FLAVOR PHYSICS & CP VIOLATION

FPCP 2015

BOOK of abstracts and information

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NAGOYA UNIVERSITY

Kobayashi-Maskawa Institute for the Origin of Particles and the Universe

Nagoya University
Tau Lepton Physics Research Center

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Challenges for New Physics in the Flavor Sector

Presenter: Dr. Wolfgang Altmannshofer (Perimeter Institute)

In this talk I will review the unique sensitivity of various flavor observables to new physics, allowing to indirectly probe very high scales beyond the direct reach of colliders. In addition, I will discuss recent anomalies in flavor observables and how they can be addressed with new physics. Finally, I will report on recent attempts to explain the hierarchical flavor structure of the SM quarks and leptons in the context of new physics models.

Theoretical Prospects for B Physics

Presenter: Prof. Robert Fleischer (Nikhef and Vrije Universiteit Amsterdam)

The exploration of B-meson decays has reached an unprecedented level of sophistication, with a phase of even much higher precision ahead of us thanks to the next run of the LHC and the future era of Belle II and the LHCb upgrade. For many processes, the theoretical challenge in the quest to reveal possible footprints of physics beyond the Standard Model will be the control of uncertainties from strong interactions. After a brief discussion of the global picture emerging from the LHC data, I will focus on the theoretical prospects and challenges for benchmark B decays to search for new sources of CP violation, and highlight future opportunities to probe the Standard Model with strongly suppressed rare B decays.

Theoretical status of non-leptonic heavy meson decays

Presenter: Prof. Rahul Sinha (The Institute of Mathematical Sciences)

I review the status and recent progress in the theoretical understanding of non leptonic heavy meson decays. I will very briefly discuss perturbative calculations in quantum chromodynamics and analyses using flavor symmetries of strong interactions. I will discuss the physics involved in understanding the three body hadronic decays examining in detail the advantage of performing the study of a Dalitz plot.

Mixing-induced CP violation in B_d decays

Presenter: Prof. Kenkichi Miyabayashi (Nara Women's University)

Measurements of mixing-incuded CP violation in various B_d decay modes have been playing essential role to perform comprehensive test of Kobayashi-Maskawa theory, especially by the decays mediated by the $b \to c$ and $b \to u$ transitions where the tree diagrams dominate. Activities extend further to hunt New Physics signature by tackling with the $b \to s$ and $b \to d$ penguin dominant decay modes to see the possible deviation with respect to the ones for the tree amplitude dominant decays. Including some recent results, a proper review of current status and future prospect are to be presented.

Mixing-induced CP violation in B_s decays

Presenter: Mr. Simon Akar (CPPM, Aix-Marseille Universit, CNRS/IN2P3, Marseille, France)

Recently LHCb reported the most precise value of the mixing-induced CP violation in the B_s system ϕ_s. The anticipated precision on this measurement requires data-driven procedures to asses the effect of sub-leading penguin diagrams. Several recent results using Cabibbo-suppressed $B_s \to J/\psi X$ decays are presented.

Recent measurements of the UT angles

Presenter: Dr. Markus Roehrken (California Institute of Technology)

The experimental determination of the angles of the Unitarity Triangle is closely related to the measurement of CP violating effects. Precise knowledge of the angles can put tight constraints on the quark flavor sector and on the Kobayashi-Maskawa scheme. In this talk recent measurements on the angles gamma and beta (phi3 and phi1, respectively) by the LHCb, BaBar and Belle experiments are presented.

Theoretical status of rare and semileptonic heavy meson decays

Presenter: Dr. Christoph Bobeth (Technical University Munich - IAS)

First, the theoretical uncertainties in semileptonic B decays will be reviewed and their influence on the determination on CKM parameters V_{ub} and V_{cb} in the standard model will be discussed, including current tensions between exclusive and inclusive determinations. Further, an overview of the theoretical status of rare B decays will be given and their role as tests of the standard model at the loop level as well as constraints on non-standard interactions will be highlighted.

Electroweak Penguin: $b \to sll$

Presenter: Dr. Christian Linn (CERN)

LHCb has recently reported several intriguing deviations from SM predictions in electroweak penguin decays of beauty hadrons, in particular in the decay $B_0 \to K^{*0}\mu\mu$. The latest measurements are reported and possible theoretical interpretations discussed.

Inclusive radiative electroweak penguin decays: $b \to s\gamma$

Presenter: Mr. Luis Pesántez (University of Melbourne)

The inclusive radiative decay $b \to s\gamma$ is a flavor-changing-neutral-current that proceeds through an electroweak penguin loop. The observables related to the decay can be precisely calculated in the Standard Model up to next-to-next-to-leading order and have been measured to a few percent accuracy. For these reasons they can provide with strong constraints on supersymmetric models and other New Physics models that predict additional Higgs scalars, or other new particles exchanged in the penguin loop. The B-factories have performed measurements of the branching fractions and CP-asymmetries using different experimental approaches: inclusive and sum of exclusive final states. We present the latest results from Belle and BABAR, give prospects for the precision expected at Belle II and present updated limits on type II Two Higgs Doublet Model parameters.

Purely leptonic and radiative leptonic B decays from the e^+e^- B-factories.

Presenter: Mr. Chanseok Park (Yonsei University)

Purely leptonic decays of B mesons provide opportunity to test the Standard Model (SM) and search for new physics (NP) beyond the SM. For instance, in some NP hypotheses, $B^+ \to \tau^+\nu_\tau$ and $B^+ \to l^+\nu_l$ can be infulenced via exchange of a new charged particle such as a charged Higgs boson from supersymmetry or from two-Higgs doublet models. In this talk, we present the recent results on purely leptonic and radiative leptonic decays of B mesons from the e^+e^- B-factory experiments, BaBar and Belle. In particular, we focus on the decays $B^+ \to \tau^+\nu_\tau$, $B^+ \to l^+\nu_l$, and $B^+ \to l^+\nu_l\gamma$. The Belle experiment has collected 772 million B-meson pairs produced by the KEKB energy-asymmetric e^+e^- collider at the $\Upsilon(4S)$ resonance, and the Babar experiment has collected 467.8 million B-meson pairs produced by the SLAC PEP-II.

new D(*) tau nu result from LHCb + non-B semileptonics

Presenter: Dr. Greg Ciezarek (Nikhef)

The discrepancy between determination of the CKM matrix elements Vub and Vcb using inclusive and exclusive decays has been a long standing issue affecting fits of the CKM unitarity triangle. Recently LHCb reported the first measurement of Vub using a decay of the Λ b baryon. Other measurements with semileptonic b-hadron decays are also presented.

New $B \to D^{(*)}\tau\nu$ result from Belle

Presenter: Prof. Thomas Kuhr (LMU)

We present an update measurement of the branching ratio of $B \to D^{(*)}\tau\nu$ relative to $B \to D^{(*)}\ell\nu$ with the full Belle dataset. A hadronic tagging method is employed to reconstruct the second B meson in the $Y(4S)$ event, which provides sufficient information to determine the invariant mass of all undetected particles. While this provides a good separation of signal and normalization modes, additional information is used to separate the signal from backgrounds with multiple undetected particles.

FLAG: Lattice QCD Tests of the Standard Model and Foretaste for Beyond

Presenter: Prof. ANASTASSIOS VLADIKAS (INFN - TOR VERGATA)

We review lattice results related to pion, kaon, D- and B-meson physics with the aim of making them easily accessible to the particle-physics community. Only a selection of FLAG averages or estimates is presented, namely the form factor $f+(0)$, arising in semileptonic $K \to \pi$ transitions at zero momentum transfer, and the decay-constant ratio f_K/f_π. We discuss the consequences of these results for the CKM matrix elements V_{us} and V_{ud}. For heavy flavours we focus on D- and B-meson decay constants and form factors and the corresponding CKM matrix elements V_{cs} and V_{cd}. In addition we briefly cover the recent advances in the calculation of B-parameters and touch upon current results relevant to the Physics beyond the Standard Model, which will be the subject of the next FLAG edition.

Charmless Hadronic B decays

Presenter: Dr. Youngmoon Goh (Hanyang University)

We report recent measurements of the branching fraction (BF) and the CP asymmetry (A_{CP}) for five rare charmless decays $B^0 \to \pi^0\pi^0$, $B^0 \to \pi^0\eta^0$, $B^+ \to \bar{K}^*(892)^0 K^*(892)^+$, $\omega\omega$ ($\omega\phi$), and $K^0_S\pi^+\pi^0$. The measured BF and A_{CP} in $B^0 \to \pi^0\pi^0$, $\pi^0\eta^0$ modes are vital for the determination of the CP-violation parameter ϕ_2 based on isospin relations in $B \to \pi\pi$ decays. The decays of $B^+ \to \bar{K}^*(892)^0 K^*(892)^+$ and $B^0 \to \omega\omega(\omega\phi)$ proceed via the penguin loop diagram and are sensitive to potential new physics contributions. The relative phases between two $K^*\pi$ intermediate states in theDalitz plot analysis of $B^+ \to K^0_S\pi^+\pi^0$ can provide the CKM angle γ parameter. All measurements employ the full $\Upsilon(4S)$ data set at Belle/Babar.

Hadronic B decays

Presenter: Dr. Eduardo Rodrigues (The University of Manchester)

Decays of B mesons provide a well defined and clean initial sample allowing for precision measurements of excited lighter quark hadrons. Recent results in D meson spectroscopy from $B \to DX$ decays are presented. Other recent results on hadronic b-hadron decays will also be discussed.

Baryonic B decays

Presenter: Dr. Marcello Rotondo (I.N.F.N. Padova)

The B meson decays into final states with baryons have a quite high predicted total width of about 7%. The high mass of the B meson allows a large variety of baryons in the final state which makes the study of baryonic B decays very rich an fruitfull. By now only about 10% of the allowed decays are exclusively know and very little is known about the machanism of baryon production in weak decays or hadronization processes. A carefull study of such decays provides information on the mechanism of baryon production and allows to test phenomenological models of strong interaction at very low Q^2. I will report on recent studies performed by BaBar, Belle and LHCb of various baryonic B decays and their resonat substructure. I will cover also the open issues and the future possibile developments.

Lattice QCD calculation of direct CP violation and long distance effects in kaon mixing and rare decays

Presenter: Prof. Norman H. Christ (Columbia University)

With the recently achieved ability to work directly at physical pion mass, a variety of important quantities become accessible to lattice calculation. We will discuss recent results and future prospects for the first-principles calculation of ϵ', the $K_L - K_S$ mass difference and the long distance contribution to other rare weak processes such as ϵ, $K^+ \to \pi^+ \nu\bar{\nu}$ and $K_S \to \pi^0 \ell^+ \ell^-$.

