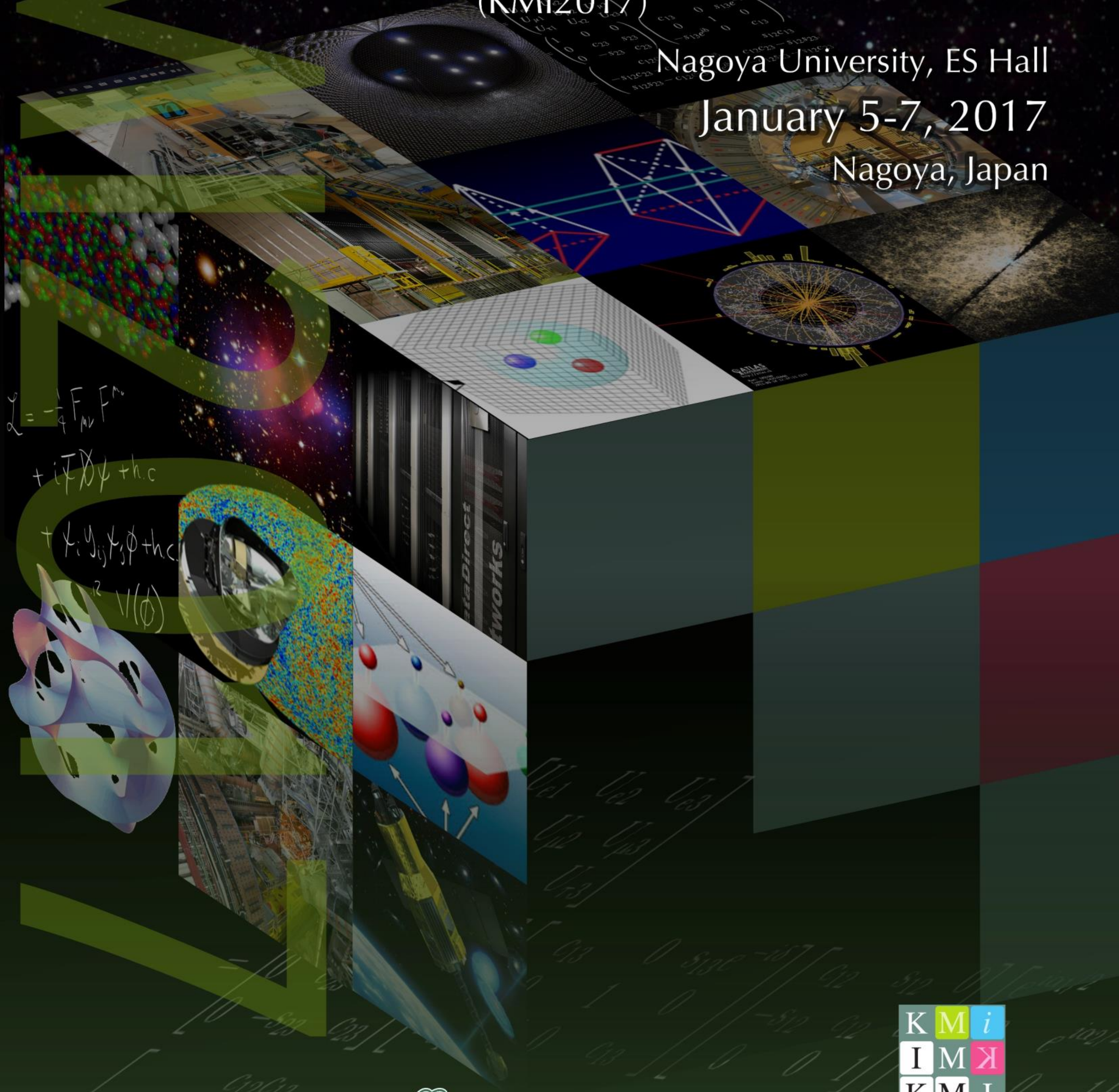
Book of abstracts
and information

The 3rd KMI International Symposium
on "Quest for the Origin of Particles and the Universe"
(KMI2017)

Nagoya University, ES Hall

January 5-7, 2017

Nagoya, Japan



NAGOYA UNIVERSITY

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

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Session 1 (Physics at LHC)

Review on the LHC Run2 results

Presenter : Yu Nakahama (KMI, Nagoya University)

The LHC Run-2 was started in 2015, producing proton-proton collisions at an unprecedented centre-of-mass energy of 13 TeV. During 2015 and 2016, the ATLAS and CMS detectors both collected about 40 fb^{-1} of data at the new collision energy. In this talk, after briefly introducing to the detector status and performances, I review the recent physics progresses [1] made by the LHC experiments, including the Standard Model, the scalar sector, and on searches for new particles. I also mention the physics prospects in the rest of the Run-2. The review mainly focuses on the ATLAS experiment, that KMI has been heavily contributing to.

Reference

[1] Visit https://twiki.cern.ch/twiki/bin/view/AtlasPublic/WebHome

Flavor physics in general two Higgs doublet model

Presenter : Kazuhiro Tobe (Nagoya University)

General two Higgs doublet model with $\mu - \tau$ flavor violation can explain the anomaly of muon anomalous magnetic moment as well as the event excess in a Higgs decay $h \to \mu\tau$, reported by the CMS collaboration. We discuss the possible predictions in this framework.

Session 1 (Physics at LHC)

Classification of Simple W' Models

Presenter : Tomohiro Abe (Nagoya University)

We investigate decay modes of spin-1 heavy vector bosons (V') from the viewpoint of perturbative unitarity in a model independent manner. Perturbative unitarity requires some relations among couplings, which are called unitarity sum rules. We derive the relation between V' couplings to the SM fermions (f) and V' couplings to the SM gauge bosons (V) from the unitarity sum rules. Using the coupling relations, we calculate partial decay widths for V' decays into VV and ff. We show that $\text{Br}(W' \to WZ) < 0.02$ in the system that contains V' and CP-even scalars as well as the SM particles. This result is independent of the number of the CP-even scalars. We also discuss what kind of interactions can make $\text{Br}(V' \to VV)$ larger than $\text{Br}(V' \to ff)$. Our result is a useful guideline to construct models that predict $\text{Br}(W' \to WZ) > 0.02$.

The Physics Program of the High Luminosity LHC and beyond

Presenter : Brian Petersen (CERN)

The LHC has successfully delivered more than 50 fb^{-1} of proton-proton collisions leading to the discovery of the Higgs Boson and a wealth of other physics results. Major upgrades of both the LHC accelerator complex and the experimental detectors are planned over the next ten years. This will increase the recorded luminosity by almost two orders of magnitude. I will describe the planned upgrades of the ATLAS experiment and the physics prospects for the full 3000 fb^{-1} data set. At the end I will briefly report on the prospects for a further high energy upgrade of the HL-LHC and studies into even more powerful hadron colliders.

Physics Prospects at SuperKEKB/Belle II

Presenter : Alessandro Gaz (KMI, Nagoya University)

The Belle II Experiment is in its final phase of construction and the SuperKEKB accelerator has successfully completed the first phase of commissioning. With an expected integrated luminosity of 50 ab^{-1} to be collected by the year 2025, the Belle II dataset will allow us to probe New Physics scales that are well beyond the reach of direct production at the LHC and will complement the searches through indirect effects that are currently ongoing or planned. An overview of the golden channels, of their physics motivations, and of the expected sensitivity of the Belle II Experiment will be given, with particular emphasis on the dataset that will be available in first two years of data taking.

Muon $g-2$/EDM experiment at J-PARC (E34)

Presenter : Yutaro Sato (KEK)

The muon anomalous magnetic moment $g-2$ and electric dipole moment (EDM) are sensitive to new physics beyond Standard Model, The E34 experiment aims to measure $g-2$ and EDM with a precision of 0.1 ppm and a sensitivity to 10^{-21} e·cm, respectively, whereas current precision of the muon $g-2$ is 0.54 parts per million (ppm) and upper limit on the EDM is 10^{-19} e·cm. In order to achieve our goal, we will utilize the high intensity proton beam at J-PARC and newly developed novel technique of the ultra-cold muon beam. The ultra-cold muon is generated from the thermal muonium production by the silica aerogel followed by the laser ionization, and then accelerated up to 300 MeV/c. The muon is injected to the super-conducting storage magnet supplying 3 T field by newly developed three dimensional injection scheme and the decay positron is detected by the silicon strip detector. We report current status of each component of our experiment and future prospect.

Null Tests of Time Reversal Invariance Using Neutrons

Presenter : William Snow (Indiana Univerity)

The intellectual motivation to search for new sources of time reversal violation is very strong and comes from deep unresolved issues in particle physics and cosmology. Experimental observables which are nonzero only if time reversal symmetry is violated are especially important for such a search. I will describe two such observables involving neutrons: the neutron electric dipole moment and T-odd forward scattering amplitudes.

