CURRICULUM VITAE

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Nationality: Japan

Sex: Male

Marital Status: Married

Educational Background

- April, 1988 ∼ March, 1992
  Department of Physics, Kobe University.
  Degrees: B.Sc (Physics)
- April, 1992 ∼ March, 1994
  The division of Science, Graduate School, Kobe University.
  Degrees: M.Sc (Physics)
- April, 1994 ∼ March, 1997
  The division of Natural Science, Graduate School, Kobe University.
  Degrees: D.Sc (Physics)

Research Careers

- 1 April, 1997 ∼ 31 March, 1999
  Kobe University. Research fellow.
- 1 April, 1999 ∼ 30 September, 2000
  Yukawa Institute for Theoretical Physics, JSPS research fellow.
- 1 October, 2000 ∼ 31 March, 2002
  Center for Theoretical Physics, Massachusetts Institute of Technology, JSPS research fellow.
- 1 April, 2002 ∼ 30 September, 2002
  Theoretical Physics Laboratory, RIKEN, Postdoctral fellow.
- 1 October, 2002 ∼ 31 March, 2005
  Theoretical Physics Laboratory, RIKEN, Special postdoctral fellow.
- 1 April, 2005 ∼ 31 March, 2008
  Department of Physics, Saga University, Lecturer.
- 1 April, 2008 ∼ 31 March, 2023
  Department of Physics, Saga University, Associate professor.
- 1 April, 2023 ∼ Now
  Department of Physics, Saga University, Professor.

Major Research Accomplishments

So far I have engaged mainly two aspects of theoretical physics. One is about physics related to (compactified) extra space dimension. The other is physics of dense hadronic and quark matter and its applications into compact stars. Among them, I would like to explain my major accomplishments.

In a series of works with M. Sakamoto and K. Takenaga, we investigated a new mechanism of spontaneous symmetry breaking on compactified space. In such a space, one can impose a nontrivial boundary condition so as not to violate the quantum mechanical principle such as the single-valuedness. The boundary condition plays a role of an external field in the system and provides the nontrivial vacuum structures. As the result, we found that there is some phase transition associated with the size of the compactified space, by identifying the Nambu-Goldstone boson related to the breaking of translational invariance. Furthermore, we applied the idea into supersymmetric models and proposed a new mechanism of supersymmetry breaking. I believe that those works are worth considering seriously if the universe has some extra dimensions and/or when one would like to study some physical systems which have (effectively) compactified spacial dimensions in both particle and condensed matter physics.

In a series of works with G. Baym, T. Hatsuda Yamamoto and A. Schmitt, we classified phase structures of QCD at moderate baryon density, by taking into account a possible interplay between chiral and diquark condensates based on the Ginzburg-Landau approach. The QCD axial anomaly plays a crucial role, i.e., it acts as an external field applied to the chiral condensate in a color superconductor, which is characterized by diquark (Cooper pair of quarks). As the result, it was found that we have no chiral symmetry restoration and there is a critical point at small temperature and moderate density region. This is a concrete realization of " Quark-hadron Continuity " proposed by Schafer and Wilczek, where hadronic phase might be continuously connected to quark matter one. The works of us made clear how the entanglement among different orders is important in the study of the QCD phase diagram. I believe that our research may provide some big impact on neutron star physics conceptually, since most people so far have just treated the first order phase transition. Besides, I have studied the magnetic properties of QCD matter, which was done in collaboration with M. Ruggieri.

In parallel with the above researches, I engaged holographic study of QCD using AdS/CFT correspondence. In the work with M. Ghoroku, N. Maru and M. Yahiro, we investigated hadron spectrum via the bottom-up approach called AdS/QCD with dilaton, which plays an important role of obtaining confining potential. Currently, we are studying cold and dense hadronic matter and trying to understand the liquid-gas phase transition of nuclear matter. We try to extend the work so as to incorporate the effect of background magnetic field. Research on holographic QCD is a fruitful collaboration between physics of extra dimension and that of dense quark matter.