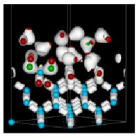
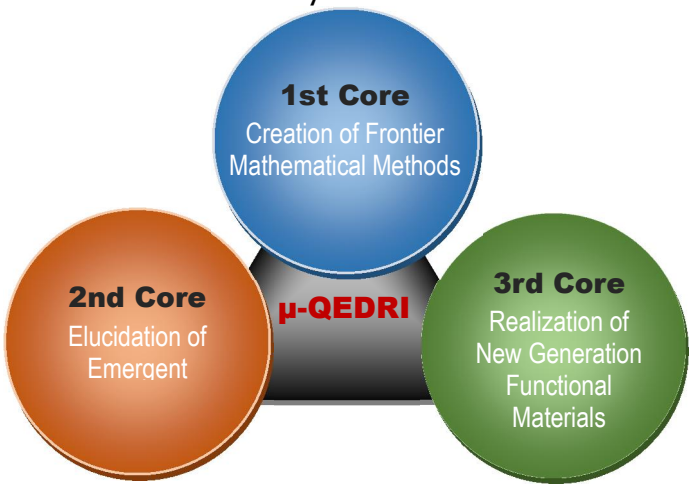
What μ-QEDRI is

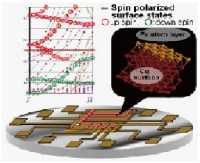
Universal Quantum Engineering Design Strategic Research Initiative (μ-QEDRI)

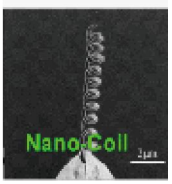
Universal Quantum Engineering Design Strategic Research Initiative (μ-QEDRI) was established in 2014 to succeed Quantum Engineering Design Research Initiative in promoting Osaka University Graduate School of Engineering as one of the "World Premier Research Centers". It is composed of researchers from various fields such as Physics, Chemistry, Mathematics, Information Technology, and Computer Science. Its mission is to carry out researches that would effectively meet the ever-changing needs of the society.





μ-QEDRI aims to promote the design of novel materials, highly sophisticated and functional devices, as well as environment-friendly technology, through the development of novel theoretical routines and techniques.





It has significantly contributed to quantum engineering research and has established collaboration with various universities in different countries.

Furthermore, it promotes academic and research excellence among young researchers and students through its graduate program "Quantum Engineering Design Course (QEDC)". μ-QEDRI is recognized and belongs to an Osaka University organization called "Center for the Advancement of Research and Education Exchange Networks in Asia (CAREN)". This organization is an Osaka University initiative and aims at creating a network of "integrated global campus" for the promotion of international collaboration and development of human resources through research and educational programs.

μ-QEDRI Organization

大阪大学
OSAKA UNIVERSITY

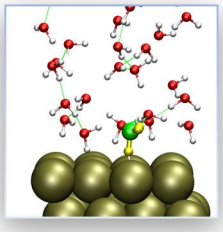
Graduate School of Science
Graduate School of Engineering
Graduate School of Engineering Science
Graduate School of Information Science and Technology
The Institute of Scientific and Industrial Research
Center for Atomic and Molecular Technologies
Research Center for Ultra-High Voltage Electron Microscopy

University-Industry
Collaborative research
with private companies
of electrical products, automobile,
gas, steel mill service and others

Local Network
International Institute Advanced Studies,
Kansai Photon Science Institute,
Japan Atomic Energy Agency,
Japan External Trade Organization,
Local Governments

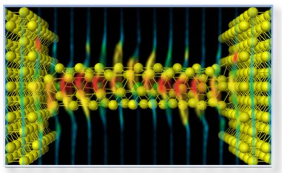
Inter-University
The University of Tokyo
Tokyo University of Science
Shinshu University
University of Fukui
Hokkaido University, etc.