Search for unknown interaction with neutrons

Presenter : Masaaki Kitaguchi (Nagoya University)

Neutron is a chargeless massive particle with the lifetime in the macroscopic range, which is suitable for precision measurement of the small influence of new physics. Non-Newtonian effect of the gravity at the short range is lead by the existence of extra-dimension of the space. We have started the experimental studies to search unknown interactions with slow neutrons. Combination of the pulsed neutrons provided by J-PARC and the advanced optical devices enables us to perform new types of high precision measurements. Neutron scattering with noble gas target enables us to measure the interaction at the range of the order of 1 nm. The apparatus was installed into beamline NOP and physics run is now on going. Neutron interferometer has the advantage to measure the gravitational potential precisely. We are now planning the unknown force search lead by dark energy, like chameleon field,by using the interferometer. We report the current status of our experiments.

Flavor Physics in Beyond Standard Models

Presenter : Yuji Omura (KMI, Nagoya Univ.)

In this talk, we discuss flavor physics in the Beyond Standard Models, such as SO(10) Grand Unified Theory (GUT) and dark matter models. In the SO(10) GUT, the realization of the realistic Yukawa couplings is one of the important issues. We propose one mechanism to solve it and discuss flavor violating processes to test this model: for example, $\Delta F = 2$ processes and lepton flavor violating μ decays. If we have time, I also present my recent work on flavor physics in dark matter models.

The OPERA experiment and its contribution to neutrino physics

Presenter : Giovanni De Lellis (University Federico II of Naples)

After the results of Super-Kamiokande in 1998 showing evidence for neutrino oscillations through muon neutrino disappearance, the proof that muon neutrino oscillate to tau neutrinos was a missing tile in the three neutrino mixing scenario. The OPERA experiment was designed with this goal, with a muon neutrino produced at CERN and detected at Gran Sasso after travelling about 730 km. Nuclear emulsion technology is the only one capable of detecting tau neutrinos through the observation of both the production and decay vertices of the tau lepton. OPERA has used a hybrid detector based on the Emulsion Cloud Chamber technology. The experiment has collected more than 10000 muon neutrino interactions and located among them 5 τ neutrino candidates. Given the low background, this has allowed to claim for the discovery of tau neutrino appearance in a muon neutrino beam. We review these results including all the other studies performed by the experiment.

Session 4 (Observational Astrophysics, Cosmology and Gravity, QCD Matter)

Recent results and future prospects of neutrino oscillation experiments

Presenter : Roger Wendell (Kyoto University)

Since the discovery of non-zero θ_{13} and oscillation-induced electron neutrino appearance, it has become possible to address the question of CP violation in neutrino oscillations in long-baseline experiments. Though current experiments have already begun to constrain δ_{cp}, the parameter responsible for CP violation in the MNS mixing paradigm, uncertainties in other oscillation parameters remain an obstacle to a precision measurement. This talk will review recent results in neutrino oscillation measurements, with a focus on progress towards and prospects for an observation (or rejection) of CP violation in neutrinos. Though emphasis will be placed on the long-baseline and atmospheric neutrino programs in Asia, discussion of results from worldwide experiments will be included.

Neutrino research program with Nuclear Emulsion at J-PARC

Presenter : Tsutomu Fukuda (Nagoya University)

We proposed a new experimental project which equips Emulsion Cloud Chamber (ECC) as a main detector in order to study low energy neutrino-nucleus interactions in detail and explore a possible existence of sterile neutrinos. First of all, a test experiment (J-PARC T60) is implemented to check the performance of newly developed emulsion gel, optimize the detector structure, and demonstrate the neutrino analysis with ultimate position resolution. Anti neutrino beam was exposed to a few kg iron and water target ECC and a 60 kg steel target ECC at J-PARC. From this summer, the analysis based on several thousands of anti-neutrino interactions accumulated in ECC was started. In this talk, I will give the status of the measurements and the future prospects.

From T_c to Q_s : Quarks and gluons at high temperature and high density

Presenter : Berndt Mueller (BNL / Duke University)

Relativistic heavy ion collisions have made it possible to explore the structure of matter temperature exceeding 3 trillion degrees. The surprising discovery was that matter under these conditions is a strongly coupled liquid quark-gluon plasma, which has a number of remarkable properties. The proposed electron-ion collider will study gluons and quarks in a regime of large density, where interactions among gluons lead to saturation. In my talk I will describe the physics program that will try to unravel the mysteries of both regimes.

Phenomenological Analysis of High-Energy Heavy-Ion Collisions

Presenter : Chiho Nonaka (Nagoya Univserity)

To gain an insight into the Quark-Gluon Plasma (QGP) and the QCD phase transition, high-energy heavy-ion collision experiments are extensively carried out at Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC).For understanding the QGP property from experimental data, a phenomenological model which can connect the first principle QCD with the dynamics of space-time evolutions of heavy-ion collisions is indispensable. I will give a short review of current achievement of phenomenological model in investigation of the QGP property in high-energy heavy-ion collisions. In particular, I will focus on a hydrodynamic model which is widely used for analysis of particle distribution, collective flow and correlations at RHIC and the LHC. We have developed the state-of-the-art numerical algorithm for solving relativistic viscous hydrodynamic equation, which is important to obtain detailed information of QGP bulk property, transport coefficients of QCD matter. Furthermore I will make a comment on future low-energy collisions experiments such as FAIR, NICA and J-PARC from the point of view of phenomenological study.

Quest for the Origin of Cosmic Rays with Gamma-Ray Observations

Presenter : Hiroyasu Tajima (Nagoya University)

Cosmic rays are among long standing mysteries of the Universe since the origin and the acceleration mechanism of cosmic rays are not known well. Gamma-ray observations are expected to play a prominent role in probing into those questions since gamma rays are produced by interaction of cosmic rays. In fact, the Fermi Gamma-ray Space Telescope found the first undeniable evidence of cosmic ray acceleration in supernova remnants (SNRs) in 2013. However, it is not yet conclusive whether the SNRs is the sole origin of Galactic cosmic rays and we also have no credible clues on the extragalactic origins. In this talk, recent progresses and future prospects on uncovering the origins of Galactic and extragalatic cosmic rays are reviewed.

GRAINE project: Cosmic Gamma-ray Observation with Balloon-Borne Telescope with Nuclear Emulsion

Presenter : Shigeki Aoki (Kobe Univ.)

GRAINE is a project to observe cosmic gamma-rays in the energy range of 10 MeV to 100 GeV by a balloon-borne telescope using nuclear emulsion film. Emulsion gamma-ray telescope can improve angular resolution by an order of magnitude than current observation at same energy. I introduce the road-map of this project and outcomes of our recent balloon experiment.
*GRAINE stands for Gamma-Ray Astro-Imager with Nuclear Emulsion.

Dark Matter Annihilation Around Black Holes

Presenter : Jeremy Schnittman (NASA Goddard)

We use a Monte Carlo code to generate a distribution function of both bound and unbound populations of dark matter particles around Kerr Black Holes. From these distribution functions, we calculate annihilation rates and observable gamma-ray spectra for a few simple dark matter models. The features of these spectra are sensitive to the black hole spin, observer inclination, and detailed properties of the dark matter annihilation cross section and density profile. Confirming earlier analytic work, we find that for rapidly spinning black holes, the collisional Penrose process can reach efficiencies exceeding 600%, leading to a high-energy tail in the annihilation spectrum. The high particle density and large proper volume of the region immediately surrounding the horizon ensures that the observed flux from these extreme events is non-negligible.

Direction Sensitive Direct Dark Matter Search with Super-High Resolution Nuclear Emulsions

Presenter : Tatsuhiro Naka (KMI, Nagoya University)

Dark matter problem is one of the most important subjects for nature science, and we can expect the character of dark matter as WIMP (Weakly Interacting Massive Particle). Especially, direct dark matter search seeing the nuclear recoil signal induced by WIMP is the most sensitive and high reliable method to directly understand the dark matter property. For the direct dark matter search, annual modulation of signal is expected to be as high reliable evidence for dark matter signal, and that has been the goal for almost experiment. Now, DAMA/LIBRA experiment using NaI scintillator at Gran Sasso laboratory in Italy has claimed the annual modulation with more than 9σ significance. However, some experiments have also claimed incompatible result with DAMA. Now we are in such chaotic situation. As important approach in this situation I think, low-mass dark matter search, same detector approach with DAMA and new search with quite difference systematics are pointed out. In those approach, direction sensitive search is the most promising method as the search with quite different systematics, because it doesn't rely on the seasonal effect, but utilized angular asymmetry for direction of WIMP. In this talk, we propose the new experiment with new technologies using super-high resolution nuclear emulsion which we developed uniquely. This detector is capable of detecting very short length track less than 1 μm, and also has developed new readout system for such signal. We submitted Letter of Intent to Gran Sasso laboratory in 2015 as " NEWS experiment ", and continue to study toward low-background experiments. In this talk, I will report about the new technologies developed here, status and future plan for this experiment, and also may discuss about application using this detector.

