Our Team

Mark Hartz

Research Area: Experimental Physics

Kavli IPMU Assistant Professor

Experimental observations of neutrino oscillations through the mixing of their mass and flavor states have established that neutrinos have mass. Recently, T2K and other experiments have established the mixing of neutrinos through the third and smallest mixing angle, which opens the door for CP violation in neutrino oscillations. If CP violation is present, neutrinos and their antimatter counterparts, antineutrinos, will oscillate differently. This CP violation signature can be observed by experiments which produce beams of muon neutrinos (antineutrinos) that oscillate to electron neutrinos (antineutrinos).

I am participating in the T2K experiment, which aims a beam of muon neutrinos produced at the J-PARC accelerator facility towards the Super-Kamiokande detector, 295 km away. We make measurements of muon neutrino to electron neutrino oscillations, the first step in detecting CP violation, and make precision measurements of neutrino oscillation parameters. I am particularly interested in the ability of T2K to search for CP violation by producing a beam of antineutrinos, and future experiments that will be necessary to more precisely measure the amount of CP violation.

Masahito Yamazaki

Research Area: Theoretical Physics

Kavli IPMU Assistant Professor

The goal of theoretical physics is to uncover the fundamental principles governing a vast variety of phenomena in nature, ranging from tiny elementary particles to the whole Universe. As a theoretical physicist working on elementary particle physics, I have been studying supersymmetric field theories and string theories from a number of different perspectives, and I am trying to identify physical and mathematical structures necessary for the better formulation of quantum field theory and for a consistent framework of quantum gravity.

I have been recently working on supersymmetric gauge theories in 2, 3, 4, 5, and 6 dimensions, and in particular, the exact results and string theory realizations for them. In this approach, the IR fixed points of the theories are characterized by geometrical/combinatorial structures, such as 3-manifolds, cluster algebras and the cells of the positive Grassmannian. This gives a manifestly duality-invariant formulation of new classes of supersymmetric field theories (with and without Lagrangians), whose properties could be further elucidated with the help of mathematicians.

I am excited to join the Kavli IPMU, which provides the ideal interdisciplinary environment for this ambitious research project.

Hanindyo Kuncarayakti

Research Area: Astronomy

Postdoc

I have been working on the close environments of supernovae, to search for the clues on the physical properties of the progenitor stars. For this purpose, I used the technique called integral field spectroscopy, which enables the observations of the supernova explosion sites in both spatial and spectral dimensions simultaneously. This provides an insight never obtained before into the immediate surroundings and the parent stellar populations of the supernova progenitor stars.

Mitsutoshi Fujita

Research Area: Theoretical Physics

Postdoc

I have studied the gauge/gravity correspondence in the background of superstring theory. The important point of the gauge/gravity correspondence is that the strong-coupling Yang-Mills theory that is difficult to analyze can be analyzed by using weak-coupling dual supergravity. In particular, I apply the gauge/gravity correspondence for understanding the difficult physics of a strongly-correlated system and condensed matter physics, such as strongly-correlated electrons. For example, we derived some FQHE and edge states from superstring theory by using the gauge/gravity correspondence.

Miho N. Ishigaki

Research Area: Astronomy

Postdoc

My research interest is how chemical elements are synthesized in various astrophysical sites and how these elements are distributed over the Milky Way Galaxy. For these purposes, I'm studying chemical abundances of metal-deficient stars in the Milky Way and its surrounding dwarf satellite galaxies, mainly by stellar spectroscopy. Using observed chemical abundances in combination with theoretical nucleosynthesis calculations in stars and supernovae, I hope to make constraints on how these galaxies are formed and chemically evolved.

Sho Iwamoto

Research Area: Theoretical Physics

Postdoc

Dark matter, inflation, the neutrino mass—we still have mysteries, and many hypotheses have been proposed to solve these problems.

I am interested in examinations of these hypotheses at collider experiments and astrophysical observations. Topics of my recent interest are the collider test of hypotheses in which the Higgs and/or the lepton sectors are extended, and the indications from cosmic-ray observations towards the dark matter problem. I want to see which models are true, and which are not.

Kunio Kaneta

Research Area: Theoretical Physics

Postdoc

My primary research interest is particle physics beyond the standard model. I have investigated signals of new physics by focusing on parity violation in QCD process at LHC. There is no parity violation in the standard model QCD, but it can be induced by new physics, which is supersymmetry and extra dimension, for example. I am also interested in Higgs physics, dark matter, and neutrino physics.