Rare Kaon decay: challenge and perspectives

Presenter: Dr. Giancarlo D'Ambrosio (INFN Sezione di Napoli)

I review rare kaon decays. I introduce the flavor problem and possible solutions. Very rare kaon decays like $K \to \pi\nu\bar{\nu}$ are very important to this purpose but also $K \to \pi l^+ l^-$. A new interesting channel is $K \to \pi\pi ee$. Chiral dynamics is important to disentangle short distance effects. We discuss also the decays $K^0 \to \mu^+\mu^-$, which have received recently some attention due to the measurement by LHCB.

Rare Kaon Decay Experiments and Future Plan

Presenter: Dr. Tadashi Nomura (KEK)

Rare Kaon decays provide good testing grounds for exploring physics beyond the Standard Model. We now have experiments which started or is just getting started physics run. In Europe, the CERN NA62 experiment to measure the $K^+ \to \pi^+ \nu\bar{\nu}$ branching ratio has started. In Japan, the operation of the J-PARC Hadron Experimental Facility resumed in April 2015, and the KOTO experiment that aims to observe $K_L \to \pi^0 \nu\bar{\nu}$ decays restarted taking data. In addition, new J-PARC experiment to precisely measure the ratio $\Gamma(K^+ \to e^+\nu)/\Gamma(K^+ \to \mu^+\nu)$ is now on commissioning and will start physics run soon. In this talk, the status of the rare Kaon decay experiments are reviewed and future plans are discussed.

Interplay between LHC and flavor physics

Presenter: Dr. Jorge Martin Camalich (UCSD/university of Mainz)

We will present some recent progress related to the powerful synergy between searches of new physics in measurements of flavor-changing decays and in collider experiments. On the phenomenological side, the main focus will be on the interpretation of various anomalies in B decays, especially in the context of possible hints of lepton-universality violation. Another illustration will be the ongoing program searching for deviations from the $V - A$ structure of the charged currents in experiments of neutron and hyperon beta decays combined with the LHC data. Time permitting, we will also show some interplay between the studies of lepton-flavor violation in Higgs and tau-lepton decays. A suitable framework for these analyses is that of the effective field theories, which allows to interpret the information of low- and high-energy processes in a systematic fashion. Examples will be given on how the information thus generated can be used to select specific models or rule them out.

LHC Run-2 Commissioning Status: ATLAS, CMS and LHCb

Presenter: Dr. Stephanie Zimmermann (University Freiburg, Germany)

After a very successful run-1, the LHC accelerator and the LHC experiments had undergone intensive consolidation, maintenance and upgrade activities during the last 2 years in what has become known as Long-Shutdown-1 (LS1). LS1 ended in February this year, with beams back in the LHC since Easter.

This talk will give a summary on the major shutdown activities of ATLAS, CMS and LHCb and review the status of commissioning for run-2 physics data taking.

Top quark properties

Presenter: Dr. Jacob Linacre (Fermilab)

The large mass of the top quark and its corresponding strong coupling to the Higgs boson make measurements of top quark properties an important probe of the mechanism of electroweak symmetry breaking. Furthermore, the top quark is the only quark that decays before hadronising, allowing the information about the properties of the bare quark to be transferred to its decay products with no dilution from the effects of QCD. The large top quark production rates at the LHC have allowed top quark properties to be probed to unprecedented statistical precision. This review summarises the recent measurements from Run 1 at the LHC and the prospects for Run 2.

Status of Higgs Boson Couplings and Searches

Presenter: Prof. Peter Onyisi (University of Texas at Austin)

The status of Higgs sector studies at the Large Hadron Collider is reviewed. The latest extractions of couplings and properties of the 125 GeV Higgs boson from the Run 1 data of the ATLAS and CMS experiments are discussed. Searches for additional Higgs boson states beyond that of the Standard Model are presented.

Searches for Beyond Standard Model Physics at the LHC: Run1 Summary and Run2 Prospects

Presenter: Dr. Altan CAKIR (DESY and ITU)

The search for new physics is a major goal of the LHC physics program. As excitement grows for the upcoming start of Run 2, I review the CMS and ATLAS searches for physics beyond the Standard Model from Run 1 and present recent analyses. These searches have covered a wide range of new physics scenarios including Supersymmetry, new resonances, additional Higgs bosons, new hidden sectors, other Dark Matter, and multi-charged particles. In addition to reviewing some of the techniques that made the analyses possible, I will summarize what we have learned from the results and briefly discuss prospects for Run 2.

Light Higgs and dark gauge boson searches

Presenter: Prof. Abner Soffer (Tel Aviv University)

New scalars and vectors with masses in the sub-GeV to few-GeV range have become a topic of interest in recent years, both theoretically and experimentally. A particularly interesting aspect is their possible role in dark-matter interactions. The talk will cover the basic theoretical ideas and will report on recent searches at the B factories and at other experiments.

Bounds on new physics from electric dipole moments

Presenter: Dr. Martin Jung (TUM IAS / Excellence Cluster Universe)

Electric dipole moments are extremely sensitive probes for additional sources of CP violation in new physics models. The multi-scale problem of relating the high-precision measurements with neutrons, atoms and molecules to fundamental parameters can be approached model-independently to a large extent; however, care must be taken to include the uncertainties from especially nuclear and QCD calculations properly. The resulting bounds on fundamental parameters are illustrated in the context of two-Higgs-doublet models.

Symmetry Tests with Slow Neutrons

Presenter: Prof. Hirohiko Shimizu (Nagoya University)

Recent improvements of accelerator-based neutron sources are enabling slow neutron experiments with high statistics. The flexibility in the design of the moderator arrangement of accelerator-based source compared with reactor source introduces efficient extraction of slow neutrons in the energy ranges of eV through neV. Using the new sources, there are many attempts to improve the experimental sensitivity to T-violating observables to search for CP-violation beyond the standard model through the CPT-theorem.

The electric dipole moment of neutron (nEDM) is strongly suppressed in the standard model and the discovery of the non-zero value of the nEDM at the present experimental sensitivity unambiguously signals CP-violation beyond the standard model. The present upper limit of the nEDM was obtained in the electric field dependence of the spin precession frequency of ultracold neutrons with the energy of about 100 neV, that were confined in a bottle. The sensitivity to nEDM is being improved by increasing the density of the confined ultracold neutrons In parallel with that, another type of nEDM measurement is being discussed by using the advanced transport optics of cold neutrons. Possible fake effects would be separated by observing the spin behavior as a function of the time-of-flight of cold neutrons from pulsed accelerator-based neutron source.

Another category of T-violation experiments using neutrons is the T-odd correlation measurements in neutron-nucleus interaction. The low energy neutron induces compound nuclear states. In some cases, symmetry violating effects are enhanced as a result of the interference among partial waves in the entrance channel into compound states. In reality, parity violation is enhanced in various compound nuclei by the six orders of magnitude. The interference may induce an extremely high sensitivity to T-violation.

Overview of these experimental possibilities will be reviewed and discussed.

Charm physics theory

Presenter: Dr. Jernej F. Kamenik (CERN, Jozef Stefan Institute, Univ. Ljubljana)

The theory of charm quark physics and its state of the the art will be reviewed. Most recent advances in understand D meson oscillations and decays, especially in conjunction with CP violation both within and beyond the standard model will be presented. Finally, several important observables which might elucidate the mechanisms of charming flavor and CP violation, and which will be accessible at upcoming experiments will be highlighted.

Mixing and time-dependent CPV in charm decays

Presenter: Prof. Fabrizio Umberto Bianchi (INFN and University of Torino)

Mixing in the D0 anti-D0 system has been firmly established by the finding of several independent measurements that will be summarized in this presentation. Instead there is not yet an evidence of CP violation despite the large number of searches performed. Recent results on the search for CP violation with time dependent technique and with measurement of triple products asymmetries will be presented.

Time-integrated CPV in charm decays

Presenter: Mr. Stefano Perazzini (INFN Bologna)

LHCb has collected the world's largest sample of charmed hadrons. This sample is used to search for direct CP violation in charm. New updated measurements from several decay modes, including ΔA_{CP} from $D^0 \to h^+h^-$ decays, are presented. The talk also focuses on measurements of production and detection asymmetries.

Recent Experimental Results on Semi-leptonic D Decays and Extraction of $|V_{cd(s)}|$

Presenter: Prof. Gang Rong (Institute of High Energy Physics, CAS, Beijing)

In this presentation, some recent experimental results on semi-leptonic D meson decays measured at the BaBar, Belle, BESIII and CLEO-c experiments are briefly reviewed. Determinations of decay form factors and extractions of $|V_{\rm cd}|$ and $|V_{\rm cs}|$ are also briefly reviewed. In addition, extractions of $|V_{\rm cd}|$ and $|V_{\rm cs}|$ based on these measurements and all available measurements of both the semi-leptonic D decays and leptonic $D^+_{(s)}$ decays are also reviewed. Furthermore, tests of the unitarity of the CKM matrix, which were determined with recently extracted $|V_{\rm cd}|$ and $|V_{\rm cs}|$ from all available measurements of both the semi-leptonic D and leptonic $D^+_{(s)}$ decays are reviewed as well.

Lepton Flavour Violation: theory overview

Presenter: Prof. Emilie Passemar (Indiana University/JLab)

Charged lepton flavour is an accidental symmetry of the Standard Model and the observation of its violation would be a clear indication of new physics. Experimentally, we are entering a new era with dedicated experiments that will test charged lepton flavour conservation in different modes with an unprecedented level of precision. If a signal is found, we will face a delicate task of reconstructing the underlying dynamics.

In this talk, I will review the different mechanisms of charged lepton flavour violation and discuss how we could proceed theoretically to unveil the underlying dynamics. Finally I will discuss a topic that has received much attention recently: lepton flavour violation in Higgs decays showing an interesting complementarity between collider experiments (LHC) and low energy searches.

cLFV searches using DC muon beam at PSI

Presenter: Prof. Satoshi Mihara (KEK)

Search for lepton-flavor violation in the charged lepton sector (cLFV) is a clue to new physics beyond the standard model. MEG experiment at PSI in Switzerland has set the world ' s most stringent limit in the search of $\mu^+ \to e^+\gamma$ decay in 2013. Analysis of further data taken in 2012 and 2013 is in progress with refined detector calibrations. Detector upgrade for the next stage of the experiment, MEG II, is also in progress toward improving the sensitivity of the experiment. Another experimental approach to address the muon cLFV through the process of $\mu^+ \to e^+e^+e^-$ is in preparation utilizing an innovative tracking detector being developed by the Mu3e collaboration. We report the status and prospect of MEG, MEG II, and Mu3e in this presentation.

