Thursday 12 September 2019 09:40 (25 minutes)

The NA62 experiment at CERN collected a large sample of charged kaon decays into final states with multiple charged particles in 2016-2018. The sensitivity to a range of lepton flavour and lepton number violating kaon decays provided by this data set improves over the previously reported measurements. Results from the searches for these processes with a partial NA62 data sample are presented.

Author: CENCI, Patrizia (INFN Perugia (IT))

Presenter: Dr DUK, Viacheslav (University of Birmingham)

Session Classification: Rare and forbidden Kaon decays - 1

Contribution ID: **48** Type: **Talk**

Search for an invisible vector boson from π0 decays at NA62

Friday 13 September 2019 11:40 (20 minutes)

The high-intensity setup, trigger system flexibility, and detector performance –high-frequency tracking of beam particles, redundant PID, ultra-high-efficiency photon vetoes –make NA62 particularly suitable for searching for new-physics effects from different scenarios. We report the results of a search for π0 decays to one photon and an invisible massive dark photon. From a total of about 400$ million π0 decays, no signal is observed beyond the expected fluctuation of the background and limits are set in the plane of the dark photon coupling to ordinary photon versus dark photon mass.

Author: CENCI, Patrizia (INFN Perugia (IT))

Presenter: SPADARO, Tommaso (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: New Physics

Contribution ID: **49** Type: **Talk**

Exotic searches at the NA62 experiment at CERN

Friday 13 September 2019 12:20 (20 minutes)

The features of the NA62 experiment at the CERN SPS - high-intensity setup, trigger-system flexibility, high-frequency tracking of beam particles, redundant particle identification, and ultra-high-efficiency photon vetoes - make NA62 particularly suitable to search for long-lived, weakly-coupled particles within Beyond the Standard Model (BSM) physics.
Searches for Heavy Neutral Lepton (HNL) production in charged kaon decays using the data collected by the NA62 experiment are reported. Upper limits are established on the elements of the extended neutrino mixing matrix for HNL masses in the range 130-450 MeV, improving on the results from previous HNL production searches. Sensitivity results for production and decay searches of Axion-Like Particles (ALP) are also presented.
Prospects for future data taking at the NA62 experiment and achievable sensitivities for searches of Dark Photons, Heavy Neutral Leptons and Axion-Like Particles will be reviewed.

Author: CENCI, Patrizia (INFN Perugia (IT))

Presenter: GOUDZOVSKI, Evgueni (University of Birmingham)

Session Classification: New Physics

Contribution ID: **50** Type: **Talk**

First observation and study of the K± ⟶ π±π0e+e− decay with the NA48/2 experiment at CERN

Tuesday 10 September 2019 15:15 (25 minutes)

The NA48/2 experiment at CERN reports the first observation of the K± ⟶ π±π0e e− decay from an exposure of 1.7×1011 charged kaon decays recorded in 2003–2004. A sample of 4919 candidates with 4.9% background contamination allows the determination of the branching ratio in the full kinematic region. The study of the kinematic space shows evidence for a structure dependent contribution in agreement with predictions based on chiral perturbation theory. Several P- and CP-violating asymmetries are also evaluated.

Author: BLOCH-DEVAUX, Brigitte (Universita e INFN Torino (IT))

Presenter: BLOCH-DEVAUX, Brigitte (Universita e INFN Torino (IT))

Session Classification: Semileptonic and 4 bodies kaon decays and CKM matrix

Contribution ID: **51** Type: **Talk**

Charged Kaon semi-leptonic form factors from NA48/2

Tuesday 10 September 2019 14:00 (25 minutes)

The most precise measurement of the charged kaon semi-leptonic form factors obtained by NA48/2 with 4.4 million Ke3 and 2.3 million Kmu3 events collected in 2004 will be presented.