Lluis Marti Magro

Research Area: Experimental Physics

Postdoc

Since I joined the Super-Kamiokande (SK) collaboration in 2009, my main motivation has been the detection of core collapse supernova (ccSN) neutrinos. This includes those from all the past ccSNe, the diffuse supernova neutrino background (DSNB). Currently having the best world limit, some SK collaborators have been working on EGADS, a project to realise GADZOOKS!. By loading the SK water with gadolinium, we will be able to detect DSNB, our main motivation, and improve SN detection and other studies.

Haruki Nishino

Research Area: Cosmology

Postdoc

My current research focuses on an experimental cosmology. I am working on the Comic Microwave Background (CMB) polarization experiment, POLARBEAR. CMB observations in the last decades have provided us with rich information about our universe. Recently the polarization measurement of CMB has attracted much attention because it is considered as a new probe for the epoch of inflation, the exponential expansion of the early universe. We deployed our telescope with polarization sensitive detectors in the Atacama Desert in Chile, and we have been observing CMB since 2012. We aim to measure undetected polarization pattern called "B-mode" and acquire new insight on the beginning of the universe.

Ryoichi Nishio

Research Area: Theoretical Physics

Postdoc

One of my research interests is hadron physics. Hadrons are particles that compose an atomic nucleus, such as protons, nucleons, and mesons. It is natural for me to be interested in hadron physics because most of the matter around us, and we ourselves, are hadrons. Particle theorists have known for several decades that the hadron physics is ruled by a fundamental theory called *QCD*. Many properties of hadrons, however, have not been derived from the fundamental theory yet. This is the problem which should be solved. I expect that essence of hadron physics may be understood by means of the holographic principle. My result based on the idea is in agreement with the experimental data of scattering processes of the hadrons.

Yoshiki Oshima

Research Area: Mathematics

Postdoc

My research interest lies in the representation theory of Lie groups, particularly branching laws of representations. The branching law describes how a given representation decomposes when restricted to a subgroup, which is a mathematical formulation of the breaking symmetry. In my thesis, I studied the branching laws of a certain class of representations of real reductive groups (the so-called derived functor modules) in terms of a geometric realization of representations by using D-modules on the flag variety.

Shun Saito

Research Area: Cosmology

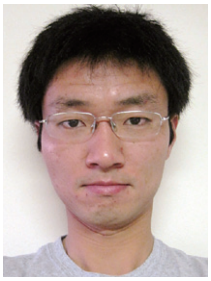
Postdoc

My research interest lies in observational cosmology, and my goal is to obtain various insights into fundamental physics through cosmological observations. I am currently focusing on the Baryon Oscillation Spectroscopic Survey in the Sloan Digital Sky Survey III, which provides us with the largest 3-dimensional galaxy map, in order to extract information on gravity theory at cosmological scales and the neutrino mass. Meanwhile, I have been working on the cosmic microwave background and gravitational wave.

Yefeng Shen

Research Area: Mathematics

Postdoc



My research area is geometry and mathematics related to string theory. More precisely, I am interested in mathematical theories related to N = (2,2) supersymmetric quantum field theory. Mathematically, Gromov-Witten invariants virtually count stable (or orbifold stable) maps to projective varieties and symplectic manifolds (or symplectic orbifolds). It gives a description for the non-linear sigma model. Fan-Jarvis-Ruan-Witten invariants virtually count solutions of Witten equations and can be viewed as a mathematical description for Landau-Ginzburg model of quasi-homogeneous hypersurface singularities. Currently, my works focus on Gromov-Witten theory, Fan-Jarvis-Ruan-Witten theory and global mirror symmetry in a broad sense, including topics such as Landau-Ginzburg/Calabi-Yau correspondence, integrable hierarchies and number-theoretic aspect of Gromov-Witten theory.

Norihiro Tanahashi

Research Area: Cosmology

Postdoc

I have been working on the theoretical study of general relativity and its applications to various topics such as fundamental aspects of black hole physics, dynamical phenomena in the gauge/gravity correspondence and modified gravity theories including massive gravity theories and their relatives. Being in the interdisciplinary environment of Kavli IPMU, in my future research I will study modified gravity theories and their observational implications, and also consider further applications of gravity theory studies.