Experimental searches for the muon to electron conversion

Presenter: Dr. Akira Sato (Osaka University)

A discovery of the charged lepton flavor violating process of muon-to-electron (μ-e) conversion in the field of a nucleus would be a conclusive evidence of a new physics beyond the standard model (SM). Its branching ratio in the SM with massive neutrinos is O(-54), which is not reachable with the current experimental technology. However, many theoretical models with new physics predict reachable branching ratios of the process. In order to to search the μ-e conversion, currently three experiments are about to start measurements; DeeMe at J-PARC-MLF, COMET at J-PARC, and Mu2e at Fermilab. They are designed to search the process with a single-event sensitivity of 2×10^{-14}, 3×10^{-17}, and 2×10^{-17}, respectively. This talk reviews the current status of these experiments and their prospects.

Majorana nature and flavor structures of massive neutrinos

Presenter: Prof. Zhi-zhong Xing (IHEP, Beijing)

Some of the ongoing and upcoming neutrino experiments will try to answer the burning questions about the neutrino mass ordering, the absolute neutrino mass scale, the octant of theta(23), the Dirac CP-violating phase delta, the Majorana nature of massive neutrinos, etc. On the theoretical side, a lot of efforts have been made to explore what is behind the observed pattern of lepton flavor mixing. The first part of this talk is intended to give a brief overview of what we have known about neutrinos, and the second part will focus on a few important issues which are currently under study. In particular, we point out that a partial or approximate mu-tau flavor symmetry is behind the observed pattern of lepton flavor mixing. A soft breaking of the mu-tau symmetry can be naturally related to the neutrino mass hierarchy, the octant of theta(23) and even the quadrant of delta, and it can be realized via the one-loop RGE running effects. We also introduce a novel three-dimensional description of the effective mass of the neutrinoless double-beta decay (0NDBD) by going beyond the Vissni graph, so as to show the dependence of the effective mass on the neutrino mass spectrum and Majorana phases. We stress that how to interpret a discovery or null result of the 0NDBD is highly nontrivial, and illustrate the constructive and destructive contributions of possible new physics.

Long-baseline accelerator neutrino experiments

Presenter: Prof. Atsuko K. Ichikawa (Kyoto University)

With the 20 years of various measurements of neutrinos, all the angles describing the mixing between flavor and mass in the lepton sector are now known except for the CP-violating phase, δ_{CP}. The current and future accelerator neutrino experiments are aiming to determine δ_{CP} and the yet-unknown ordering of the neutrino mass eigenstate, both of which are important piece of information to know the origin of mass and universe. These experiments also search for new phenomena which cannot be understood with the standard three-flavor mixing. Right now, two experiments, T2K and NOνA, are running in the world. I will summarize the latest status and prospect of these two experiment.

Overview of the Reactor-based Neutrino Experiments

Presenter: Prof. Seon-Hee Seo (Seoul National University)

Reactors are ample source of electron anti-neutrinos. Using liquid scintillator detectors one can study properties of the neutrinos from reactors such as neutrino oscillation parameters. The smallest neutrino mixing angle, θ_{13}, was measured using reactor neutrinos in 2012, which boosted searching for leptonic CP violation phase angle and neutrino mass ordering in reactor, accelerator, and atmospheric neutrino sectors. In this talk I will overview the most updated measurements of $\sin^2 2\theta_{13}$, the 5 MeV excess, and future prospects on reactor-based neutrino experiments. I will also briefly discuss about sterile neutrino searches.

The Hyper-Kamiokande Experiment

Presenter: Prof. Francesca Di Lodovico (Queen Mary University of London)

The Hyper-Kamiokande experiment is a proposed next generation underground water Cherenkov detector. It will serve as a far detector of a long baseline neutrino oscillation experiment envisioned for the upgraded J-PARC beam, and is capable of observing – far beyond the sensitivity of the Super-Kamiokande detector – proton decays, atmospheric neutrinos, and neutrinos from astronomical origins. The baseline design of Hyper-Kamiokande is based on the highly successful Super-Kamiokande, but with a 20 times larger detector and higher beam power. In this talk, a general overview of the experiment will be presented, detailing both the technical aspects and the expected performance.

Production and decay of HF baryons

Presenter: Dr. Nicola Neri (INFN - Sezione di Milano)

With one Λ_b baryon produced for every two B^0 mesons, the LHC is a b-baryon factory allowing to explore novel areas for rare decays and CP violation searches. We report on recent results in b-baryon production, spectroscopy and decays.

Recent results in quarkonium production and decays

Presenter: Dr. Peter M Lewis (University of Hawaii)

This talk covers recent experimental progress in conventional charmonium and bottomonium production and decays, including results from the B-factories (Belle and BaBar), BESIII and LHC experiments.

Exotic hadrons at hadron colliders

Presenter: Prof. Sheldon Stone (Syracuse University)

The latest years have seen a resurrection of interest in searches for exotic states motivated by tantalizing observations by Belle, BES and CDF. Using the data collected at pp collisions at 7 and 8 TeV by the LHCb experiment we present studies of the X(3872) properties including its decay rate to $\psi(2S)\gamma$, as well as studies of putative states such as the $Z(4430)^+$ and others in B decays. A recent determination of the $X(3872)$ quantum numbers using its $\rho^0 J/\psi$ decay is presented.

Exotics in leptonic machines

Presenter: Dr. Zhiqing Liu (Johannes Gutenberg University of Mainz)

Exotic states with quark content different from conventional baryons and mesons are of high interest in the hadron spectroscopy field. Over the last decade, more than a dozen of XYZ particles was discovered experimentally, which are good candidates for exotic states. The $X(3872)$ is the first one which was discovered by Belle in 2003, and by now still remains quite puzzling for its nature. Following the $X(3872)$, there are also mysterious 1^{--} $Y(4260)$-states observed by BABAR and Belle. Recently, the BESIII experiment takes more than 5 fb^{-1} data above 4 GeV, which also enable us to study XYZ particles in an efficient way. In 2013, BESIII discovered the charged charmoniumlike states $Z_c(3900)$, which is a convincing exotic state with at least four quarks inside. In addition, BESIII also has studied $X(3872)$, $Y(4260)$ and other XYZ particles with its unique data sample. In this talk, I'll review the recent progress on exotic states in leptonic machines.

Spectroscopy of Heavy Quark Hadrons from QCD

Presenter: Prof. Makoto Oka (Tokyo Institute of Technology)

I will review theoretical aspects of the spectroscopy of hadrons with strange, charm and bottom quarks. Recent discoveries of exotic heavy-flavor states have made us to introduce new approaches to the hadron spectroscopy. Some of these approaches are quite similar to what we have seen in Nuclear Physics. We need to extract "collective" degrees of freedom from QCD and construct effective theories. A key dynamics is the spin-dependent forces in QCD, which depends on the quark masses significantly and the heavy quark limit is in particular simple because of the heavy-quark spin symmetry. I will discuss a new aspect of the excited heavy baryon spectrum.

Recent results in tau decays at Belle experiment

Presenter: Dr. Kiyoshi Hayasaka (Kobayashi-Maskawa Institute for the Origin of Particles and the Universe (KMI), Nagoya University)

We present a preliminary result of search for the Electric Dipole Moment of the τ lepton and the measurement of Michel parameters in leptonic τ decays using the world-largest data sample collected by the Belle detector at the KEKB collider. The Electric Dipole Moment of the τ lepton is one of the fundamental parameters and useful to discuss the new physics as a signal of it through CP violating loop effect. We have analyzed $\tau^+\tau^-\gamma$ vertex effect from the $e^+e^- \to \tau^+\tau^-$ reaction in Belle's full τ-pair data sample which is about 30 times larger than that used at the previous measurement, using the optimal observable method. Michel parameters of the τ lepton are extracted from $(\tau^\mp \to \ell^\mp\nu\nu\ (\ell = e, \mu)$, $\tau^\pm \to \pi^\pm\pi^0\nu)$ and $(\tau^\mp \to \pi^\mp\pi^0\nu$, $\tau^\pm \to \pi^\pm\pi^0\nu)$ events in Belle's full data sample, where $\tau^\pm \to \pi^\pm\pi^0\nu$ is used as a spin analyzer since τ spin information is necessary to evaluate Michel parameters.

Low-energy hadronic cross sections and g-2

Presenter: Prof. Bill Gary (U. California, Riverside)

Results are presented from the Babar experiment on low-energy hadronic cross sections, focusing on recent results on final states with kaons. The relation to the standard model prediction for g-2 and relevant results from other experiments will also be discussed.

New Experiments to Measure the Muon Anomalous Gyromagnetic Ratio

Presenter: Prof. Michael Eads (Northern Illinois University)

The magnetic moment is a fundamental property of particles. The measurement of these magnetic moments and the comparison with the values predicted by the standard model of particle physics is a way to test our understanding of the fundamental building blocks of our world. In some cases, such as for the electron, this comparison has resulted in confirmation of the standard model with incredible precision. In contrast, the magnetic moment of the muon has shown a long-standing disagreement in the measured and the predicted value. There is currently a tantalizing three-standard-deviation difference between the current best measurement (with a precision of 0.54ppm) and the state-of-the-art standard model prediction. This represents one of the very few experimental hints for physics beyond the standard model. There are currently two major experimental efforts underway to improve the precision of the muon magnetic moment measurement. The first is an evolution of the E-821 experiment, originally located at Brookhaven National Laboratory in the United States. This is experiment, E-989, is located at Fermilab and will measure the spin precession rate of positive muons in a 50-ft diameter storage ring using decay positrons. The goal of the experiment is to reduce the current experimental uncertainty by a factor of three. The experiment is currently being constructed and aims to start taking data in 2017. An alternative, and very complementary, experiment is being planned at J-PARC in Japan. This experiment, E-34, will utilize low energy, ultra-cold muons in a much smaller storage ring. This experiment aims for a similar precision to the Fermilab experiment and aims to begin data taking on a similar timescale.

LHCb upgrade

Presenter: Dr. Umberto Marconi (INFN Bologna Italy)

During the LHC Run 1 the LHCb experiment has successfully performed a large number of world-class precision measurements in heavy flavour physics by having collected over 3 fb^{-1} at centre-of-mass energies of 7 TeV and 8 TeV. However, even after an additional expected integrated luminosity of 5-6 fb^{-1} in Run 2, many of the LHCb measurements will remain limited by statistics. The current 1 MHz readout system is the main bottle neck to run LHCb at higher luminosity and with higher trigger efficiencies. LHCb will therefore undergo a major upgrade in the Long Shutdown 2 of LHC (2018- 2019) aimed at collecting an order of magnitude more data by 2028. The upgrade consists of a new full readout at the LHC bunch crossing rate (40 MHz) with the ultimate flexibility of only a software trigger. In order to increase the instantaneous luminosity five times, up to $2x10^{33}$ $cm^{-}2$ s^{-1}, several sub-detector upgrades are also underway, such to cope with the expected higher occupancies and radiation dose.