Author: CENCI, Patrizia (INFN Perugia (IT))

Presenter: LAMANNA, Gianluca (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: Semileptonic and 4 bodies kaon decays and CKM matrix

Contribution ID: **52** Type: **Talk**

K to Pi nu nu and new physics in the neutrinos

Thursday 12 September 2019 11:40 (30 minutes)

I discuss generic effects of new physics on the rare decay modes KL ⟶ π0νν̄ and K+ ⟶ π+νν̄ from the point of view of the neutrino sector. I consider left-handed neutrino couplings; right handed neutrino couplings; neutrino lepton flavour violating (LFV) interactions; and ΔI = 3/2 interactions. The first of these cases has been studied before as it covers many new physics extensions of the standard model; the second one requires the existence of a new light (sterile) right-handed neutrino and its contribution to both branching ratios is always additive to the SM. It is motivated as a possible solution to the so called charged B anomalies. The case of neutrino LFV couplings produces interesting constraints on CLFV modes such as semi-tauonic tau decay.

Author: Prof. VALENCIA, German (Monash University - School of Physics and Astronomy)

Presenter: Prof. VALENCIA, German (Monash University - School of Physics and Astronomy)

Session Classification: Rare and forbidden Kaon decays - 2

Contribution ID: **53** Type: **Talk**

Higgs boson couplings to quarks and leptons at the ATLAS experiment

Wednesday 11 September 2019 10:00 (25 minutes)

In the Standard Model, fermion masses are generated by Yukawa couplings between the Higgs boson and the fermions. These couplings can be determined from measurements of Higgs boson production and decays. For example, Higgs boson production via gluon fusion and in association with a ttbar pair are sensitive to the top Yukawa coupling, and Higgs boson decays to fermions are sensitive to the lighter fermion Yukawa couplings. In addition, differential distributions and rare decays to a meson and a photon can be used to set limits on light fermion Yukawa couplings. This talk presents an overview of these measurements and their results.

Author: ATLAS COLLABORATION

Presenter: WANG, Zirui (Shanghai Jiao Tong University (CN))

Session Classification: ElectroWeak - Standard Model

Contribution ID: **54** Type: **Talk**

Searches for Charged Lepton Flavour Violation with the ATLAS Experiment

Thursday 12 September 2019 14:30 (25 minutes)

Charged Lepton flavour violation (LVF) is a striking signature of potential beyond the Standard Model physics. Searches for LFV with the ATLAS detector are reported in channels focusing on the decay of the Higgs boson, the Z boson and of a heavy neutral gauge boson, Z', using pp collisions data with a center of mass energy of 13 TeV

Author: ATLAS COLLABORATION

Presenter: ITURBE, Julia (The Chinese University of Hong Kong (HK))

Session Classification: Other rare decays

Contribution ID: **57** Type: **Talk**

Introduction to Kaon 2019

Tuesday 10 September 2019 09:50 (40 minutes)

Introduction to Kaon 2019 - Experiments -

Presenter: YAMANAKA, Taku (Osaka University)

Session Classification: Introduction

Contribution ID: **58** Type: **Talk**

Latest results of the K to pi-nu-nu branching ratio calculations

Tuesday 10 September 2019 10:50 (30 minutes)

Presenter: GORBAHN, Martin (Liverpool University)

Session Classification: Hot topics

Contribution ID: **59** Type: **Talk**

Extraction of Vus from experimental measurements

Tuesday 10 September 2019 14:25 (25 minutes)

Presenter: PASSEMAR, Emilie

Session Classification: Semileptonic and 4 bodies kaon decays and CKM matrix

Contribution ID: **60** Type: **Talk**

Connection between B anomalies and Kaon physics

Wednesday 11 September 2019 09:00 (30 minutes)

Presenter: MARZOCCA, David (University of Zurich)

Session Classification: ElectroWeak - Standard Model

Contribution ID: **61** Type: **Talk**

K->pi-pi decay, epsilon' and the RBC-UKQCD kaon physics program

Wednesday 11 September 2019 11:10 (30 minutes)

An overview of the kaon physics program of the RBC and UKQCD collaborations will be presented with a focus on the lattice calculation of K->pi-pi decay and the direct CP violation parameter epsilon'. We will describe substantial improvements to our earlier 2015 K->pi-pi calculation, including the use of three independent pi-pi interpolating operators and the results we obtain for I=0 pi-pi scattering for energies at and below the kaon mass. While a new result for epsilon' is not yet complete, the enhanced statistics and improved analysis that underlies our expanded calculation will be presented.