Probing Dark Matter with Cosmic Messengers

Presenter : Andrea Albert (Los Alamos National Laboratory)

There is overwhelming evidence that non-baryonic dark matter constitutes ~85% of the mass in the Universe. Many promising dark matter candidates, like Weakly Interacting Massive Particles (WIMPs), are predicted to produce Standard Model particles like gamma rays and cosmic rays via annihilation or decay. These messengers would be observed by space-based detectors, like the Fermi Large Area Telescope and the Alpha Magnetic Spectrometer, or by ground-based arrays like the High Altitude Water Cherenkov (HAWC) Observatory and the IceCube Neutrino Observatory. These cosmic, multimessenger searches compliment underground detectors and accelerator searches, all of which are needed to fully probe and understand the particle nature of dark matter. A detection of dark matter through cosmic messengers would not only confirm the existence of dark matter through a non-gravitational force, but also indicate the existence of physics beyond the Standard Model. I will summarize the recent results from indirect dark matter searches and discuss future prospects for the field.

Session 5 (Dark Matter, Flavor physics, Belle II experiment)

DM search with high-resolution X-ray spectroscopy

Presenter : Tetsu Kitayama (Department of Physics, Toho University)

X-ray spectroscopic observations provide a unique probe of direct signatures of dark matter, such as a decay line of a hypothetical sterile neutrino in the keV mass range. There have been reports on possible detection of the unidentified emission line at 3.5 keV in several low-resolution studies of galaxies and their clusters, e.g., by the XMM-Newton satellite. I will present the first and only high-resolution spectroscopic measurement made by the Hitomi satellite toward the center of the Perseus galaxy cluster, which finds no unidentified emission line at 3.5 keV. While the Hitomi data lack sensitivity to inspect the average signal inferred from the large sample of galaxy clusters by XMM-Newton, they have excluded the brightest signal reported for the Perseus cluster at more than 99% confidence level.

Axion and dark matter studies in IBS

Presenter : Kiwoon Choi (Institute for Basic Science)

The QCD axion, which was introduced originally to solve the strong CP problem, is one of the most compelling candidate for the dark matter in our universe. I discuss some theoretical issues on axion dark matter, and present the experimental efforts in the Institute for Basic Science (IBS) in Korea to search for the axion and WIMP dark matter.

Muon Trigger development toward High luminosity LHC

Presenter : Makoto Tomoto (Nagoya University)

High-luminosty LHC (HL-LHC) is scheduled from 2026 to provide more precise measurements of Higgs boson properties and more sensitive new physics searches. In order to cope with the higher data-taking rate for HL-LHC, the trigger and readout electronics will be replaced by new ones. In this talk, contributions of Nagoya group to the developments of new muon trigger electrons are presented.The prototype front-end electronics with Time-to-Digital Converter (TDC) on Field Programmable Gate Array (FPGA) for the monitored drift tube (MDT) detector and the prototype front-end module for Thin Gap Chamber muon trigger detector are introduced. The performance of the electronics using the muon beam at CERN and results on the radiation irradiation tests are also presented.

Session 5 (Dark Matter, Flavor physics, Belle II experiment)

Construction of the Belle II TOP counter

Presenter : Kodai Matsuoka (KMI, Nagoya University)

The Belle II experiment operating at SuperKEKB of the luminosity frontier accelerator will perform high precision flavor physics measurements. An efficient particle identification is essential for Belle II to extend its reach toward New Physics, and it is realized by the TOP counter. The TOP counter is a novel ring imaging Cherenkov detector, which measures the time of propagation (TOP) of the internally reflected Cherenkov photons. After the long R&D of more than a decade, we finally assembled the 16 TOP counter modules and installed them in success in 2016. That is a major milestone of the Belle II construction and will be reviewed in this talk.

Overview of the Belle II Computing

Presenter : Yuji Kato (KMI, Nagoya University)

The Belle II experiment is the next-generation flavor factory experiment at the SuperKEKB accelerator in Japan. 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 reaches 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, private/public 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, focusing on our Nagoya activity.

R&D for Neutron Physics

Presenter : Katsuya Hirota (Nagoya University (Phi-Lab))

Neutron is chargeless hadron with the lifetime of about 15 minutes. Slow neutrons are available to control their trajectory by using magnetic lenses and multilayer metal mirrors. Optically controlled slow neutrons are applied to study weak interaction, gravitational interaction and exotic interactions related to new physics beyond the standard model. The efficacy of the neutron beam is increasing by the neutron optics and the application is spreading to fundamental physics and industrial uses. However, the use of neutron beams is currently limited to large-scale facilities such as nuclear research reactors and high-intensity accelerators. Applicability of small-scale and medium-scale neutron sources has been discussed for activating the potentials. A few small-scale neutron sources have been constructed, some others are under construction or under discussion in Japan. The Nagoya University Accelerator driven Neutron Source (NUANS) is also now constructing at main campus of Nagoya University. These sources are designed relatively specialized for specific applications. The combination of large-scale neutron sources and (small-scale) application-oriented specialized sources is becoming more important. In this talk I will present the current status of NUANS and device development.

Muography

Presenter : Hiroyuki Tanaka (University of Tokyo)

The idea of muography was first proposed by E.P. George in 1955, more than 60 years ago, during his attempt to measure the areal density of rock overburden above a Geiger counter he installed into a gallery of Snowy Mountain Scheme, Australia. 13 years later, muography was applied by Louis Alvarez to measure the internal structure of Chephren's pyramid in Egypt. However, he did not successfully detect an unrevealed chamber inside the pyramid. 40 years after Alvarez's experiment, the muography technique developed to the extent that a visualization of the magma pathway inside a volcano was obtained for the first time. In this talk, I will discuss how this first visualization has subsequently triggered a ripple effect, motivating the global muography community to apply this technique to several scientific targets including a glacier, historic architecture, caves, CCS (carbon capture storage), and surveys of ore bodies.

Hitomi X-ray mission and observation of the Perseus cluster of galaxies

Presenter : Takaya Ohashi (Tokyo Metropolitan University)

I will report on the X-ray astronomy mission Hitomi, launched in February and operated for about a month, and its results on the Perseus cluster of galaxies. The satellite carried microcalorimeter instrument for the first time and achieved an energy resolution of about 5 eV, which is 25-30 times better than the CCD instrument. Other detectors provided a wide-band coverage to hard X-rays. The turbulence of the hot intracluster gas around the cluster center was measured precisely to about 164 km/s along the line of sight, showing that the turbulent pressure is only 4% of the thermodynamic pressure. I will describe the Hitomi spacecraft and other provisional results expected from this mission.

LIGO's first detection of gravitational waves and the development of KAGRA

Presenter : Kentaro Somiya (Tokyo Institute of Technology)

Gravitational waves are ripples of spacetime that Albert Einstein predicted 100 years ago. The direct observation had not been achieved for long time until the LIGO detector in the US discovered the first signal in 2015. KAGRA is the Japanese second generation gravitational-wave detector that is currently under development. KAGRA is the world first underground cryogenic detector and its final sensitivity will be a factor of 2 better than the current LIGO. I will introduce the history of gravitational-wave detection toward the historical first detection by LIGO and will report the current status of KAGRA.

Theoretical implications of gravitational-wave observations

Presenter : Enrico Barausse (Institut d'Astrophysique de Paris/CNRS)

I will review gravitational-wave emission in theories of gravity different from General Relativity, and discuss what constraints can be placed on them with binary pulsars, with the recent LIGO detections, and with future gravitational-wave experiments.

Session 6 (Cosmology and Gravity)

Theoretical constraints on modified theories of gravity

Presenter : Keisuke Izumi (KMI & Dept. of Math., Nagoya U.)

General relativity (GR) has been verified by many experimental and observational results and describes them with high precision at distances longer than 0.01 mm and shorter than 1 Gpc. Beyond these scales, however, the theory of gravity is still shrouded in mystery. For example, at cosmological distances, we are facing with the so-called dark energy problem. Looking at small scale physics, on the other hand, we face on many difficulties of the quantization of GR. These big mysteries motivate for us to upgrade the theory of gravity. The modification has to be consistent with the experimental and observational results, while the modified theory should have theoretical consistency. GR has many mathematical properties, which are required in fundamental physics. For instance, GR gives good causal structures. The positive energy theorem guarantees the semi-classical stability of Minkowski vacuum. However, by modification of gravity theory these mathematical structures of GR are easily broken. In this talk, I talk about the mathematical properties in modified theories of gravity.

LHCf and RHICf, collider experiments to reveal the nature of high-energy cosmic rays

Presenter : Takashi Sako (KMI/ISEE Nagoya University)

High-energy cosmic rays are observed through atmospheric air showers. Because the interpretation of air shower observations requires comparison with Monte Carlo simulation of hadronic cascade, precise knowledge of the hadronic interaction at high energy is indispensable. However difficulty in modeling such processes makes the interpretation, especially determination of the mass composition of primary cosmic rays, uncertain. The Large Hadron Collider forward (LHCf) experiment succeeded to measure high-energy forward particles at collision energies from 900 GeV to 13 TeV at LHC. The Relativistic Heavy Ion Collider forward (RHICf) experiment, a successor of LHCf, will take data at 510 GeV in 2017 at RHIC. Combining results from two experiments, hadronic interaction in a wide range of energy, from 10^{14} eV to 10^{17} eV in cosmic-ray equivalent energy, can be studied. We will discuss the LHCf results, cross sections of forward photons, neutrons and π^0's comparing with the various model predictions. We also introduce the expected results from RHICf and its status of preparation.