The Belle II experiment and SuperKEKB

Presenter: Dr. Matthew Barrett (University of Hawai'i at Mānoa)

The Belle II experiment is an upgrade to the Belle experiment, with a projected luminosity forty times that of its predecessor, allowing for precision measurements and the potential for new physics discoveries in the flavor sector. This presentation describes some of the physics that will be explored at Belle II, together with details of the construction and schedule of the experiment.

Theoretical Outlook

Presenter: Mr. Zoltan Ligeti (Lawrence Berkeley National Lab)

In this talk I will focus on future direction in flavor physics, the future sensitivity of flavor physics experiments to new phenomena, and their complementarity with LHC high-pT searches. I will probably comment both on measurements which are currently in tensions with the standard model expectations, as well as others which are not. At the time of writing this abstract I am interested in exploring how large data sets would be useful to accommodate in different type of flavor physics experiments, and what they may teach us.

FPCP 2015 Summary Talk on Experiments

Presenter: Dr. Karim Trabelsi (KEK/EPFL)

This talk will summarize the presentations on experiments at the 2015 conference on Flavor Physics and CP Violation, covering the high points of the conference.

Poster 01

Lepton-Flavored Scalar Dark Matter with Minimal Flavor Violation

Presenter: Mr. Chao-Jung Lee (National Taiwan University;National Center for Theoretical Sciences)

We explore scalar dark matter that is part of a lepton flavor triplet satisfying symmetry requirements under the hypothesis of minimal flavor violation. Beyond the standard model, the theory contains in addition three right-handed neutrinos that participate in the seesaw mechanism for light neutrino mass generation. The dark-matter candidate couples to standard-model particles via Higgs-portal renormalizable interactions as well as to leptons through dimension-six operators, all of which have minimal flavor violation built-in. We consider restrictions on the new scalars from the Higgs boson measurements, observed relic density, dark-matter direct detection experiments, LEP II measurements on e^+e^- scattering into a photon plus missing energy, and searches for flavor-violating lepton decays. The viable parameter space can be tested further with future data. Also, we investigate the possibility of the scalar couplings to the Higgs boson accounting for the tentative hint of its flavor-violating decay $h \to \mu\tau$ recently detected in the CMS experiment. They are allowed by constraints from other Higgs data to produce a rate of this decay roughly compatible with the CMS finding.

Poster 02

Way to crosscheck μ-e conversion in the case of no signals of $\mu \to e\gamma$ and $\mu \to 3e$

Presenter: Dr. Masato Yamanaka (Nagoya university)

We consider the case that the μ-e conversion signal is discovered but other charged lepton flavor violating (cLFV) processes will never be found. In such a case, we need other approaches to confirm the μ-e conversion and its underlying physics without conventional cLFV searches. We study R-parity violating (RPV) SUSY models as a benchmark. We briefly review that our interesting case is realized in RPV SUSY models with reasonable settings in light of current theoretical and experimental status. We focus on the exotic collider signatures at the LHC ($pp \to \mu^- e^+$ and $pp \to jj$) as the other approaches. We show the correlations between the branching ratio of the μ-e conversion process and cross sections of these processes. It is the first time that these correlations have been graphically shown. We exhibit the RPV parameter dependence of the branching ratio and the cross sections and discuss the feasibility of determining the parameters.

Poster 03

Lepton-flavor-violating Higgs decay $h \to \mu\tau$ and muon anomalous magnetic moment in a general two Higgs doublet model

Presenter: Dr. Kazuhiro Tobe (Nagoya University)

A two Higgs doublet model (2HDM) is one of the minimal extensions of the standard model (SM), and it is well-known that the general setup predicts the flavor-violating phenomena, mediated by neutral Higgs interactions. Recently the CMS collaboration has reported an excess of the lepton-flavor-violating Higgs decay in $h \to \mu\tau$ channel with a significance of 2.4σ. We investigate the CMS excess in a general 2HDM with tree-level flavor changing neutral currents (FCNSs), and discuss its impact on the other physical observations. Especially, we see that the FCNCs relevant to the excess can enhance the neutral Higgs contributions to the muon anomalous magnetic moment (muon g-2), and can resolve the discrepancy between the measured value and the SM prediction. We also find that the couplings to be consistent with the muon g-2 anomaly as well as the CMS excess in $h \to \mu\tau$ predict the sizable rate of $\tau \to \mu\gamma$, which is within the reach of future B factory. (Reference: arXiv:1502.07824 by Y. Omura, E. Senaha, K. Tobe)

Improved analysis of the CLFV decay of muonic atoms $\mu^- e^- \to e^- e^-$

Presenter: Mr. Yuichi Uesaka (Osaka University)

Koike et al. proposed the charged lepton flavor violation (CLFV) decay of the muonic atom $\mu^- e^- \to e^- e^-$ as one of the promising processes to search for new physics beyond the standard model. It was found that the attractive interaction of leptons with the nucleus enhances the transition rate of the $\mu^- e^- \to e^- e^-$ process. We report on our improved the analysis of this process by taking into account the distortion of the out-going electrons in the nuclear Coulomb potential and the relativistic treatment of the muon and the electrons. As results, we found significant enhancement of the decay rate. The decay rate for ^{208}Pb becames about 7 times larger than the previous estimation, which enhances the sensitivity of this process to discover the CLFV interaction. We also report on the energy spectrum of the out-going electron.

[1] M. Koike, Y. Kuno, J. Sato and M. Yamanaka, Phys. Rev. **105**, 121601 (2010).

Poster 05

Search for Charged Lepton Flavor Violation at the Mu2e Experiment

Presenter: Dr. Markus Roehrken (California Institute of Technology)

The new Mu2e experiment being constructed at Fermilab will search for the neutrinoless conversion of muons to electrons in the field of nuclei. The sensitivity of Mu2e for this charged lepton flavor violating process will be four orders of magnitude better than previous experiments. The poster to be presented at FPCP 2015 will address the underlying physics including the prospective sensitivity to physics beyond the Standard Model and the experimental setup.

Development of Cylindrical Drift Chamber for COMET Phase-I

Presenter: Mr. TingSam Wong (Osaka University)

COMET is an experiment to search for neutrinoless $\mu^- - e^-$ conversion with a single-event of sensitivity of 3×10^{-15} for Phase-I and 3×10^{-17} for Phase-II which is a factor of 10,000 better than the current upper limit. In COMET Phase-I, the Cylindrical Drift Chamber (CDC) is the main part of the detection system. To test prototypes of the CDC, an experiment was performed at Research Center for Electron Photon Science of Tohoku University and Electron Beam with momentum at 460MeV/c. The purpose of this study was to evaluate the detector performance of the prototype CDC under two types anode wires and three kinds of gas types.

In the experiment, Prototype II and III were stringed with $\phi 25 \mu$m and $\phi 30 \mu$m tungsten anode wire coated with gold, respectively. Three He-based gas candidates with iC_4H_{10}, CH_4 and C_2H_6 were studied. For the setup, two scintillators were used as the trigger and four tracking chambers were used to reconstruct electron beam tracks. The data was acquired by using four Belle II RECBE boards. By using TMinuit in ROOT, the reconstructed tracks were fitted. With different setting of applied high voltage and signal threshold, the detector response with efficiency more than 95% and spatial resolution less than σ=200 μm for each prototype chamber were confirmed. The result of this experiment has lead us to finalize the parameters of the CDC in Phase-I.

This poster presents an overview of the COMET experiment and the prototype CDC studies including setup, analysis method, result and finally the discussion of the beam test

Key words: Drift chamber; COMET; charged Lepton Flavor Violation

Poster 07

COMET Experiment searching for muon to electron conversion

Presenter: Mr. Nakazawa Yu (Osaka University)

The COMET is one of experiments that search for new physics beyond the Standard Model. It is dedicated to searching for charged lepton flavor violation processes with muon to electron in a muonic atom ($\mu^- N \to e^- N$). A staging approach is planed for the COMET experiment. The COMET Phase-I plans to achieve a signal sensitivity of 3×10^{-15} in 2017 followed by the COMET Phase-II with the sensitivity of 10^{-17} in 2020.

In this poster, I introduce status of the COMET Phase-I, which consists of a proton beam line, a muon beam section and a detector section. A pion capture system will be installed at the end of the proton beam line to provide a very intense muon beam of 1×10^9 μ/sec. The pion capture system is currently under construction at J-PARC. The detector section has a muon stopping target surrounded by a Cylindrical Drift Chamber (CDC).

Poster 08

Overview of the COMET Phase-I experiment

Presenter: Mr. Mark Wong (Osaka University)

Charged Lepton Flavour Violation (CLFV) has yet to be observed experimentally. If observed, it would be a clear signal of new physics. One of the ways of finding this is via the neutrino-less conversion of muons to electrons bound to an atomic 1s ground state, $\mu^- N \to e^- N$ with the COMET experiment. This experiment is designed to look for 105 MeV electrons converted from muons with a sensitivity a factor of 10000 better than that of current experimental limit. The COMET beam line is undergoing construction at KEK, Tsukuba. Upon its completion, it will have, at its disposal, the world most intense beam of the order of 10^{18} muons, capable of an experimental single-event sensitivity of 3×10^{-17} or better. The first stage of the COMET experiment, COMET Phase-I, will be using the Cylindrical Drift Chamber (CDC) as it is designed to avoid the high-radiation and high-hit rate due to the muon beam, muon decay-in-orbit (DIO) background events and low energy protons emitted by the muon nuclear capture process. Estimated backgrounds of order of 0.02 events are sufficient to small for COMET Phase-I sensitivity of 10^{-15}. The COMET collaboration has been advancing areas critical to the eventual deployment of the Phase-I since the beginning of 2011 with studies being done in muon yield simulations, FPGA firmware programming in triggers, DAQ, magnetic field calculations and so on. The overview and the current overall status of COMET Phase-I will be presented.

Poster 09

Search for mu-e conversion with DeeMe experiment at J-PARC MLF

Presenter: Mr. Truong Minh Nguyen (Osaka University)

DeeMe project is an experiment searching for muon to electron conversion (mu-e conversion) signal with the pulsed proton beam from J-PARC RCS. The mu-e conversion is a process called Charged Lepton Flavor Violation (cLFV). Although this process is essentially forbidden in Standard Model (SM) of particle physics, numerous theoretical models beyond SM predict the cLFV could happen, and mu-e conversion is indicated to be observed at a level of 10^{-14}. Therefore, the DeeMe project is being planned to carry out a search for mu-e conversion at level 10^{-14}.

DeeMe experiment is proposed at J-PARC MLF and it will be conducted at new beam line (H-line). The pulsed proton beam, 3GeV 25Hz, from RCS will be extracted to the muon production target. Pions will be produced and a fraction of produced pions will decay to muons in the target and some of these muons will be captured by the target atoms to form muonic atoms. The DeeMe experiment is very unique to use these muonic atoms produced in the target itself as a source of electrons from the mu-e conversion process. The electron emitted from the production target will be transported to spectrometer by H-Line. A single event sensitivity (S.E.S) is estimated up to 2.1 x 10^{-14} with silicon carbide and 1.2 x 10^{-13} with graphite target, providing 1-2 orders of magnitudes improvements over the current upper limits (4.6 x 10^{-12} for Ti and 7 x 10^{-13} for Au). Details of the experimental technique, status of detector and beam line preparation, their expected performance and schedule will be presented.