Presenter: CHRIST, Norman (Columbia University)

Session Classification: Epsilon'/Epsilon

Contribution ID: **62** Type: **Talk**

Higher-order contributions to direct CP violation in □→□□ decays

Wednesday 11 September 2019 11:40 (30 minutes)

Novel lattice results reveal a tension between the measured direct CP violation in □→□□ decays and the standard model theory prediction. This inconsistency could have several sources, one of which could be the missing contribution of new particles in the theory predictions. However, a reliable standard model prediction is needed to disentangle possible new physics effects from the standard model background. As rapid progress on the lattice is bringing non-perturbative long-distance effects under control, a more precise knowledge of short-distance contributions is essential. We describe higher-order QCD contributions for this observable and discuss future prospects, as well as issues of scheme dependence and the separation of perturbative and non-perturbative effects.

Presenter: CERDÀ-SEVILLA, Maria

Session Classification: Epsilon'/Epsilon

Contribution ID: **63** Type: **Talk**

The Standard Model prediction of epsilon'/epsilon

Wednesday 11 September 2019 12:40 (30 minutes)

We review the current status of epsilon'/epsilon within the Standard Model, discussing in detail the different ingredients that enter into the calculation of this observable. Both short-distance and long-distance contributions need to be taken into account, within a properly-defined theoretical framework. An update of the Standard Model prediction is presented and the prospects for future improvements are analysed.

Presenter: PICH, Antonio (IFIC, U. Valencia -.)

Session Classification: Epsilon'/Epsilon

Contribution ID: **64** Type: **Talk**

Rare kaon decays in general and recent results on K⟶ pill

Thursday 12 September 2019 08:45 (30 minutes)

After a brief review of some theoretical aspects and difficulties related to the calculation of rare kaon decays in the SM, I describe recent work done in the particular case of the K⟶ pill decay

Presenter: KNECHT, Marc (CNRS)

Session Classification: Rare and forbidden Kaon decays - 1

Contribution ID: **65** Type: **Talk**

Latest results on lattice calculations concerning K->pill decays

Thursday 12 September 2019 09:15 (25 minutes)

Previous lattice calculations by the RBC and UKQCD collaborations, at an unphysical pion mass, have successfully extracted the matrix elements needed to describe the form factor of the $K \to \pi\ell^+\ell^-$ decay.

I will present the latest results of the calculation at the physical point and discuss future outlooks.

Presenter: O HOGAIN, Fionn

Session Classification: Rare and forbidden Kaon decays - 1

Contribution ID: **66** Type: **Talk**

Eps'/Eps, K+-> pi+ nunubar and KL-> pi0 nunubar in the Standard Model and Beyond

Thursday 12 September 2019 12:10 (30 minutes)

Presenter: BURAS, Andrzej (Munich)

Session Classification: Rare and forbidden Kaon decays - 2

Contribution ID: **67** Type: **Talk**

Results and prospects from the PIENU experiment

Thursday 12 September 2019 15:20 (20 minutes)

 The PIENU experiment at TRIUMF aims to measure the branching ratio, R_{e/mu;} = Gamma;(pi;⁺ rarr; e⁺nu;(gamma;))/Gamma;(pi;⁺ rarr; mu;⁺nu;(gamma with 0.1providing the most precise test of the lepton universarity. The collaboration collected physics data during 2009–2012, and the result of R_{e/mu;} based on part of the 2010 data was published in 2015. The analysis of the full data set (10⁷ of pi;⁺ rarr; e⁺ nu; decays) with 0.1

The search for heavy neutrinos in pi;rarr;enu; and pi;rarr;mu;nu; decays were also performed using the high statistics pion-decay data we had accumulated. The results were published in 2018 for pi;rarr;enu; and accepted-for-publication for pi;rarr;mu;nu;.