Interplay between LHC and flavor physics

Presenter : Jernej F. Kamenik (Jozef Stefan Institute)

The discovery of the Higgs boson and subsequent measurements of its properties at the LHC have spectacularly confirmed the Standard Theory of electroweak symmetry breaking. At the same time, flavor physics, also intimately tied to Higgs interactions, remains among the least understood sectors of the Theory. On the one hand, the peculiar pattern of quark and lepton masses, and their mixing angles, may be the clue to some new dynamics beyond the Standard Theory. Experimental studies of the Higgs boson are finally starting to probe this aspect of flavor physics directly. On the other hand, the generally excellent agreement between Standard Theory predictions and existing experimental measurements of the multitude of flavor physics observables at lower energies represents a serious challenge to Theory extensions predicting new particles in direct reach of the LHC. Fortunately, several recent experimental hints of possible deviations from Standard Theory predictions in rare semileptonic B meson decays do have interesting implications for direct searches performed at high energies.

Unexplored regions of WIMP

Presenter : Shigeki Matsumoto (Kavli IPMU, U. Tokyo)

WIMP is known to be one of influential candidates for dark matter in our universe. Thanks to recent development of collider, underground, cosmological and astrophysical experiments, the era of serious WIMP searches has begun. Then, important questions are "what is the current status of the WIMP paradigm?", "how far can we cover the WIMP paradigm in future?" and "what is then the leftover remaining as unexplored regions?" I try to answer these questions in this talk using some concrete examples.

Poster 01

Charged massive spin two particles

Presenter : Yuichi Ohara (Nagoya university)

We constructed a model of self-interacting charged massive spin two particles by using the interaction proposed by Hinterbichler. Then, we investigate the some basic properties of this theory.

Poster 02

Light Stop, Heavy Higgs, and Heavy Gluino in Supersymmetric Standard Models with Extra Matters

Presenter : Wataru Kuramoto (Nagoya Univ.)

We have explored the possibilities of scenarios with heavy gluinos and light stops in the supersymmetric (SUSY) standard models with extra vector-like multiplets. If we assume the hierarchical structure for soft masses of MSSM scalar fields and extra scalars, the light stop and the observed Higgs boson can be realized. While the stau is the lightest SUSY particle (LSP) in broad parameter space, we have found the neutralino LSP is realized in the case that the non-zero soft parameters for the MSSM Higgs doublets or the non-universal gaugino masses are assumed.

Poster 03

Recent measurements of top-quark pair differential cross-sections at $\sqrt{s} = 7$, 8, and 13,TeV with the LHC-ATLAS experiment

Presenter : Kentaro Kawade (Nagoya University)

Measurements of the kinematic distribution top quark pair ($t\bar{t}$) production provide crucial test of the standard model and have a unique sensitivity to the BSM physics. In this poster, recent measurements of top-quark differential cross-sections with respect to the top quark and top-pair kinematic variables in proton-proton collisions at center-of-mass energies of $\sqrt{s} = 7$, 8, and 13 TeV. The differential cross-sections are compatible with the prediction of Monte Carlo generators and theoretical calculations in a wide kinematic range.

Poster 04

Search for squarks and gluinos with the ATLAS detector in final states with jets and missing transverse momentum in Run2

Presenter : Yuta Sano (Nagoya University)

Despite the absence of experimental evidence, weak scale supersymmetry remains one of the best motivated and studied Standard Model extensions. The recent increase in the center of mass energy of the proton-proton collisions gives a unique opportunity to extend the sensitivity to production of supersymmetric particles at the Large Hadron Collider. This poster presents the latest ATLAS result on inclusive searches for promptly decaying supersymmetric squarks and gluinos in events containing jets, missing transverse momentum and no light lepton using the dataset recorded until 2016 July, corresponding to an integrated luminosity of 13.3 fb^{-1}. The prospect of further searches using higher statistics is also reported.

Poster 05

Search for scalar top quark pair production in final states with one isolated lepton, jets, and missing transverse momentum in $\sqrt{s}$=13 TeV pp collisions with the ATLAS detector

Presenter : Kouta Onogi (Nagoya University)

One of the most important parameters to compose supersymmetry is the mass of supersymmetric partner of the third generation quarks. Top squark mass lighter than 1 TeV is favored in theory, however the evidence of the top squark have not been indicated from the various searches in Run-1. Therefore, a wide range of scenarios with different mass splittings between the top squark, the lightest chargino and the lightest neutralino should be considered. The poster presents recent ATLAS results from searches for direct stop pair production, decaying to a bottom quark and the lightest chargino, using the proton-proton collisions at a centre-of-mass energy of 13 TeV recorded by the ATLAS detector and corresponding to an integrated luminosity of 13.2 /fb. In particular, new dedicated search was developed to cover compressed phase spaces between the top squark and the lightest chargino and the result greatly extended the LHC Run-1 exclusion limit.

Poster 06

Flavor Structure, Higgs boson mass and Dark Matter in Supersymmetric Model with Vector-like Generations

Presenter : Naoyuki Takeda (Keio University)

We study a flavor texture in a supersymmetric model with vector-like generations by using Froggatt-Nielsen mechanism. We find realistic flavor structures which reproduce the Cabbibo-Kobayashi-Maskawa matrix and fermion masses at low-energy. Furthermore, the fermionic component of the gauge singlet field becomes a candidate of dark matter, whereas the vacuum expectation value of the scalar component gives the vector-like mass. In our model, flavor physics and dark matter are explained with moderate size couplings through renormalization group flows, and the presence of dark matter supports the existence of just three generations in low energy scales. We analyze the parameter region where the current thermal relic abundance of dark matter, the Higgs boson mass and the muon $g-2$ can be explained simultaneously.

Poster 07

Flavor physics induced by light Z' from SO(10) GUT

Presenter : Yoshihiro Shigekami (Nagoya Univ.)

In this talk, we investigate predictions of the SO(10) Grand Unified Theory (GUT), where an extra U(1)' gauge symmetry remains up to the supersymmetry (SUSY) breaking scale. The minimal setup of SO(10) GUT unifies quarks and leptons into a 16-representational field in each generations. The setup, however, suffers from the realization of the realistic Yukawa couplings at the electroweak scale. In order to solve this problem, we introduce 10-representational matter fields, and then the two kinds of matter fields mix with each other at the SUSY breaking scale, where the extra U(1)' gauge symmetry breaks down radiatively. One crucial prediction is that the Standard Model quarks and leptons are given by the linear combinations of the fields with two different U(1)' charges. The mixing also depends on the flavor. Consequently, the U(1)' interaction becomes flavor violating, and the flavor physics is the smoking-gun signal of our GUT model. The flavor violating Z' couplings are related to the fermion masses and the CKM matrix, so that we can derive some explicit predictions in flavor physics. We especially discuss $K-\bar{K}$ mixing, $B_{(s)}-\bar{B}_{(s)}$ mixing, and the (semi)leptonic decays of K and B in our model. We also study the flavor violating mu and tau decays and discuss the correlations among the physical observables in this SO(10) GUT framework.

Poster 08

First Measurement of the tau Lepton Polarization in $B \to D^{*}\tau\nu$ at Belle

Presenter : Shigeki Hirose (Nagoya University)

The decay $B \to D^{*}\tau\nu$ is sensitive to new physics (NP) beyond the standard model (SM). The current world average of the ratio of branching fractions $R(D^{*}) = \mathrm{BF}(B \to D^{*}\tau\nu)/\mathrm{BF}(B \to D^{*}l\nu)$ shows a 3.3σ deviation from the theoretical prediction based on the SM. We have measured $B \to D^{*}\tau\nu$ with hadronic tau decays, which is an independent measurement from the previous studies at Belle using leptonic tau decays. In this presentation, we report the first result of the tau lepton polarization measurement in $B \to D^{*}\tau\nu$ as well as a new $R(D^{*})$ measurement, using the full data sample of Belle containing 772×10^{6} B meson pairs. Based on our new result, we discuss possibilities of NP.

Poster 09

Precision Measurement of the $\pi^+ \rightarrow e^+ \nu_e$ Branching Ratio in the PIENU Experiment

Presenter : Shintaro Ito (Okayama University)

Study of rare decays is an important approach to search for new physics beyond the Standard Model. Precision measurement of the ratio of the pion branching ratios provides a stringent test of the hypothesis of electron-muon universality in weak interactions. The goal of the PIENU experiment at TRIUMF is to measure the ratio of the pion branching ratios with precision of $<0.1\%$. This precision allows access new physics beyond the Standard Model up to the mass scale of 1000 TeV for psuedoscalar interactions. The latest result of the analysis will be presented.

Poster 10

Comparison of gamma production from thermal neutron capture of gadolinium with the MonteCarlo simulation

Presenter : Kaito Hagiwara (Okayama Univ.)

Gadolinium(Gd) has the largest cross-section of thermal neutron capture among natural element. When Gd captures thermal neutron, it emits several γ-rays that have energy of 8 MeV in total. We carried out the experiment to measure prompt γ-rays emitted from neutron reaction of enriched Gd(A=155,157). In this presentation, comparison of experimental data with MonteCarlo simulation will be described.