Poster 10

Development of a high-rate-tolerant HV-switching multi-wire proportional chamber and its readout electronics for DeeMe experiment

Presenter: Ms. Natsuki TESHIMA (Osaka City University)

The DeeMe experiment at Materials and Life Science Experimental Facility (MLF) of J-PARC is planned to search for mu-e conversion processes with a single event sensitivity of one or two orders of magnitude better than the current upper limits. The Charged Lepton Flavor Violation (cLFV) such as the mu-e conversion process is forbidden in the Standard Model (SM) and experimental observations of the cLFV provide clear evidence of new physics beyond the SM.

In the DeeMe experiment, the charged-particle tracking detectors, multi-wire proportional chambers (MWPCs), are irradiated in high-rate prompt-charged particles ($\simeq 2 \times 10^8$ particles/pulse) before signal electrons arrive at the MWPCs. With standard design of the MWPC, the detector will be totally saturated and blinded for a while due to the huge amount of ions produced by the avalanche with such a high rate. In order to avoid the problem, we developed a novel technique based on the micro-cell structure of MWPC with HV switching of the potential wires to dynamically control the avalanche gas gain. The readout electronics is optimized to tolerate large prompt current and to cancel 1/t tail of the response to prompt-charged particles. In this talk, the details of the MWPC system will be presented.

Poster 11

After Proton background estimation for DeeMe experiment

Presenter: Mr. Daiki Nagao (Osaka University)

Muon to electron conversion is one of charged lepton flavor violation (CLFV) processes, which is forbidden in the Standard Model. There are some theories predicting existence of CLFV signature at the branching ratio level of $\sim 10^{-14}$. DeeMe is an experiment searching for muon to electron conversion with a single event sensitivity of 2 $\times 10^{-14}$(with silicon carbide production target) being constructed at J-PARC. DeeMe utilizes 3-GeV 25Hz pulsed proton beam from Rapid Cycling Synchrotron (RCS). The beam hits a target and produces muonic atoms in the target. The signal of DeeMe is the 105-MeV electrons directly emerging out of the target with delayed timing. It is very important to understand the mechanism of proton production with delayed timing, if any, and to evaluate the amount of such protons producing electrons that mimic our signal electrons. The expected number of background coming from the delayed proton was less than 0.03 in the past study, and the number was limited by the particle identification performance of the delayed-proton monitor. In this talk, the updated design of the monitor and the analysis of the data taken in this spring will be presented in detail.

Poster 12

Upgrade of liquid xenon calorimeter for MEG II experiment with VUV sensitive MPPCs

Presenter: Mr. Shinji Ogawa (The University of Tokyo)

The MEG II experiment is the upgrade of the MEG experiment to search for the charged lepton flavor violating decay of muon, $\mu^+ \to e^+\gamma$. The MEG II experiment is expected to reach a branching ratio sensitivity of 5×10^{-14}, which is one order of magnitude better than the sensitivity of the current MEG experiment. All detectors will be upgraded, aiming to significantly improve the resolutions to cope with twice or higher beam rate in MEG II. The performance of the liquid xenon (LXe) gamma-ray detector will be greatly improved with a highly granular scintillation readout realised by replacing 216 photomultiplier tubes (PMT) on the gamma-ray entrance face with 4092 MPPCs. For this purpose, we have developed a new type of MPPC which is sensitive to the LXe scintillation light in VUV range, in collaboration with Hamamatsu Photonics K.K. In this presentation, the performance of the VUV-sensitive MPPC will be reported, as well as the expected resolutions of the LXe detector in MEG II evaluated by Monte Carlo simulations based on the measured properties of the MPPC.

Development of Positron Timing Counter with SiPM Readout for MEG II Experiment

Presenter: Mr. Kohei Yoshida (The University of Tokyo)

The MEG experiment is now being upgraded to search for the charged lepton flavor violating decay $\mu^+ \to e^+\gamma$ with an improved branching ratio sensitivity, 5×10^{-14}. In this context, we are developing a new Timing Counter to precisely measure the timing of the decay positrons.The Timing Counter consists of 512 counters and each counter is based on an fast plastic scintillator plate readout by multiple SiPMs. The positron timing can be measured with an ultimate time resolution by averaging positron impact times over multiple counter hits. An excellent timing resolution of 30ps (RMS) was demonstrated with prototype counters in beam tests under the high rate condition expected in MEG II.

It is quite important to precisely time-align all the counters. We are developing time calibration methods using multiple counter hits by a positron from a normal muon decay or distributing a light pulse from a picosecond laser pulser to all the counters. We report on the beam test results and the calibration methods in this presentation.

Poster 14

Probing dark matter self-interaction in the Sun with IceCube-PINGU

Presenter: Dr. Chian-Shu Chen (Naiotnal Center for Theoretical Sciences)

We study the capture, annihilation and evaporation of dark matter (DM) inside the Sun. It has been shown that the DM self-interaction can increase the DM number inside the Sun. We demonstrate that this enhancement becomes more significant in the regime of small DM mass, given a fixed DM self-interaction cross section. This leads to the enhancement of neutrino flux from DM annihilation. On the other hand, for DM mass as low as as a few GeVs, not only the DM-nuclei scatterings can cause the DM evaporation, DM self-interaction also provides non-negligible contributions to this effect. Consequently, the critical mass for DM evaporation (typically 3 to 4 GeV without the DM self-interaction) can be slightly increased. We discuss the prospect of detecting DM self-interaction in IceCube-PINGU using the annihilation channels $\chi\chi$ to $\tau^+\tau^-$ and $\nu\bar{\nu}$ as examples. The PINGU sensitivities to DM selfinteraction cross sections are estimated for track and cascade events.

Poster 15

Fermi-Boltzmann statistics of neutrinos and relativistic effective degrees of freedom in the early universe

Presenter: Mr. Jun Iizuka (Tokai University)

We investigate an effect of the presence of non-pure fermionic neutrinos on the relativistic effective degrees of freedom in the early universe. The statistics of neutrinos is transformed continuously from Fermi-Dirac to Maxwell-Boltzmann statistics. We find that the relativistic degrees of freedom decreases with the deviation from pure Fermi-Dirac statistics of neutrinos if there are constant and large lepton asymmetries.

Poster 16

AXEL : neutrinoless double beta decay search with a high pressure Xe gas TPC

Presenter: Mr. Sei Ban (Kyoto University)

AXEL is a high pressure xenon gas TPC detector being developed for neutrinoless double-beta decay search. We use proportional scintillation mode with a new electroluminescence light detection scheme to achieve very high energy resolution with a large detector. The detector also has a capability of tracking to reduce background. The project is in a R&D phase, and I will report current status of our prototype chamber with 10 L and up to 10 bar Xe gas. And I will also present future plan and final goal of AXEL.

First measurements of muon anti-neutrino disappearance by the T2K experiment

Presenter: Mr. Takahiro Hiraki (Kyoto University)

The T2K experiment [1] is a long-baseline neutrino oscillation experiment.

Intense 30GeV protons extracted from the J-PARC accelerator hit a carbon target to produce secondary hadrons, which decay to produce mostly muon neutrinos.

The neutrino beam is measured by a near detector complex (ND280) and a far detector, Super-Kamiokande (SK) located 295 km away from J-PARC.

Last year we started to take anti-neutrino beam data for the first time. Anti-neutrino beam can be obtained by reversing the polarity of the electromagnetic horns.

In this poster the first result of numubar disappearance analysis is shown.

In this analysis, to be able to see potential effects coming from new physics like CPT violation, we treat (theta23, Deltam223) and (theta23bar, Deltam223bar) as independent parameters. Other oscillation parameters are assumed to be the same for neutrinos and anti-neutrinos.

We describe the analysis overview and neutrino flux prediction and present systematic errors and the results obtained by fitting t he reconstructed energy spectrum of single muon-like events observed at SK.

[1] K. Abe et al. (T2K Collaboration), Nucl. Instrum. Meth. A659, 106 (2011).

Poster 18

A new experiment at J-PARC to measure the neutrino cross section ratio between water and plastic.

Presenter: Mr. Naruhiro Chikuma (The University of Tokyo)

For the precise measurement of neutrino oscillation, the understanding of neutrino interactions on nucleus is indispensable. One of the main systematic errors in neutrino oscillation analysis in T2K experiment is induced due to the difference in the acceptance and target materials between Super-Kamiokande, with water target, and Near-Detector, with plastic target. In order to reduce this uncertainty, a new experiment, named WAGASCI, at J-PARC neutrino beam-line has been developed. Its goal is to measure the cross section ratio of charged current neutrino interaction on nucleus between water target and plastic target with the accuracy of a few percent. The detector adopts 3D grid-like configuration of scintillator around water and plastic targets, to obtain large angular acceptance. MPPCs will be used to detect the light yield from scintillators. The design of the new detectors optimized by using Monte Carlo simulation, research and development of detector components, and the expected performance of the detector will be presented.

Measurement of T2K Anti-neutrino Beam Properties Using the INGRID On-axis Near Detector

Presenter: Mr. Tatsuya Hayashino (Kyoto University)

In the T2K experiment, neutrino oscillations are measured by using the J-PARC neutrino beam, the near detectors in J-PARC and the far detector, Super-Kamiokande, at Kamioka. The T2K experiment uses an almost pure muon neutrino beam and measures neutrino oscillation parameters. T2K made the first observation of electron neutrino appearance in a muon neutrino beam and constrained CP-violating phase δ_{CP}. T2K started taking data using an anti-neutrino beam to enhance the sensitivity to CP violation in 2014. This is the first anti-neutrino beam operation for T2K, so, it is important to measure the beam properties using the near detectors.

INGRID on-axis near detector consists of $14 + 2$ identical modules. We use only 14 modules arranged in horizontal and vertical arrays around the beam center to measure the beam properties. Neutrino beam profile center and intensity are measured using the number of observed neutrino events in each module.

We will report anti-neutrino beam measurements using the INGRID based on the anti-neutrino run data taken up to March 2015.

Poster 20

Development of Scintillation Fiber Detector for the Next Generation of Long-Baseline Neutrino Oscillation Experiment

Presenter: Ms. Mika Yamamoto (Kyoto univ.)

We are planning a long baseline neutrino oscillation experiment that combines the J-PARC accelerator neutrino beam and Hyper-Kamiokande. As a near detector of this experiment , we are promoting the development of tracking detector using scintillation fiber . The detector which has a position resolution of 1 2mm, allows a detailed understanding about the neutrino reaction point . In this poster, We will report the results of the production and its performance test of the prototype detector .