The result of the heavy neutrinos search and the updated status of the R_{e/mu;} analysis with the full data set will be presented.

Presenter: AOKI, Masaharu (Osaka University)

Session Classification: Other rare decays

Contribution ID: **68** Type: **Talk**

Feebly interacting particles: experimental landscape

Friday 13 September 2019 12:40 (25 minutes)

Light feebly interacting particles (axions/ALPs, HNLs, Dark Photons, Dark Scalars) represent an alternative paradigm to the current lore of strongly coupled New Physics at the TeV scale and are getting an increasing attention within the accelerator-based communities.
I will review the experimental prospects for their searches at beam dump, fixed-target, and collider-based experiments.

Presenter: LANFRANCHI, Gaia (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: New Physics

Contribution ID: **70** Type: **Talk**

KAON 2019 experimental summary

Friday 13 September 2019 14:55 (45 minutes)

KAON 2019 experimental summary

Presenter: LAZZERONI, Cristina (University of Birmingham (GB))

Session Classification: Conclusions

Contribution ID: **71** Type: **Talk**

Welcome by the INFN

Tuesday 10 September 2019 09:30 (10 minutes)

Presenter: CENCI, Patrizia (INFN Perugia (IT))

Session Classification: Welcome

Contribution ID: **73** Type: **Talk**

KAON 2019 theory summary

Friday 13 September 2019 14:10 (45 minutes)

KAON 2019 theory summary

Presenter: KNECHT, Marc (CNRS)

Session Classification: Conclusions

Contribution ID: **74** Type: **Talk**

KAON 2019 concluding remarks

Friday 13 September 2019 15:40 (20 minutes)

Presenters: CENCI, Patrizia (INFN Perugia (IT)); YAMANAKA, Taku (Osaka University)

Session Classification: Conclusions

Contribution ID: **75** Type: **Poster**

SEARCH FOR EXOTIC DECAYS WITH NA62

Tuesday 10 September 2019 17:50 (1 minute)

The features of the NA62 experiment at the CERN SPS - high-intensity setup, trigger-system flexibility, high-frequency tracking of the beam particles, redundant particle identification, and high-efficiency photon vetoes - make NA62 particulary suitable to search for long-lived, weakly-coupled particles within Beyond the Standard Model physics, using kaon and pion decays as well as operating the experiment in dump mode.
The NA62 sensitivity for search of Dark Photons, Heavy Neutral Leptons and Axion-Like Particles are presented, together with prospects for future data taking at the NA62 experiment.

Presenter: ZAMKOVSKY, Michal (Charles University (CZ))

Session Classification: Poster session

Contribution ID: **76** Type: **Poster**

The RICH detector of the NA62 experiment

Tuesday 10 September 2019 17:51 (1 minute)

NA62 is the last generation kaon experiment at the CERN SPS aiming to study the ultra-rare $K^+ \to \pi^+\nu\overline{\nu}$ decay.
The challenging aspect of NA62 is the suppression of background decay channels with BR up to 10 orders of magnitude higher than the signal and with similar experimental signature, such as $K^+ \to \mu^+\nu$. To this purpose, the NA62 experimental strategy requires, among other conditions, good particle identification (PID) capability and rejection power of the kinematic selection.
A key element of PID in NA62 is the Ring-Imaging Cherenkov (RICH) detector, exploiting neon gas at atmospheric pressure as radiator medium. According to the NA62 requirements,
the RICH identifies μ^+ and π^+ in the momentum range between 15 and 35 GeV/c with a muon rejection factor of 10^{-2}.
It also measures the arrival time of charged particles with a
precision better than 100 ps, needed to correctly associate the π^+ with the parent K^+ at a kaon decay rate of about 5 MHz, and is one of the main components of the NA62 trigger system.
The RICH detector has been successfully operated during the 2016, 2017 and 2018 data taking periods of NA62. The main design aspects and operational characteristics of the detector will be described in detail and a detailed report of its performance, directly measured with the data collected, will be presented.