Poster 11

Measurement of Relative Intensity of the discrete gamma-rays from the thermal neutron capture reaction ^{155,157}Gd using ANNRI detector (J-PARC)

Presenter : Pretam Kumar Das (Okayama University)

Among all stable nuclei, Gd has the largest thermal neutron capture cross-section. Gd(n, γ) reaction emits total $\sim$8 MeV γ-rays. It is used for anti-neutrino detection technology. In this experiment, we measured the discrete γ-rays from the ^{155,157}Gd(n, γ) reactions using ANNRI detectors (Ge detectors) with good energy resolution. The purpose of our experiment is to provide precise information and MC simulation for the neutrino detection experiments. The relative intensities of discrete γ-rays from the n-capture with ^{157}Gd reaction have been calculated with good accuracy and were compared with the table value (NNDC CapGam). The relative Intensities of discrete γ-rays from the n-capture with ^{155}Gd reaction have been calculated for the first time with good accuracy.

Poster 12

Measurement of angular correlation of (n, γ) reaction with polarized neutrons

Presenter : Tomoki Yamamoto (Nagoya Univ.)

Large enhanced P-Violation in nuclear resonance reaction has been observed by using polarized neutron beam. Enhanced CP-Violation is suggested according to the same nuclear reaction. We are now preparing to supply polarized neutron beam for the CP-Violation search experiment. In the enhancement process of CP-violation, we assume that the P-violation of compound nuclear state doesn't depend on the final state, however this assumption has not been verified yet. We plan to verify the assumption by measuring $^{139}\mathrm{La}(n, \gamma)$ reaction with polarized neutron beam at BL04.The polarized neutron beam supplied by using ^{3}He spin filter,which will be installed into BL04. In my poster, I will talk about the states of development for ^{3}He spin filter and study of the equipment in BL04.

Poster 13

Measurement of neutron scattering from noble gas to search for a short-range unknown force

Presenter : Oi Noriko (Nagoya University)

We are searching for an unknown force by neutron scattering from nobel gas at low-divergence beam branch in BL05 NOP beamline in Materials and Life Science Experimental Facility (MLF) at the Japan Proton Accelerator Research Complex (J-PARC). Neutron is a chargeless massive particle with the long lifetime, which consequently is suitable for the precision measurement of a small interaction with the range of the order of 1 nm by the measurements of the scattering angular distribution. The experiment were performed in June 2016. The data were compared with Monte-Calro simulation to estimate the sensitivity of an unknown force. We will present our study and the data analysis.

Poster 14

Precise measurement of the angular correlations in (n,γ) reaction for T-Violation search

Presenter : Takuya Okudaira (Nagoya University)

The P violations enhanced by 10^6 times have been observed in several compound nucleus reactions. It is suggested that T violation also can be enhanced in the reactions. We plan experiments for the sensitive T violation search in J-PARC. Candidates nuclei for the experiments are ^{139}La, ^{131}Xe, ^{81}Br, ^{115}In and so on, which have the large enhanced P violations. The T violation search is based on the compound nucleus theory. However, the theory has not been verified in detail yet. The angular and polarized correlations in the (n,γ) reaction of compound nucleus need to be measured to verify the theory. We measured the angular correlations in the (n,γ) reaction of ^{139}La, ^{131}Xe, ^{115}In with Germanium detectors at BL04 in J-PARC. As the experimental results, the angular correlations in p-wave resonance are first observed with gamma ray from $^{139}\mathrm{La}+n$ to ground state of ^{140}La. I will present the results of experiments and analysis.

Poster 15

Stop-μ Analysis for Atmospheric $\nu_\mu/\bar{\nu_\mu}$ Separation in Super-Kamiokande

Presenter : Misaki Murase (ISEE,Nagoya Univ.)

We study μ^+/μ^- separation using decay electron information in cosmic ray stopping muon in order to separate atmospheric $\nu_\mu/\bar{\nu_\mu}$. We discuss new event selection defined in cosmic ray MC/data to distinguish decay electron and apply it to atmospheric neutrino MC.

Poster 16

Searching for dibaryon from lattice QCD

Presenter : Faisal Etminan (University of Birjand)

We investigate properties of the Baryon-Baryon interaction in lattice QCD to seek for possible dibaryon states.

Poster 17

Numerical simulations of causal relativistic viscous hydrodynamics for high-energy heavy-ion collisions

Presenter : Kazuhisa Okamoto (Nagoya University)

Relativistic hydrodynamic models play an important role in exploring the QGP bulk property and the QCD phase transition from analyses of high-energy heavy-ion collisions at RHIC and LHC. In the quantitative analyses of the QGP property, high-precision numerical algorithm of solving the hydrodynamic equation is important. Recently, we developed a new 3+1 dimensional relativistic viscous hydrodynamics code in Milne coordinates which is suitable for description of strong longitudinal expansion in high-energy heavy-ion collisions. In the algorithm, we use a Riemann solver based on the two-shock approximation which is stable under existence of large shock waves with small artificial viscosity. We check the correctness of the numerical algorithm by comparing numerical calculations and analytical solutions such as Gubser flow and so on. We find that the new numerical scheme is stable under existence of strong shock waves even with small numerical viscosity, which is an important feature to extract the physical viscosities at RHIC and LHC.

Poster 18

Spectral function for excited $\bar{D}$ meson as the signal of partial restoration of chiral symmetry in the nuclear matter

Presenter : Daiki Suenaga (Nagoya University)

Although chiral symmetry is spontaneously broken in the vacuum, it is expected to be partially restored in the nuclear matter. In this study, we propose the $\bar{D}$ mesons as probes to explore the chiral symmetry in nuclear matter. In the context of chiral partner structure, mass difference between $\bar{D}(0^-)$ and $\bar{D}_0^*(0^+)$ mesons comes from the breakdown of chiral symmetry. Then we see the mass of these mesons and spectral function for $\bar{D}^*$ meson in nuclear matter. As a result, we can see that decay width for $\bar{D}_0^* \to \bar{D}\pi$ gets narrowed as mass difference between them gets closer in the nuclear matter. Furthermore, we can find the appearance of a peak of the Landau damping due to the interaction with nuclear matter.

Poster 19

Analysis of cosmic-ray interaction in balloon-borne emulsion detector.

Presenter : Hiroaki Kawahara (Nagoya University)

I will report some results of analysis for hadronic interaction in emulsion detector mounted on balloon gondola. The experiment is called "GRAINE" that performed in 2015 in Australia, Alice Springs.

Poster 20

Charged pions probing strong CP violation in chiral-imbalance medium?

Presenter : Mamiya Kawaguchi (Nagoya University)

A novel probe for the strong CP violation is proposed: it is the charged-pion profile coupled to the electromagnetic field in a medium, what we call the chiral-imbalance medium, which can be produced in hot QCD with the finite chiral-chemical potential associated with the strong CP phase. Such a charged-pion profile could be observed by the direct photon detection measurement at heavy ion collision experiments, as the remnant of the strong CP violation.

Poster 21

Chiral invariant mass of N(939) in a three-flavor parity doublet model

Presenter : Hiroki Nishihara (Nagoya Univ.)

We summarize our recent work on the investigation of masses and decay widths of positive and negative parity nucleons using a three-flavor parity doublet model (PD model), by introducing three representations, $[(3,3)\oplus(3,3)]$, $[(3,6)\oplus(6,3)]$ and $[(1,8)\oplus(8,1)]$ of the chiral $U(3)_L \times U(3)_R$ symmetry. We find that the chiral invariant mass (m_0) of N(939) is roughly 500-800 MeV.

Poster 22

Analysis of Hadron Interactions Detected in Balloon-borne Emulsion Chamber by Automated Emulsion Read-out System

Presenter : Misaki Morishita (Nagoya University)

The purpose of GRAINE project is precise observation for cosmic gamma ray by using a balloon-borne emulsion detector. We conducted the experiment in Australia in May/2015. The emulsion detector is able to record all charged particles which passed the chamber in flight. I'm developing a method to detect hadron interactions induced by proton in primary cosmic ray. I will report about a result in this poster.

Poster 23

GRAINE Project: balloon-borne emulsion gamma-ray telescope

Presenter : Hiroki Rokujo (Nagoya University)

Gamma-Ray Astro-Imager with Nuclear Emulsion (GRAINE) is a γ-ray observation project with a new balloon-borne emulsion gamma-ray telescope.In May 2015, we performed a balloon-borne experiment in Alice Springs, Australia, in order to demonstrate the imaging performance of our telescope. The emulsion telescope that has the aperture area of 0.4 m^2 was employed in this experiment. In this presentation, we will report the latest results and the status of GRAINE project.