Poster 21

Absolute branching fractions of Λ_c hadronic decays at BESIII

Presenter: Mr. Qingnian XU (University of Chinese Academy of Sciences)

BESIII collected $567pb^{-1}$ sample at $\sqrt{s} = 4.6$ GeV, which allows us to perform the double-tag technique to measure the rates in the model-independent way near threshold for the first time. Herein, we present preliminary results on branching fractions for 12 Λ_c^+ hadronic decays, including $BF(\Lambda_c^+ \to pK^-\pi^+)$. These are all more precise than those on PDG2014.

Poster 22

Direct CP violation in Λ_b decays

Presenter: Prof. Yu-Kuo Hsiao (The national center for theoretical sciences)

We present the study of direct CP violating asymmetries (CPAs) in the two-body Λ_b decays of $\Lambda_b \to pM(V)$ with $M(V) = K^-(K^{*-})$ and $\pi^-(\rho^-)$ based on the generalized factorization method. After simultaneously explaining the observed decay branching ratios of $\Lambda_b \to (pK^-,\ p\pi^-)$, we find that their corresponding direct CPAs are $(5.8 \pm 0.2, -3.9 \pm 0.2)\%$ in the standard model (SM). For $\Lambda_b \to (pK^{*-}, p\rho^-)$, the decay branching ratios and CPVs in the SM are predicted to be $(2.5 \pm 0.5, 11.4 \pm 2.1) \times 10^{-6}$ and $(19.6 \pm 1.6, -3.7 \pm 0.3)\%$, respectively. We point out that the large CPA for $\Lambda_b \to pK^{*-}$ is promising to be measured by the CDF and LHCb experiments, which is a clean test of the SM.

Study of the $B_c \to J/\psi D_s$ and $B_c \to J/\psi D_s^*$ decays with the ATLAS detector

Presenter: Dr. Daniel Scheirich (Charles University in Prague)

The B_c meson is the only known weakly decaying particle consisting of two heavy quarks, each of which can decay weakly. Their presence affects theoretical calculations of the decay properties of the B_c meson. The decays $B_c \to J/\psi D_s$ and $B_c \to J/\psi D_s^*$ provide means to test these theoretical predictions. In the poster we present a measurement of the branching fractions of $B_c \to J/\psi D_s$ and $B_c \to J/\psi D_s^*$ decays normalized to that of $B_c \to J/\psi \pi$ decay performed recently with the ATLAS detector. In addition, we show results of the polarisation measurement in the decay $B_c \to J/\psi D_s^*$.

Poster 24

The latest results on top quark pair cross-section measurement at the LHC-ATLAS experiment

Presenter: Mr. Katsuya Yamauchi (Nagoya University)

The latest results on top quark pair production cross-section measurement in proton-proton collisions at $\sqrt{s}$ = 7 TeV and $\sqrt{s}$ = 8 TeV with the ATLAS detector are reported. The inclusive cross-section was measured with 4% of uncertainty using di-lepton e-mu events. The measurement of the differential cross-section as functions of various observables such as the transverse momentum and the rapidity of the top quark and the invariant mass of the pseudo-top-quark pair system including the results in boosted topologies are also reported. These results are compared with the various generators such as POWHEG, ALPGEN and MC@NLO and the various PDF sets.

Poster 25

Dispersion relation of $\bar{D}$ mesons in the Chiral Density Wave

Presenter: Dr. Daiki Suenaga (Nagoya University)

In this report, we put $\bar{D}$ mesons in the Chiral Density Wave (CDW) phase, and calculate the dispersion relation of $\bar{D}$ mesons. CDW is an inhomogeneous phase that spatially varying chiral condensation occurs and it is said that this phase may exist in the finite density region. In this phase, the potentials which $\bar{D}$ mesons are affected by take the form of cosine or sine function, then we have to employ the Bloch's theorem for $\bar{D}$ mesons wave function to get dispersion relations. Thereby, dispersion of D mesons drastically changes from that of in the vacuum, e.g., the existence of Brillouin zone and the emergence of collective modes. These modifications are the signals of the emergence of CDW in the finite density region.

Poster 26

Kaon Decay into Three Photons Revisited

Presenter: Mr. Shu-Yu Ho (Caltech)

We evaluate the rare radiative kaon decays into three photons. Applying the requirements of gauge invariance and Bose symmetry, we derive a general form of the decay amplitude, including both parity-conserving and parity-violating contributions. We employ a chiral-Lagrangian approach combined with dimensional analysis arguments to estimate the branching ratios of these decays in the standard model, obtaining values as large as B(Kaon long to three photons) equals to 1 times 10 to the power of minus fourteen and B(Kaon short to three photons) equals to 2 times 10 to the power of minus seventeen, which exceed those found previously by a few orders of magnitude. Measurements on the branching ratios which are significantly larger than these numbers would likely hint at the presence of new physics beyond the standard model.

Impact of $K_L \to \pi^0 \nu\bar{\nu}$ decay on high scale SUSY

Presenter: Dr. Kei Yamamoto (KEK)

We have studied the contribution of the high-scale SUSY to the $K_L \to \pi^0 \nu\bar{\nu}$ and $K^+ \to \pi^+ \nu\bar{\nu}$ processes by correlating with the CP violating parameter ϵ_K. The KOTO experiment at J-PARC is an in-flight measurement of $K_L \to \pi^0 \nu\bar{\nu}$. This rare K decay is the direct CP violating process and theoretically clean one. It can prove the new physics.

In our work, taking account of the recent LHC results for the Higgs discovery and the SUSY searches, we consider the high-scale SUSY at the $10 - 50$TeV scale in the framework of the non-minimal flavor violation. The Z penguin mediated the chargino dominates the SUSY contribution for these decays. At the 10TeV scale of the SUSY, the chargino contribution can enhance the branching ratio of $K_L \to \pi^0 \nu\bar{\nu}$ in eight times compared with the SM predictions whereas the predicted branching ratio $BR(K^+ \to \pi^+ \nu\bar{\nu})$ increases up to three times of the SM one. The gluino box diagram dominates the SUSY contribution of ϵ_K up to 30%. If the down-squark mixing is neglected compared with the up-squark mixing, the Z penguin mediated the chargino dominates both SUSY contributions of $BR(K_L \to \pi^0 \nu\bar{\nu})$ and ϵ_K. Then, it is found a correlation between them, but the chargino contribution to ϵ_K is at most 3%. Even if the SUSY scale is 50TeV, the chargino process still enhances the branching ratio of $K_L \to \pi^0 \nu\bar{\nu}$ from the SM prediction in the factor two, and ϵ_K is deviated from the SM prediction in $\mathcal{O}(10\%)$. We also discuss the chargino contribution to $K_L \to \pi^0 e^+ e^-$ process.

Development of Acrylic Cherenkov Counter in the KOTO experiment

Presenter: Mr. Satoshi Shinohara (Kyoto University)

The KOTO experiment at J-PARC aims to observe the CP-violating rare decay $K_L \to \pi^0\nu\bar{\nu}$. This decay mode is sensitive to new physics beyond the Standard Model.

We identify the signal $K_L \to \pi^0\nu\bar{\nu}$ by detecting a single π^0 reconstructed from two photons, and requiring that there is no observable particles other than the two photons. In order to ensure that, we need hermetic veto system with high detection efficiencies, even for particles escaping in the beam region.

For the detection of such particles, an in-beam photon counter with lead-aerogel sandwich was prepared in the downstream of the KOTO detectors. We found, however, a detection gap in the edge of the in-beam photon counter just outside of the beam core. Thus, we prepared a new photon-veto counter named Beam Hole Guard Counter(BHGC) to cover the gap. The BHGC consists of a lead plate to convert photons, and an acrylic plate which acts as a Cherenkov radiator. One feature of the BHGC is neutron blindness, which is important because there are large amount of neutrons scattered from the in-beam photon counter.

The counter is insensitive to neutrons because charged particles generated from neutrons tend to be slow and cannot make Cherenkov radiation when the velocity is below the Cherenkov threshold. The acrylic plate acts as a light guide to photomultipliers attached at the both end of the acrylic plate and also helps to suppress neutron backgrounds. If the charged particles generated from neutrons exceed the Cherenkov threshold, a Cherenkov radiation may be emitted, but the Cherenkov angle tends to be smaller in this case. And if the angle is smaller than the total reflection threshold in the acrylic plate, such photons cannot be transported to the edge of the acrylic plate.

We evaluated the performance with the electron test beam and installed the BHGC at the most downstream of the KOTO detectors in March 2015. We operated the BHGC during April 2015 taking the physics data. We report the design, development and performance of the BHGC in the KOTO experiment.

Development of Amplifier with Pulse Shaper for High Rate MWPC

Presenter: Mr. Ichinori Kamiji (Kyoto University)

An amplifier has been developed for a multi-wire proportional chamber (MWPC) used as an in-beam detector for charged particles in the KOTO experiment, which aims at discovering a rare decay of long-lived neutral K meson, $K_L \to \pi^0\nu\bar{\nu}$. Due to a large number of photons and neutrons (about 1 GHz in total) contained in the K_L beam for the KOTO experiment, the maximum counting rate of the MWPC is expected to be 1 MHz. In order to avoid severe pulse pile-up and large baseline fluctuation in this high rate condition, the amplifier has pulse shaping circuit, which suppresses low frequency components in raw signals of the MWPC remaining over tens of microseconds. This pulse shaping circuit consists of three pole-zero cancellation parts. Each part suppresses lower frequency components. Unlike high-pass filters it can pass DC component and keep the signal baseline unchanged. This characteristic is suitable for high rate operation. The pulse shaping circuit was designed by assuming a fitting function of output waveforms. By using this function the circuit parameters were determined by calculations on its transfer function. The performance of the pulse shaping circuit was confirmed by using a prototype single-channel MWPC, and the pulse width became about 150 ns without remaining low frequency components. The multi-channel amplifiers for the actual MWPC have also been manufactured, and started its operation in the KOTO experiment. In this poster we will present the design principle and performance of the amplifiers.

Development of gas wire chambers for in-beam charged particle detector in the KOTO experiment

Presenter: Mr. Kota Nakagiri (Kyoto University)

The KOTO experiment [1] aims to study the rare CP-violating decay $K_L \to \pi^0\nu\nu$. The decay mode is known as a " golden mode " for new physics, because of the suppressed branching ratio in the Standard Model (2×10^{-11}) and its small theoretical uncertainty (2%)[2]. A large effect from unknown CP-violating process is expected.

The first goal of KOTO is to observe $K_L \to \pi^0\nu\nu$ events. To identify the signal, we measure two photons from a π^0 with a CsI calorimeter and ensure no other observable particles with the hermetic veto counters.