Presenters: BRIZIOLI, Francesco (Universita e INFN, Perugia (IT)); LOLLINI, Riccardo (Universita e INFN, Perugia (IT))

Session Classification: Poster session

Contribution ID: **77** Type: **Poster**

The RICH detector of the NA62 experiment

Wednesday 11 September 2019 14:26 (1 minute)

NA62 is the last generation kaon experiment at the CERN SPS aiming to study the ultra-rare $K^+ \to \pi^+\nu\overline{\nu}$ decay.
The challenging aspect of NA62 is the suppression of background decay channels with BR up to 10 orders of magnitude higher than the signal and with similar experimental signature, such as $K^+ \to \mu^+\nu$. To this purpose, the NA62 experimental strategy requires, among other conditions, good particle identification (PID) capability and rejection power of the kinematic selection.
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The RICH detector has been successfully operated during the 2016, 2017 and 2018 data taking periods of NA62. The main design aspects and operational characteristics of the detector will be described in detail and a detailed report of its performance, directly measured with the data collected, will be presented.

Presenters: BRIZIOLI, Francesco (Universita e INFN, Perugia (IT)); LOLLINI, Riccardo (Universita e INFN, Perugia (IT))

Session Classification: Poster session

Contribution ID: **78** Type: **Poster**

SEARCH FOR EXOTIC DECAYS WITH NA62

Wednesday 11 September 2019 14:25 (1 minute)

The features of the NA62 experiment at the CERN SPS - high-intensity setup, trigger-system flexibility, high-frequency tracking of the beam particles, redundant particle identification, and high-efficiency photon vetoes - make NA62 particulary suitable to search for long-lived, weakly-coupled particles within Beyond the Standard Model physics, using kaon and pion decays as well as operating the experiment in dump mode.
The NA62 sensitivity for search of Dark Photons, Heavy Neutral Leptons and Axion-Like Particles are presented, together with prospects for future data taking at the NA62 experiment.

Presenter: ZAMKOVSKY, Michal (Charles University (CZ))

Session Classification: Poster session

Contribution ID: **79** Type: **Poster**

The Data-Acquisition System with Cluster-Finding Trigger at the J-PARC KOTO Experiment

Wednesday 11 September 2019 14:24 (1 minute)

The J-PARC KOTO experiment aims to search the rare kaon decay $K_L^0 \to \pi^0\nu\bar{\nu}$, which breaks CP in the FCNC process. It is sensitive to the new physics beyond the Standard Model because of the small theoretical uncertainty. The signature of $K_L^0 \to \pi^0\nu\bar{\nu}$ is two photon clusters on the CsI calorimeter from the pion without any hit in other detector components. To collect $K_L^0 \to \pi^0\nu\bar{\nu}$ with that signature, the two-level trigger system is introduced. The custom-designed ADCs continuously sample and digitize the analog pulses from nearly 4000 channels for each $8\ ns$. The first level trigger is determined by the combination of energy sum in the CsI calorimeter and other detector parts in veto. The clustering bits generated in each ADC are then sent to a custom-designed module for counting the number of clusters, which is the condition for the second level trigger. The architecture and the performance of this system after the commission from 2017 will be presented.

Author: Mr LIN, Chieh (National Taiwan University)

Presenter: Mr LIN, Chieh (National Taiwan University)

Session Classification: Poster session

Contribution ID: **80** Type: **Poster**

Results on the search for the $K_L \to \pi^0\nu\bar{\nu}$ decay with the KOTO detector at J-PARC

Wednesday 11 September 2019 14:23 (1 minute)

The KOTO experiment was designed to observe and study the $K_L \to \pi^0\nu\bar{\nu}$ decay at J-PARC. The Standard Model (SM) prediction for the process is (3.0±0.3) x 10^{-11} with small uncertainties. This unique golden decay is an ideal candidate to probe for new physics and can place strict constraints on beyond the standard model (BSM) theories. The previous experimental upper limit of the branching ratio (BR) was set by the KEK E391a collaboration as BR 2.6 x 10^{-8}.