Poster 24

A simple solution for one of the cosmological constant problem by a topological field theory

Presenter : Taisaku Mori (Nagoya University)

We propose a simple and totally covariant model which may solve the fine-tuning problem. The model proposed in this presentation is a kind of topological field theories. A redefinition of one of the scalar fields make the quantum corrections irrelevant to the dynamics. We focus on the time evolution of the scalar fields and investigate the initial condition which may explain the density of the dark energy in the present universe. Further more, we investigate the conditions of stability in this model

Poster 25

Secluded dark matter with a massive mediator

Presenter : Shohei Okawa (Nagoya University)

We study a dark matter (DM) model in which a DM particle interacts predominantly with non-SM particles (mediator particles) which decay into the SM particles later. This kind of DM is called "secluded DM". We first introduce a simple model of secluded DM to survey the parameter space. Then, it is pointed out that if the mass splitting between DM and mediator is small, there is a novel thermal history of DM in which the DM number density evolution in early universe exhibits a temporary freeze-out behavior. Besides, a larger annihilation cross section than that of well-known thermal relic DM models is required in order to achieve the observed density. Based on these observations, a novel possibility of DM model building is proposed in which DM and mediator are unified in an approximate dark symmetry multiplet. A pionic DM model is introduced to illustrate this idea in a renormalizable field theory framework. The model naturally realizes the degenerate mass spectrum and the large cross section of the DM and the mediator.

Poster 26

Study of Axion Dark Matter Detection Using Josephson Junctions

Presenter : Naoya Kitajima (APCTP)

Axion is a plausible candidate for the present dark matter component of the Universe. Although the axion has only extremely weak interactions with visible sector particles, a coherently oscillating feature of the axion dark matter can amplify detection signals through resonance effects. We discuss a possibility for the axion dark matter detection using Josephson junction which consists of two superconductors connected by a weak link.

Poster 27

Astrophysical Constraints on Dissipative Dark Matter Models

Presenter : Eric Kramer (Harvard University)

After nearly a century of searching, the nature of dark matter continues to elude us. While Ockham's razor may at face value want a simple dark matter model, the complexity of the visible sector urges us to consider complex models for the visible sector as well, including dissipative interactions. In a galaxy like the Milky Way, these interactions would lead to cooling of the dissipative sector, resulting in a disk of dark matter with enhanced local density. I will briefly review the current bounds on the local dark matter density and explain why they do not apply to a dark disk. I will then explain what the latest astrophysical data truly say about a dark disk, including the bounds we recently determined from Milky Way stellar kinematics and from the distribution of the local interstellar gas, and what we can expect in upcoming the Gaia era.

Poster 28

Study of fluorescence for cryogenic fine-grain emulsion

Presenter : Hirmasa Ichiki (Nagoya University)

Nuclear emulsion is a solid detector which contains gelatins and AgBrI crystals and records charged particles as traces. When a charged particle penetrates crystals, it deposits energy and electrons appear on the surface of them. If an electron meets Ag^{+}, Ag core is generated. Thus, we can recognize a trace of a charged particle under a microscope. On the other hand, AgBrI emit photons with recombination of electrons and holes just like semiconductor, and such emission is enhanced at cryogenic temperature. This process is reported, e.g., by S. Takada (Photogr.Sci.Eng.21,3,1997). In such studies, they usually use light source or rubbing to excite electrons. Now we consider to bring out the new aspect of our detector using this process, and start to study for fluorescence of AgBrI crystals caused by charged particles at cryogenic temperature (77 K). This time, we will report about the result of detecting photons induced by β-ray with photo detector for the first time.

Poster 29

TOP counter for Belle II - post installation R&Ds

Presenter : Raita Omori, Noritsugu Tsuzuki, Genta Muroyama (Nagoya University)

We have developed new particle identification device, named TOP counter, for next B-factory "Belle II" experiment. We produced 17 TOP counter modules and installed into Belle II structure. We will present the R&D items after the installation, such as the performance studies in the 1.5 T magnetic field, issues on the magnet test and further investigation to achieve longer lifetime of the photon sensor element.

Poster 30

Ultra fast nuclear emulsion readout system HTS

Presenter : Yoshimoto Masahiro (Nagoya University)

Nuclear emulsion is a tracking detector with high spatial resolution, and it is used in various experiments. We developed the latest nuclear emulsion readout system HTS, and its speed has reached 0.5 m^2/h. We will report on the operation and achievement of HTS.

Poster 31

Nuclear Emulsion for WIMPs Search NEWS ∼development of scanning tecnology with nanometric resolution∼

Presenter : Atsuhiro UMEMOTO (Nagoya University)

NEWS is an experiment of directional dark matter search with emulsion. Dark matter particles should be interacted with nucleus in emulsion, then recoil nucleus makes a track that range is about 100 nm. So we are developing new scanning system to achieve the nanometric resolution.

Poster 32

Development of Large Crystal Nuclear Emulsion for Cosmic-ray Radiography

Presenter : AKIRA NISHIO (Nagoya University)

We are developing larger crystal size nuclear emulsion than conventional 200 nm one. Large crystal nuclear emulsion has a potential of high contrast and stability, so it is hopeful as future cosmic-ray radiography detector. We report basic characteristic of large crystal nuclear emulsion in this poster.

Poster 33

Firmware Development for the first level trigger of ATLAS LAr Calorimeter

Presenter : Kenta Uno (University of Tokyo)

The single electromagnetic trigger is important for ttH and vector boson associated Higgs production analyses which are necessary for Higgs-Yukawa coupling measurement. The upgrade of the trigger readout for the ATLAS Liquid Argon (LAr) calorimeter can read 10 times finer granularity than the current trigger readout to tolerant an increasing instantaneous luminosity. It is possible to improve the energy resolution and background rejection power and decrease the energy threshold at L1 trigger in the new trigger readout. FPGA firmware which manages huge data ($\sim$41 Tbps) within a small latency is required to achieve this. So, we have implemented multi-stage impulse response filter (FIR Filter) with high speed links for the new trigger readout. The firmware can calculate each energy with a very limited latency. This poster will give details on the design of the firmware, result of resource use, latency, and maximum operation frequency. We will show the development of an environment for simulation study and results of the hardware test of Aria-10 evaluation kit.

Poster 34

Charge determination for high-Z nucleus by fine grain nuclear emulsion

Presenter : Osamu Sato (Nagoya University)

A study for charge determination for high-Z nucleus with fine grain nuclear emulsion will be presented. Standard nuclear emulsion records delta rays from high-Z nucleus and the track are recorded as very thick radium several 10 μm. Using fine grain nuclear emulsion (developed for Dark Matter experiment) have no sensitivity for δ ray, then even Pb tracks are recorded without δ rays but a narrow radius like MIP tracks in standard nuclear emulsion. With the combination of standard nuclear emulsion plates and fine grain nuclear emulsion plates, it is expected as possible to identify its velocity β and Z. A search for Mono-Pole with large surface detector using this combinations could be considered.

Poster 35

Development of a prototype front-end board of the Thin Gap Chamber for ATLAS at the High-Luminosity LHC

Presenter : Tomomi Kawaguchi (Nagoya University)

In 2026, High-Luminosity LHC is planned to increase the luminosity by a factor of 10 in order to provide more accurate measurements of new particles including the Higgs boson and enable observations of rare processes. The trigger and readout electronics for ATLAS are planned to be replaced by new ones to cope with the higher latency and rate for the High-Luminosity LHC. The endcap muon trigger plans to make the decision using the deflection angle between the segments before and after the magnetic field. The Thin Gap Chamber (TGC) provides the muon track information after the magnetic field with $\sim$3 mrad angular resolution. In order to implement the new TGC trigger, the front-end boards of TGC need to send all 320k hit data with the bunch ID to off-detector electronics. The prototype of the front-end board with the concept for the upgrade has been developed and demonstrated using muon test beam line at CERN. In this presentation, we introduce the prototype of the front-end board and show the results of the beam test.

Poster 36

The design of the beam line of the Nagoya University Accelerator-driven Neutron Source

Presenter : Ito Ikea (Nagoya University)

The Nagoya University Accelerator driven Neutron Source (NUANS) are now constructing at main campus of Nagoya University. The electrostatic accelerator is used with the maximum proton energy and power of 2.8 MeV, 15 mA(42 kW). Two neutron beamlines are planned at NUANS. The first beamline is using epithermal neutron for BNCT. The second beamline is constructing for detector development and neutron imaging.The neutron used for the 2nd beam line is generated by using the (p, n) reaction of Be. As a result of the simulation using PHITS, the size of the target station for the 2nd beamline which can be used in physical research can be designed to be compact shape of 90 cm $\times$ 90 cm $\times$ 95 cm. The neutron beam hole is 10 cm $\times$ 10 cm, and it is assumed that it can be used for radiography. The neutron flux is expected to be about 10^4 n / cm^2 / s with energy of 0.1 eV or less with respect to the position about 2 m from the neutron source. We report on the transport calculation of the proton beam from the exit of the electrostatic accelerator to the target of the 2nd beam line and the process and results of the shielding calculation done to design the 2nd beamline.

Poster 37

Measurement of forward eta meson by LHCf in $\sqrt{s} = 13$ TeV p-p collisions.

Presenter : Maiko Shinoda (ISEE, Nagoya Univ.)