The Beam Hole Charged Veto (BHCV) detector is one of the veto counters and is located at a downstream in-beam area. The BHCV detector should be insensitive to neutral particles because the K_L beam contains a large amount of photons and neutrons.

Low-mass thin gap chambers (gas wire chambers) have been developed and installed in the KOTO experimental area for the upgraded BHCV detector. They were operated during the physics data taking period in April, 2015. We will present the performance of the BHCV detector in the KOTO experiment.

References

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Poster 31

Precise discussion on T-asymmetry with B-meson decays

Presenter: Mr. Hiroyuki Umeeda (Hiroshima University)

BaBar collaboration announced that they measured time reversal asymmetry with B-meson system. They observed the two processes $\bar{B}^0 \to B_-$ and $B_- \to \bar{B}^0$ (where B_- denotes CP odd B-meson) by means of CP and flavor taggings. Since the two processes are related with flipping time direction, the asymmetry is seemingly thought to be a T-odd quantity. However, E. Applebaum et. al. pointed out that the BaBar asymmetry deviates from a T-odd quantity due to ambiguity of B-meson taggings. In our study, a time reversal-like asymmetry is constructed as event number difference. The contribution from ϵ_K is clarified. The reasons for the asymmetry to deviate from a T-odd quantity are discussed. We also consider a method to constrain parameters such like CPT violation, from the asymmetries.

This work is based on the paper, Precise Discussion of Time-Reversal Asymmetries in B-meson decays, arXiv:1411.2104, JHEP 1502(2015)174. (Takuya Morozumi, Hideaki Okane, Hiroyuki Umeeda)

Poster 32

Global Fits of the CKM Matrix with the scan Method

Presenter: Prof. Gerald Eigen (University of Bergen)

We present updated global fits of the CKM matrix with the Scan Method, adding measurements of the Bs-¿ mumu and Bd-¿ mumu branching ratios. In addition, we explore the theory parameter space by scanning over sets of three out of the ten observables with significant theory uncertainties. We provide constraints on two new physics models that assume new physics in Bd or Bs mixing.

Poster 33

Flavor violating Z' from $SO(10)$ SUSY GUT in High-Scale SUSY

Presenter: Dr. Yuji Omura (KMI)

We propose an $SO(10)$ supersymmetric grand unified theory (SUSY GUT), where the $SO(10)$ gauge symmetry breaks down to $SU(3)_c \times SU(2)_L \times U(1)_Y \times U(1)_X$ at the GUT scale and $U(1)_X$ is radiatively broken at the SUSY-braking scale. In order to achieve the observed Higgs mass around 126 GeV and also to satisfy constraints on flavor- and/or CP-violating processes, we assume that the SUSY-breaking scale is $O(100)$ TeV, so that the $U(1)_X$ breaking scale is also $O(100)$ TeV. One big issue in the SO(10) GUTs is how to realize realistic Yukawa couplings. In our model, not only **16**-dimensional but also **10**-dimensional matter fields are introduced to predict the observed fermion masses and mixings. The Standard-Model quarks and leptons are linear combinations of the **16**- and **10**-dimensional fields so that the $U(1)_X$ gauge interaction may be flavor-violating. We investigate the current constraints on the flavor-violating Z' interaction from the flavor physics and discuss prospects for future experiments.

Poster 34

GUT Scale Threshold Effect on Proton Decay

Presenter: Mr. Takumi Kuwahara (Nagoya University)

The nucleon decay is a significant phenomenon to verify grand unified theories (GUTs). For the precise prediction of the nucleon lifetime induced by the gauge bosons associated with the unified gauge group, it is important to include the renormalization effects on the Wilson coefficients of the dimension-six baryon number violating operators. In this study, we have derived the threshold corrections to these coefficients at the one-loop level in the minimal supersymmetric SU(5) GUT and the extended one with additional SU(5) vector-like pairs. As a result, it is found that the nucleon decay rate is suppressed about 5

Poster 35

Electroweak phase transition in the singlet-extended SM

Presenter: Ms. Kaori Fuyuto (Nagoya University)

We improve the sphaleron decoupling condition in the real singlet-extended standard model using the finite temperature one-loop effective potential with daisy resummation, and discuss its impact on the mass bound of the second Higgs boson and the deviation of the Higgs boson coupling. It is found that, in order to satisfy the refined sphaleron decoupling condition, the deviations of the Higgs boson couplings get more enhanced than those obtained by the conventional criterion. This talk is based on Phys. Rev. D 90, 015015.

Cartan's Supersymmetry and the Decay of $H^0(0^+, 125\text{GeV})$ to $\gamma\gamma$, WW and ZZ

Presenter: Prof. Sadataka Furui (Graduate School of Science and Engineering, Teikyo University)

Higgs $H^0(0^+$,125GeV) decays to $\gamma\gamma(\ell\bar{\ell}\ell\bar{\ell})$, $W(\ell\bar{\nu})\bar{W}(\bar{\ell}\nu)$ and $Z(\ell\bar{\ell})\bar{Z}(\bar{\ell}\ell)$ with the ratio of the signal strength $\sigma(H^0 \to xx) = B(H^0 \to xx)_{exp}/B(H^0 \to xx)_{SM}$, equals 1.58 ± 0.3 for $\gamma\gamma$, 0.87 ± 0.2 for WW [ATLAS, 2014] and 0.93 ± 0.3 for ZZ[Finco, 2014].

Cartan's supersymmetry[Cartan, 1966] fixes couplings of two types of fermions ψ, ϕ and two types of vector fields x^i and $x^{i'}$, $(i = 1, 2, 3, 4)$. Assuming that the coupling of a Higgs bosons to two leptons and to two quarks are given by [Labelle,2010]

$$-y_\ell^{ij}\mathcal{E}_i(\mathcal{L}_j \circ \mathcal{H}_d) = -y_\ell^{ij} H_d^0 \bar{\ell}_{L_i}\ell_j \text{ and } -y_b^{ij}\mathcal{D}_i(\mathcal{Q}_j \circ \mathcal{H}_d) = -y_b^{ij}\,\nu_d\,\bar{b}_i b_j.$$

The electromagnetic interaction of leptons and quarks is expressed as ${}^t\psi\mathcal{C}x^i\psi$. In the case of coupling of leptons and quarks with W, we extend the coupling ${}^t\phi\mathcal{C}X\psi$ to ${}^t\phi\mathcal{C}X(1-\gamma_5)\psi$, where $X = x^i$ or $x^{i'}$, and unify the interactions in the form

$${}^t\phi\mathcal{C}\bar{x^i}\psi + {}^t\phi\mathcal{C}\bar{x^{i'}}\mathcal{C}\psi + {}^t\phi_4(+\gamma_5 x^{4'})\mathcal{C}\psi_4$$

where $\bar{x^i}$ implies appropriate x^i or $(-\gamma_5 x^i)$ is chosen, except the term ${}^t\phi_4(+\gamma_5 x^{4'})\mathcal{C}\psi_4$ which has the opposite sign[SF, 2015], whose effect is under investigation.

We express the Higgs boson $\mathcal{H}_d$ by two types of quaternions Ψ and Φ, leptons $\mathcal{L}_j$ and quarks $\mathcal{Q}_j$ by two types of quaternions ψ, ϕ and the charge conjugate $\mathcal{C}\psi$ and the coupling between the fields are given by the Yukawa type, parametrized by y_ℓ^{ij} and y_b^{ij}. We observe the number of diagrams that allow transitions from H^0 to $\gamma\gamma, WW$ and ZZ are 16, 9 and 9, respectively [SF, 2015a].

We can understand absence of $B_s(0^+)^+ \to B_s(0^-)\pi^+$, and presence of $B_s(0^+)^+ \to D_s^*(0^+)^+ \to D_s(0^-)\pi^+$ from the triality selection rules that Cartan's supersymmetry predicts[SF, 2014]. Interpretation of $\chi_b(3p) \to \Upsilon(1S)\gamma$ as the decay of Higgs partner $h^0(0^+$,10GeV)$\to \Upsilon(b\bar{b}, 1S)\gamma(\ell\bar{\ell})$ is discussed[SF,2015b].

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Poster 37

CEDM constraints in $E_6 \times SU(2)_F \times U(1)_A$ SUSY GUT model

Presenter: Mr. Yoshihiro Shigekami (Nagoya University)

We show chromo-electric dipole moment (CEDM) constraint in $E_6 \times SU(2)_F \times U(1)_A$ grand unified theory (GUT). In general, down quark CEDM decouples in large sfermion mass limit, while for up quark CEDM, there is non-decoupling effects caused by stop loop. Therefore, if up-quark and up-squark sectors are complex at GUT scale and stop mass is light in order to realize 125 GeV Higgs mass, up quark CEDM is enhance and become one of the strong constraint for supersymmetric (SUSY) GUT model. Usually, we need to consider the model with universal sfermion mass at GUT scale to suppress CEDM, for example minimal supergravity (mSUGRA). However, in this model, although the mass of third generation $SU(5)$ **10** representation sfermion is lighter than that of the other sfermions, up quark CEDM is suppressed because real up-quark and up-squark sectors at GUT scale can be also obtained. We saw that up and down quark CEDM satisfy current constraints in E_6 SUSY GUT with $SU(2)$ flavor and anomalous $U(1)_A$ gauge symmetries. Moreover, in this model, we found that proton or neutron EDM may be observed in future experiments.

Poster 38

Probing New Physics with q^2 distributions in $\bar{B} \to D^{(*)}\tau\bar{\nu}$

Presenter: Dr. Ryotaro Watanabe (CTPU-IBS)

Recent experimental results for the ratios of the branching fractions of the decays $\bar{B} \to D^{(*)}\tau\bar{\nu}$ came as a surprise and lead to a discussion of possibility of testing New Physics beyond the Standard Model through these modes. We show that these decay channels can provide us with quite good constraints on the New Physics couplings. In order to discriminate various New Physics scenarios, we examine the q^2 distributions and estimate the sensitivity of this potential measurement at SuperKEKB/Belle II experiment.

Poster 39

Study of anomalous tau lepton decay using chiral Lagrangian with vector mesons

Presenter: Prof. Takuya Morozumi (Hiroshima University)

Abstract: An intrinsic parity violating hadronic tau lepton decay is investigated. $\tau^- -> \eta\pi^-\pi^0\nu_\tau$ is the process in which the major contribution to the amplitude occurs through the intrinsic parity violation. We predict the hadronic invariant mass spectra of the process and compare them with the experimental data. For this purpose, we adopt the chiral Lagrangian with vector mesons including intrinsic parity violating terms. We determine the coefficients of the anomalous terms using the decay rates of hadronic and electro-magnetic intrinsic parity violating processes as well as the hadronic mass spectra of the intrinsic parity violating hadronic tau lepton decay. The former processes include $V \to P\gamma$, $V \to 3P$ etc.,where V denotes vector mesons (1^-) and P denotes pseudo-scalar mesons (O^-).