The signature of the decay is a pair of photons from the π^0 decay and no other detected particles, and a large discernible transverse momentum. For the measurement of the energies and positions of the photons, KOTO uses a Cesium Iodide (CSI) electromagnetic calorimeter as the main detector, and hermetic veto counters to guarantee that there are no other detected particles. KOTO's initial data was collected in 2013 and achieved a similar sensitivity to the E391a result. We completed hardware upgrades and had the first major physics runs in 2015. I will present KOTO's results from the physics runs in 2015 were we set a new upper limit of BR $<$ 3.0 x 10^{-9} at 90\%(C.L.).

Author: BECKFORD, Brian (University of Michigan)

Presenter: BECKFORD, Brian (University of Michigan)

Session Classification: Poster session

Contribution ID: **81** Type: **Poster**

Normalization Studies on the 2016-2018 Data for the KOTO Experiment

Wednesday 11 September 2019 14:22 (1 minute)

The KOTO experiment at the J-PARC research facility in Tokai, Japan aims to observe and measure the rare decay of the neutral kaon, $K_L^0 \to \pi^0\nu\bar{\nu}$. This decay has a Standard Model (SM) predicted branching ratio (BR) of $(3.00 \pm 0.30) \times 10^{-11}$ [1]. While this decay is extremely rare, it is one of the best decays in the quark sector to probe for new physics beyond the SM due to small theoretical uncertainties. In 2018, KOTO set a new experimental limit of BR($K_L^0 \to \pi^0\nu\bar{\nu}$) $< 3.0 \times 10^{-9}$ from data collected in 2015, improving the best experimental upper limit by an order of magnitude [2]. From 2016 to 2018, KOTO collected around 1.5 times more data than in 2015, and the analysis of this dataset is currently underway. A critical part of this analysis includes a detailed study of the normalization modes, $K_L^0 \to 3\pi^0$, $K_L^0 \to 2\pi^0$, and $K_L^0 \to 2\gamma$, which are used to calculate the K_L flux and kinematic and veto cut efficiencies. This poster will focus on the 2016-2018 data and the details of the normalization mode studies.

References:
[1] A. Buras et al., JHEP, vol. 1511, no. 033 (2015)
[2] J. K. Ahn et al., Phys. Rev. Lett. vol. 122, p. 021802 (2019)

Author: HUTCHESON, Melissa (University of Michigan)

Presenter: HUTCHESON, Melissa (University of Michigan)

Session Classification: Poster session

Contribution ID: **82** Type: **Poster**

A new charged particle detector for the KOTO experiment at J-PARC.

Wednesday 11 September 2019 14:21 (1 minute)

The KOTO experiment at J-PARC is searching for the $K_L \to \pi^0\nu\bar{\nu}$ decay, which is one of the most sensitive probes to new physics beyond the Standard Model. Its signature is a pair of photons from a π^0 decay without any additional activity in a hermetic detector system surrounding the decay region. In order to detect this highly suppressed decay, expected at the 3×10^{-11} level, it is important to reject background events related to other kaon decay modes. Recently, KOTO achieved an experimental sensitivity of 1.3×10^{-9} and upgraded some detector systems for further improvements. The Downstream Charged Veto(DCV) is one of them, designed to further reject background events related to $K_L \to \pi^+\pi^-\pi^0$ decay. To detect charged pions, the DCV is composed of two plastic scintillator pipes read out by MPPCs through wavelength shifting fibers. It is placed inside the beam pipe where is the limited space. The First beam commissioning was finished on April 2019. We will present the fabrication process and performance of the DCV.