Very forward production of eta mesons is highly unknown and has large discrepancy among the cosmic-ray interaction models. The Large Hadron Collider forward (LHCf) experiment aims to verify the hadronic interaction models by using the LHC. Data taking in $\sqrt{s} =$ 13 TeV p-p collisions was carried out in Jun 2015. Here we report the initial results of forward eta meson measurement. We first verified the energy scale of the calorimeter detectors in the wide energy range by using the reconstructed mass peaks of π^0 and η mesons. Then we show the eta energy spectrum compared with model predictions.

Poster 38

Development of nuclear emulsion with thick plastic base for improvement of angular accuracy

Presenter : Yuta MANABE (Nagoya University)

In our laboratory, we make nuclear emulsion to use particle physics experiments. Nuclear emulsion is a kind of photographic film witch is sensitive to radial ray. We pour emulsion gel on plastic base. After dry it, we pour gel on opposite face. To correct distortion of gelatin, we pour emulsion gel on both surfaces. Now, we use 175 micrometer polystyrene base. This time, we change this 175 micrometer polystyrene base to 500 micrometer cyclo olefin polymer (=COP) base to improve angular accuracy. Long distance between upper and lower emulsion layer is good for angular accuracy, and polystyrene base has not good flatness because it isn't made for photographic film so we want to use thick and flat base. When use new material with nuclear emulsion, we have to check that it doesn't have bad effect on emulsion. We put COP base emulsion in constant temperature and humidity chamber to check long term performance.(32 ℃, 60%, 7 day) And put it on Egyptian pyramid (30 ℃, 30%, 49 day) to check it's long term performance at real environment and it's angular accuracy. As a result, COP base doesn't have a bad effect on emulsion at real environment, and angular accuracy is improved. I will talk about detail of this experiment at poster session.

Poster 39

ScanPyramids : Measurement of Cosmic-rays with Nuclear Emulsion inside Pyramids at Egypt

Presenter : Kunihiro Morishima (Nagoya University)

We are developing muography with nuclear emulsion. Muography is a non-destructive technology to see through gigantic objects just like X-ray imaging by using cosmic-rays. An international scientific project "ScanPyramids" is started from 2015 in order to study Pyramids at Egypt without destroy by using innovative technologies. In this project, we are conducting muography and are measuring cosmic-rays with nuclear emulsion inside Pyramids at Egypt. In this presentation, we will present current status of this project, development of nuclear emulsion technologies for this project and latest results with nuclear emulsion.

Poster 40

Angle Calibration of emulsion read-out system for gamma-ray telescope by test beam

Presenter : Yuya Nakamura (Nagoya university)

In our laboratory we use Hyper Track Selector (HTS) which is the world's fastest emulsion read-out system. HTS has an optical systematic error in angular measurement caused by difference of refractive index between emulsion and base film, and it makes 3% uncertainty in absolute angle. Such kind of error is a factor which makes imaging performance of gamma-ray telescope worse at larger angle. I conducted calibration by a beam test with 400 GeV proton beam at SPS/CERN to reduce that uncertainty to 1% or less. I will report its results.

Poster 41

Development of High Spatial Resolution Cold/Ultra-cold Neutron Detector

Presenter : Naotaka Naganawa (Nagoya University)

We have been developing high spatial resolution detectors for cold or ultra-cold neutrons by using fine-grained nuclear emulsion and nuclides which absorb neutrons with large cross section. Those detectors will be powerful tools for experiments detecting position distribution of neutrons, such as study of gravitation using quantized states of ultra-cold neutrons in the earth's gravitation field. Status of the development of those detectors will be presented.

Poster 42

Critical behavior of the domain wall collapse and oscillon

Presenter : Taishi Ikeda (Nagoya University)

The gravitational collapse is the one of the most important phenomena of gravity. About 20 years ago, Choptuik discovered a critical collapse in the massless scalar system. After this discovery, many author have shown that the critical behavior appears in the many systems, and it contains to the rich phenomena. In particular, Okawa et al showed the massive scalar system, which has the typical length scale, has a non trivial phase diagram with respect to the critical collapse. In this study, we consider the spherically symmetric domain wall collapse. This system also has the typical length scale in the action. In this regard, it is expected that this system also has the non trivial phase diagram. For the purpose of the analysis of such the phase diagram, we study the gravitational collapse around threshold of the BH formation, and found type II critical collapse. Now, in order to find the non-trivial phase diagram in this system, I consider non trivial configuration of this system, which is called oscillon. In this poster, I report the intermediate result of this study.

Poster 43

Relativistic Stars in Massive Gravity

Presenter : Masashi Yamazaki (Nagoya University)

To explain phenomena that cannot be explained by general relativity, several types of modified gravity theory are considered. One of such phenomena is a maximum mass of relativistic stars. By several observations, the maximum mass of neutron star can be more than $2M_\odot$ and it cannot be explained by general relativity and usual hadron physics. Therefore some modified gravity theories or hadron physics models are considered to explain it. The de Rham-Gabadadze-Tolley (dRGT) massive gravity, which describes ghost-free massive spin-2 field, is regarded as one of the modified gravity theories. The theory can be applied to hydrostatic equilibrium of relativistic stars and modify the density structure, because the hydrostatic equilibrium is determined by their weight (gravity theory) and pressure of the matter (hadron physics). We calculate the maximum mass of neutron star and quark star by using the dRGT massive gravity and their equations of state (EoS).

Poster 44

Dark Matter in Modified Gravity?

Presenter : Taishi Katsuragawa (Nagoya University)

The modified gravity theories have been investigated so far to explain the late-time accelerated expansion of the Universe. The modification of gravity leads to the emergence of the new degree of freedom described by the dynamical field, which plays a role of the dark energy and causes the cosmic acceleration. Besides the dark energy problem, it has been suggested that the new particle derived from the modified gravity can be a dark matter candidate. Recently, I investigated the above scenario in the F(R) gravity. The F(R) gravity includes the extra scalar field in addition to the graviton. Since this scalar field originates from the gravitational theory, it has very weak interactions with the standard model particles. And, the scalar field becomes heavy in the high-density region because of the chameleon mechanism. These two properties suggest that the scalar field can be the cold dark matter. In this talk, I study the nature of this scalar field in the framework of particle physics. I evaluate the lifetime of the new scalar particle and discuss the constraint to the form of the F(R) function.

Poster 45

Effective field theory of Horava Lifshtiz gravity

Presenter : Shun Arai (Nagoya University)

A violation of Diff invariance generically induces an additional degree of freedom. In Horava-Lifshitz (HL) gravity, where the 4D Diff invariance is broken into the foliation preserving Diff, there appears a scalar degree of freedom in the gravity sector, Khronon, which describes the degree of freedom for the time foliation. Then, one may naively expect that during inflation, we have to solve a mixed system with the inflaton and Khronon. By contrast, we find that in the non-projectable version of HL gravity, in the Lifshitz scaling regime, Khronon acuires a mass which is much heavier than the Hubble scale and is decoupled from the adiabatic perturbation ζ which is sourced by the inflaton fluctuation. While Khronon grows expotentially due to the anti-friction, this effect can be gauged away by performing a global time reparametrization. As a result, the adiabatic perturbation ζ behaves as if in an effectively single field system and the spectrum is conserved at super Hubble scales. The imprint of the Lorentz violation appears only from the deformed dispersion relation.

Poster 46

Developing a new template foreground cleaning method for the LiteBird experiment

Presenter : Kiyotomo ICHIKI (KMI, Nagoya University)

Detecting gravitational wave background generated during inflation through the B-mode polarization of the cosmic microwave background (CMB) is one of the main scientific goals of future CMB experiments. However, it has already become clear that the synchrotron and thermal dust emissions from our galaxy hinder the cosmological B-mode signal across the sky. Here we develop a new template cleaning method taking into account spatial variations of spectral indices of the foreground emissions, and apply it to various foreground models using Monte-Carlo simulation technique. We find that the method successfully remove the unwanted bias in determining the tensor-to-scalar ratio r that was found in the simple template cleaning method presented in Katayama and Komatsu 2011. In this poster, we present how small r we will be able to reach according to the frequency band and noise specification proposed for the LiteBird experiment.

Poster 47

Zero degree neutron energy spectra in $\sqrt{s}$=13TeV proton-proton collisions at LHC

Presenter : Mana Ueno (ISEE, Nagoya university)

The Large Hadron Collider forward (LHCf) experiment is designed to verify the hadronic interaction models used in cosmic-ray physics. We measured forward particle spectra in $\sqrt{s} = 13$ TeV proton-proton collisions at LHC in 2015. In this poster, we report neutron energy spectra for LHC $\sqrt{s} = 13$ TeV proton-proton collisions. And discuss about the comparison with $\sqrt{s} = 7$ TeV proton-proton collisions data at LHC.

Poster 48

Monte Carlo study of diffraction in proton-proton collisions at $\sqrt{s} = 13$ TeV with the very forward detector

Presenter : Zhou Qi-Dong (Nagoya University)

Very forward (VF) detectors in hadron colliders, having unique sensitivity to diffractive processes, can be a powerful tool for studying diffractive dissociation by combining them with central detectors. Several Monte Carlo simulation samples in p-p collisions at $\sqrt{s} = 13$ TeV were analyzed, and different nondiffractive and diffractive contributions were clarified through differential cross sections of forward neutral particles. Diffraction selection criteria in the VF-triggered-event samples were determined by using the central track information.The corresponding selection applicable in real experiments has approximately 100% purity and 30%-70% efficiency. Consequently, the central information enables classification of the forward productions into diffraction and nondiffraction categories; in particular, most of the surviving events from the selection belong to low-mass diffraction events at $\log_{10}(\xi) < -5.5$. Therefore, the combined method can uniquely access the low-mass diffraction regime experimentally.