This work is based on collaboration with Daiji Kimura (Ube National College of Technology) and Hiroyuki Umeeda(Hiroshima Univ.).

Poster 40

New PID detector - TOP counter - for Belle II experiment

Presenter: Dr. Kenji Inami, Dr. Kazuhito Suzuki and Dr. Kodai Matsuoka (Nagoya University)

We have been developing a Cherenkov ring-imaging counter as a barrel particle identification device of Belle II detector for super B-factory at KEK. Recently, we have started the module production with 2.7m long quartz radiator, honeycomb panel box, MCP-PMTs and the fast electronics. In the performance tests, we evaluate the number of detected photons, time resolution and the related performance for each component. In this presentation, we show the overview of TOP counter, test results, module production status and prospects.

Poster 41

Overview and Highlights of the Belle II Computing

Presenter: Dr. Yuji Kato and Dr. Kiyoshi Hayasaka (KMI, Nagoya University)

The Belle II experiment is the next-generation flavor factory experiment at the SuperKEKB accelerator in Japan. The first physics run will take place in 2017, then we plan to increase the luminosity gradually. We will reach the world's highest luminosity $L = 8 \times 10^{35}$ cm^{-2}s^{-1} after roughly five years operation and collect a total of 50 ab^{-1} data by the end of the data taking period.The Belle II computing system is expected to manage the process of massive raw data, production of copious simulation as well as many concurrent user analysis jobs. The required resource estimation for the Belle II computing system reacheas roughly one million HS06 CPU and a few hundred Peta Bytes storage, in total. Therefore, it is natural to adopt a distributed computing model based on existing technologies. We chose DIRAC as a workload and data management system and AMGA as a metadata service. In particular, DIRAC provides us an interoperability of heterogeneous computing systems such as grids with different middleware, academic/commercial clouds and local computing clusters. Nagoya group leads monitoring team for Belle II computing and makes a big effort to maximize the active resources. In this presentation, we will present the highlights of the recent achievements of the Belle II computing system, forcusing on our Nagoya activity.

Transportation

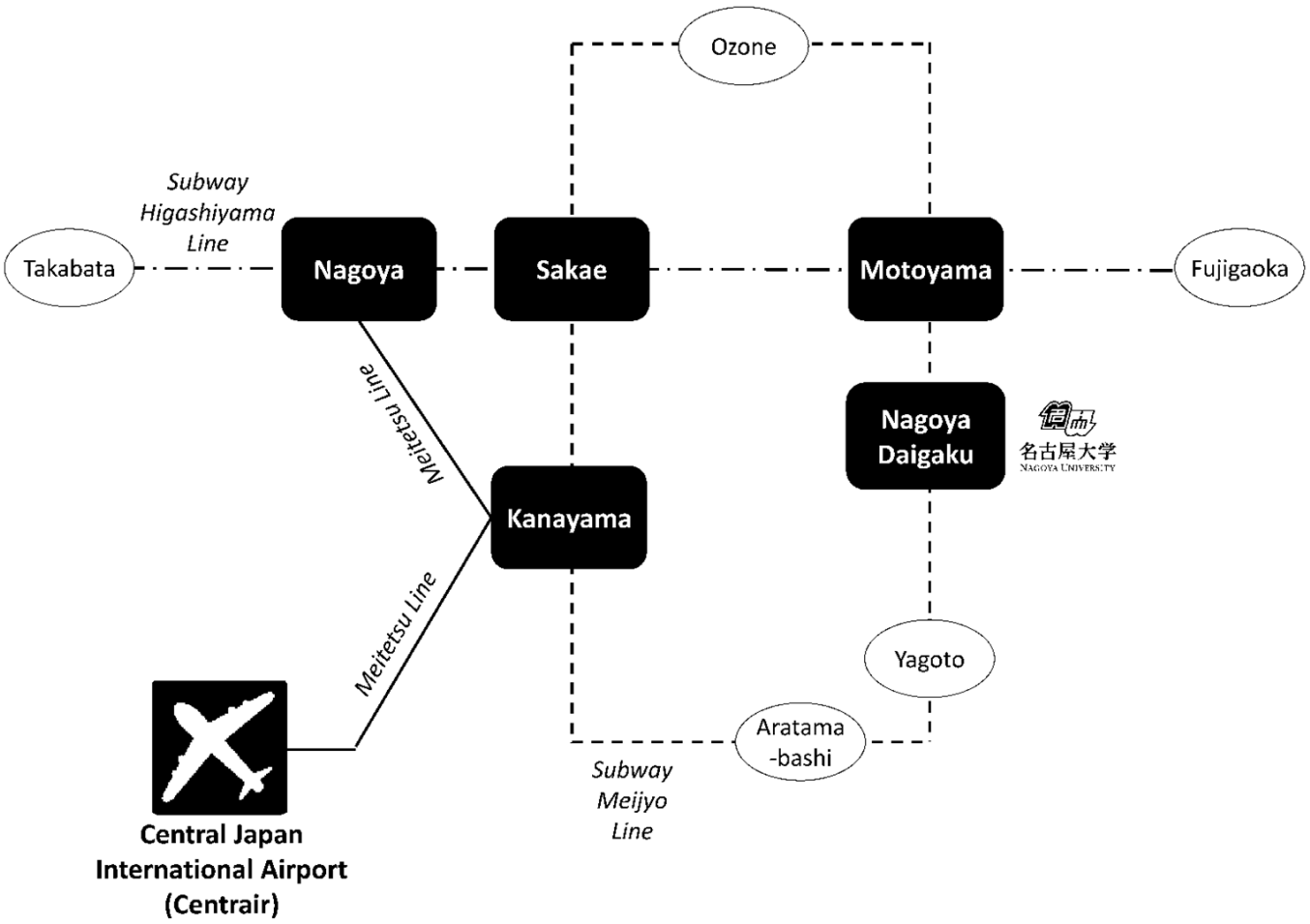
From Nagoya Station or Sakae Station to Nagoya University, Higashiyama Campus.

You can take the Subway Higashiyama Line in the direction of "Fujigaoka" at Nagoya Station or Sakae Station, and get off at "Motoyama Station". You change to the Subway Meijyo Line in the direction of "Yagoto and Aratamabashi" and get off at "Nagoya Daigaku Station". Subway fee is 270 yen (240 yen) from Nagoya Station (Sakae Station).

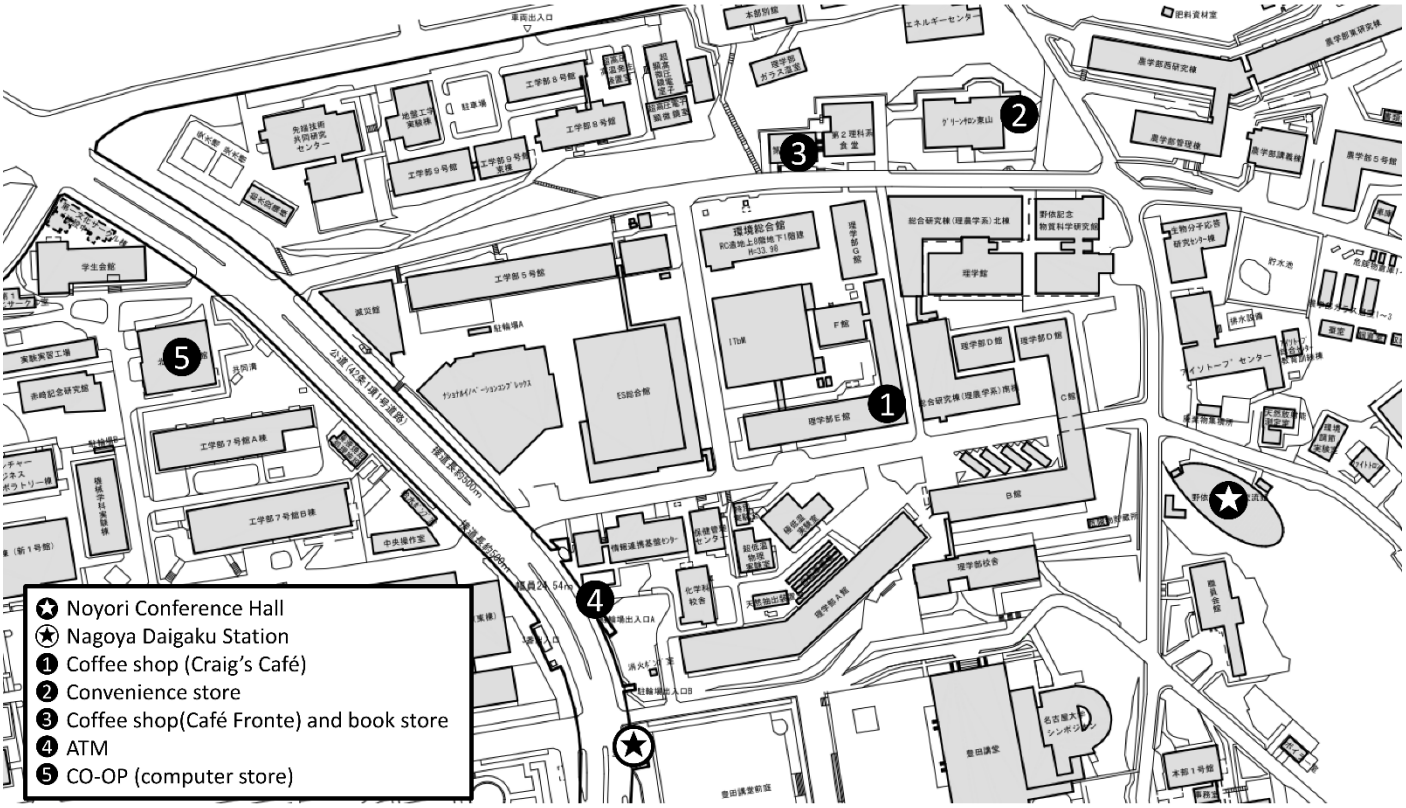
From Nagoya University, Higashiyama Campus to Central Japan International Airport (Centrair)

You can take the Subway Meijyo Line in the direction of "Yagoto and Aratamabashi" and get off at "Kanayama Station" (270 yen). You change to the Meitetsu Line to the Central Japan International Airport. Please note that additional ticket called a "μ ticket" (360 yen) is required in addition to the regular passenger fare (810 yen), when you take the Airport Rapid Limited Express "μ-sky" or first class cars on the limited express. Total travel time is about 75 minutes.

If you use μ-sky, total travel time is about 60 minutes.



Campus map



Wireless network

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The Internet access is made under the SSID: nuwnet. The ID and the password for the access can be found on your name tag, which you will be asked to enter when you open a web browser. Connection via eduroam is also available.