Author: KIM, HongMin (Chonbuk National University)

Presenter: KIM, HongMin (Chonbuk National University)

Session Classification: Poster session

Contribution ID: **83** Type: **Poster**

Neutron rejection performance of the upgraded KOTO CsI calorimeter

Wednesday 11 September 2019 14:20 (1 minute)

We are searching for the $K_L \to \pi^0\nu\bar{\nu}$ decay at the J-PARC KOTO experiment. This decay mode is highly suppressed in the Standard Model and its branching ratio is predicted to be $(3.0 \pm 0.3) \times 10^{-11}$ with small theoretical uncertainties. This decay mode is thus sensitive to new physics beyond the Standard Model.
The signature of the signal events is two photons from a π^0 decay and no other detected particles.One of the main background sources is caused by the beam halo neutron producing a hadronic shower in the CsI calorimeter and new neutron from this shower interacting at another position of the CsI calorimeter.To suppress this neutron backgrounds, we installed MPPCs (silicon photo sensor) on the upstream surface of CsI calorimeter in 2018.Neutrons and photons can be distinguished by using timing difference of the MPPC signal from upstream and the PMT signal from downstream. I will present the performance of the neutron background reduction with the upgraded CsI calorimeter.

Author: Ms OSUGI, Mayu (Osaka University, Japan)

Presenter: Ms OSUGI, Mayu (Osaka University, Japan)

Session Classification: Poster session

Contribution ID: **84** Type: **Poster**

Construction of the double-side readout calorimeter for $K_L \to \pi^0\nu\bar{\nu}$ search

Wednesday 11 September 2019 14:19 (1 minute)

We are searching for the decay $K_L \to \pi^0\nu\bar{\nu}$ at the KOTO experiment in J-PARC. The standard model prediction for the branching ratio (BR) is $(3.0 \pm 0.3) \times 10^{-11}$. In 2018 KOTO achieved the best upper limit to date of BR$< 3.0 \times 10^{-9}(90\%$ C.L.), improving by an oder of magnitude the previous limit by KEK E391a. The experimental signature is two photons from the π^0. To detect this simple signature, the KOTO detector consists of a cesium iodide (CsI) calorimeter and hermetical veto counters in a high vacuum environment. The calorimeter is made of 50-cm-long CsI crystals stacked in a cylinder of 1.9 m diameter. Each crystal is read out with a PMT on its back side.

For the next step, we have updated the calorimeter to reduce one of the major backgrounds caused by a neutron generating two clusters in the calorimeter. Because neutrons tend to generate scintillation showers deeper in the calorimeter, the updated calorimeter reads out the scintillation lights from the front side and the back side of the crystals—the time difference between the front and back readout helps in separating photons from neutrons.

To implement a double side readout, we have installed 4000 silicon photomultipliers˜(SiPMs) on the front surface of crystals in addition to PMTs on the back surface. The construction was carried out on-site without disassembling the stack of crystals in the detector from September to December 2018. I will report the special techniques we used to glue the SiPMs on the CsI crystals to keep UV transparency, mechanical robustness, radiation tolerance, and vacuum resistance.

Author: KOTERA, Katsushige (Osaka University)

Presenter: KOTERA, Katsushige (Osaka University)

Session Classification: Poster session

Contribution ID: **85** Type: **Poster**

Study of the kaon electromagnetic form factors in e^+e^- annihilation and τ decays

Wednesday 11 September 2019 14:18 (1 minute)

The recent measurements of the $\tau^- toK^-K_S\nu_\tau$ decay spectral function carried out with BABAR detector is described. Combining the results on K^-K mass spectrum and measurements of $e^+e^- \to K_SK_L$ and $e^+e^- \to K^+K^-$ cross sections, the isoscalar and isovector electromagnetic kaon form factors and their relative phase are derived in a model independent way. The experimental results are compared with a fit based on the vector-meson-dominance model.