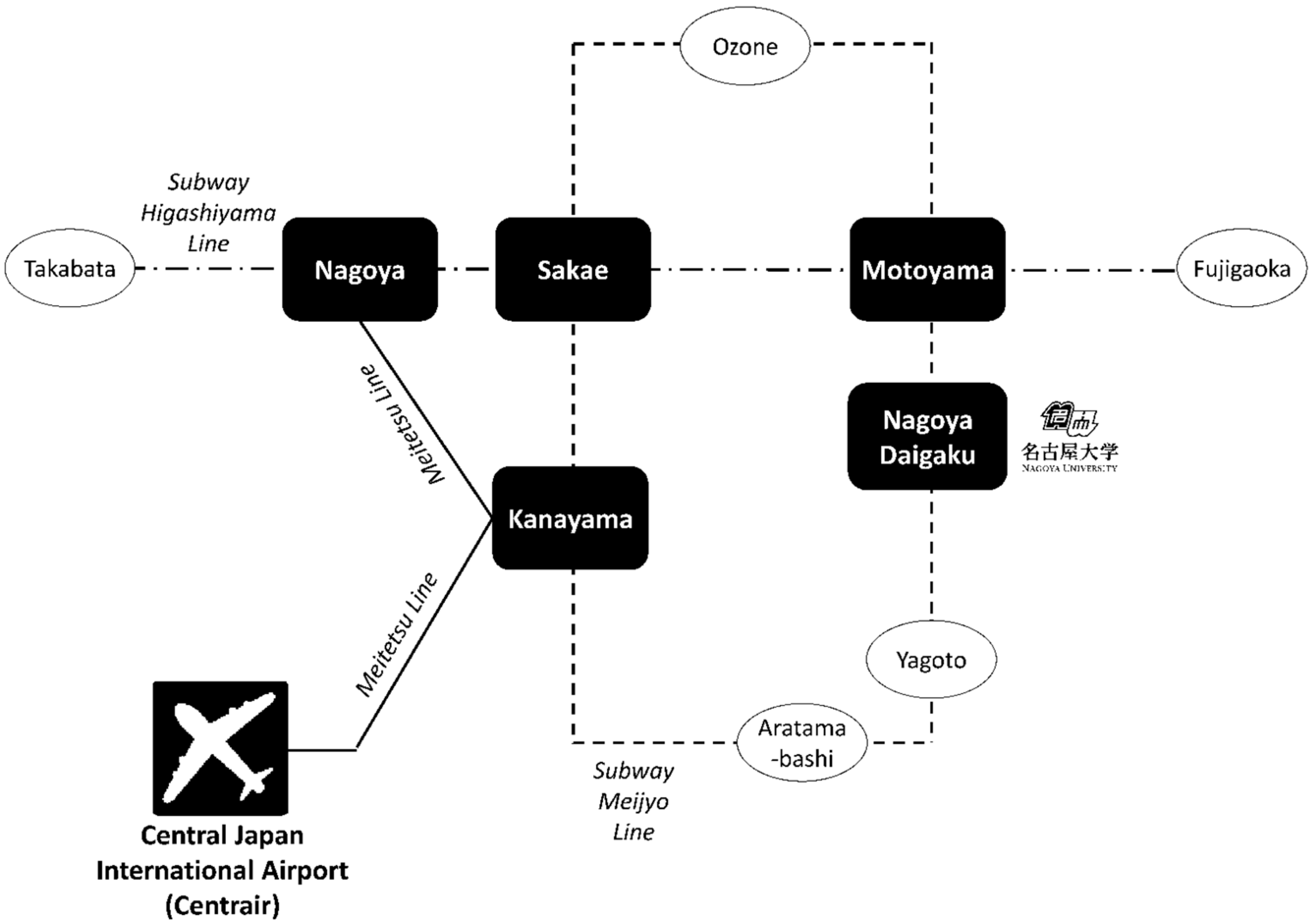
Transportation

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

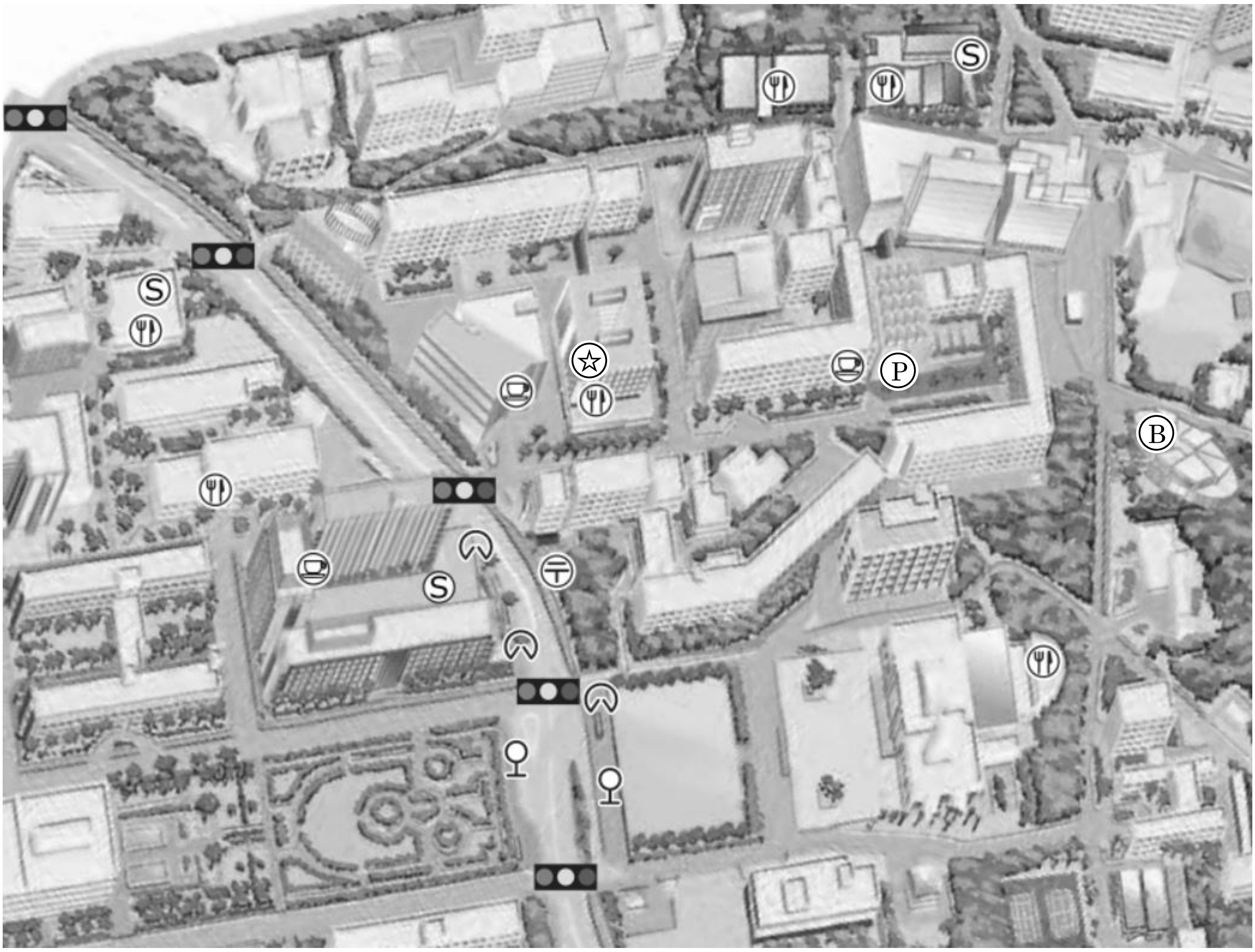
Take the Subway Higashiyama Line at Nagoya or Sakae Station bound for Fujigaoka, and get off at Motoyama Station. Change trains to the Subway Meijyo Line bound for Yagoto and Aratamabashi and get off at Nagoya Daigaku Station. Subway fee is 270 yen (240 yen) from Nagoya Station (Sakae Station).

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

Take the Subway Meijyo Line at Nagoya Daigaku Station bound for Yagoto and Aratamabashi and get off at Kanayama Station (270 yen). Change trains to the Meitetsu Line bound for Central Japan International Airport. When you take an Airport Rapid Limited Express “μ-sky”, a limited express ticket called “μ ticket” (360 yen) is required in addition to the regular ticket (810 yen). Total travel time is about 75 minutes or 60 minutes by the express.



Campus map



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B Noyori Conference Hall (Place for banquet)
P Sakata-Hirata Hall (Place for poster session)
S Shop
Restaurant/Cafeteria
Café
Subway entrance (Nagoya Daigaku Station)
〒 Post office

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Connection via “eduroam” is also available.