Author: Dr SEREDNYAKOV, Sergey (Novosibirsk State University)

Presenter: Dr SEREDNYAKOV, Sergey (Novosibirsk State University)

Session Classification: Poster session

Contribution ID: **86** Type: **Poster**

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

Wednesday 11 September 2019 14:15 (1 minute)

Spin correlations for the $\Lambda\Lambda$ and $\Lambda\bar{\Lambda}$ pairs, produced 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 – thus, the respective spin correlations can be
rather easily distinguished and studied experimentally, which is especially important for studies of multiple particle generation at modern and future ion colliders (RHIC, LHC, NICA). 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 and singlet states of respective pairs, are discussed.

In this report, spin correlations for two identical ($\Lambda\Lambda$) and two non-identical ($\Lambda\bar{\Lambda}$) particles are generally considered within the conventional model of one-particle sources, implying that correlations vanish at
enough large relative momenta. However, under these conditions (especially at
ultrarelativistic energies), for two non-identical particles ($\Lambda\bar{\Lambda}$) the two-particle – quark-antiquark and two-gluon – annihilation sources 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.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **87** Type: **Poster**

On the spin correlations of final leptons generated in the high-energy two-photon processes $\gamma\gamma \to e^+e^-, \mu^+\mu^-, \tau^+\tau^-$

Wednesday 11 September 2019 14:17 (1 minute)

The theoretical study of spin structure for the processes of lepton pair
production by pairs of γ quanta, which may be emitted in various relativistic hadronic reactions and decays (in particular – in the rare two-photon decays of the neutral kaons K^0_S and K^0_L), is performed. For the two-photon process $\gamma\gamma \to e^+e^-$, it is shown
that in the case of unpolarized photons the final electron and positron remain unpolarized as well, but their spins prove to be strongly correlated. Explicit expressions for the components of the correlation tensor and for
the relative fractions of singlet and triplet states of the final (e^+e^-) system are derived. It is demonstrated that in the process $\gamma\gamma \to e^+e^-$ at least one of the "classical" incoherence inequalities of the Bell type for the correlation tensor components is always violated (i.e. there is always at least one case when the modulus of sum of two diagonal components exceeds unity), and, thus, spin correlations of the final electron and positron in this process have the strongly pronounced quantum character.

Analogous analysis can be wholly applied also to the two-photon processes with the generation of a muon pair and a tau-lepton pair ($\gamma\gamma \to \mu^+\mu^-, \gamma\gamma \to \tau^+\tau^-$), which become possible at considerably higher energies.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **88** Type: **Poster**

On the correlations of polarizations in the system of two photons produced in hadronic decays

Wednesday 11 September 2019 14:16 (1 minute)

The theoretical study of correlations of the linear and circular polarizations in the system of two γ quanta emitted in hadronic decays (in particular – in the rare two-photon decays of the neutral kaons K^0_S and K^0_L) has been performed. The polarization of a two-photon state is described by the one-photon Stokes parameters and by the components of the correlation "tensor" in the Stokes space. It is shown that the correlations between the Stokes parameters
in the case of the two-photon decays $\pi^0 \to 2\gamma$, $\eta \to 2\gamma$, $K^0_L \to 2\gamma$, $K^0_S \to 2\gamma$ and the cascade process $|0\rangle \to |1\rangle + \gamma \to |0\rangle + 2\gamma$ ($|0\rangle$ and $|1\rangle$ are states with the spin 0 and 1, respectively) have the purely quantum
character: the incoherence inequalities of the Bell type for the components of the correlation "tensor", established previously
for the case of classical "mixtures", are violated (i.e. there is always one case when the modulus of sum of two diagonal components of the correlation "tensor" exceeds unity). The general analysis of the registration procedure for the system of two correlated photons by two one-photon detectors is performed.

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

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

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

Session Classification: Poster session

Contribution ID: **89** Type: **Talk**

Welcome by the University of Perugia

Tuesday 10 September 2019 09:40 (10 minutes)

Presenter: Prof. PETRILLO, Caterina (Università degli Studi di Perugia)

Session Classification: Welcome