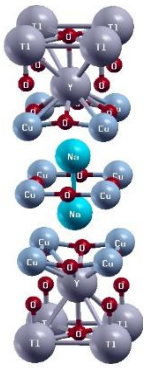
1st Core Creation of Frontier Mathematical Methods



Yoshitada MORIKAWA (Chair of the 1st Core)
Professor, Department of Precision Science & Technology,
Graduate School of Engineering
Physics, Quantum Simulation, Surfaces & Interfaces, Heterogeneous Catalysis,
Electrochemistry, Organic Devices

Satoshi HAMAGUCHI
Professor, Center for Atomic and Molecular Technologies,
Graduate School of Engineering
Plasma Physics and Technologies, Computational Plasma Physics,
Plasma Processing for Semiconductor Devices and Biomaterials,
Nuclear Fusion Plasmas

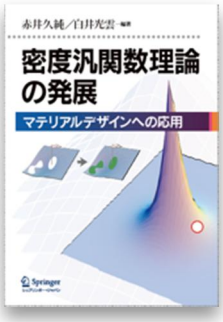




Koichi KUSAKABE
Associate Professor, Department of Materials Engineering Science,
Graduate School of Engineering Science
Theory of interacting electrons, Magnetism,
Rigorous theory of correlated electron systems

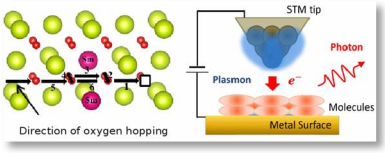
Hidekazu GOTOU
Associate Professor, Department of Precision Science & Technology,
Graduate School of Engineering
First-Principles Electronic Structure Calculations

Koun SHIRAI
Associate Professor, The Institute of Scientific and Industrial Research
Condensed Matter Physics (Theory), Material Design, Dynamical Properties

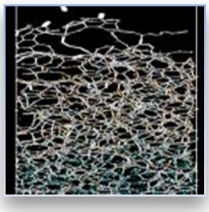


Kazunori SATO
Associate Professor, Department of Materials and Manufacturing Science, Graduate School of Engineering
Theoretical Solid State Physics, First-Principles Calculation, Computational Materials Design

Yoshitaka YAMAMOTO
Associate Professor, Department of Information and Physical Sciences,
Graduate School of Information Science and Technology
Mathematical Physics, Mathematical modeling for fluid and flows,
Development and applications of linear/nonlinear functional analysis



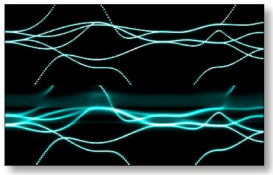
Mamoru SAKAUE
Specially Appointed Professor, Center for International Affairs,
Graduate School of Engineering
Theoretical Solid State Physics, Theoretical Surface Physics,
Ultrafast Quantum Dynamics, Computational Materials Design



Hisazumi AKAI
Professor, The Institute for Solid State Physics (The University of Tokyo)
Development of First Principles Methods,
First Principles Electronic Structure Calculations, Magnetism, Transport Properties,
Disordered Systems, Metals and Alloys, Semiconductors

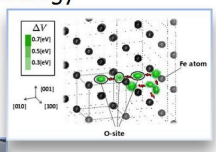
Daisuke MATSUNAKA
Associate Professor, Department of Mechanical Engineering, Graduate School of Engineering (Shinshu University)
Computational Materials Science, Solid Mechanics, Condensed Matter Theory,
First-principles Calculations of Interface, Multiscale Modeling of Surface Dynamics and Growth

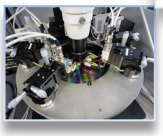
Masako OGURA
Scientific Staff (Forschungszentrum Jülich)
Condensed Matter Theory, First-Principles Electronic Structure Calculation



2nd Core Elucidation of Emergent Material Function

Yoji SHIBUTANI (Chair of the 2nd Core)
Professor, Department of Mechanical Engineering, Graduate School of Engineering
Solid Mechanics, Computational Mechanics, Materials Science Size Effects of Solid Mechanics,
Multiscale Modeling of Defects, Plastic-physics of Crystalline and Amorphous Materials, Beam-induced Acoustic Technology

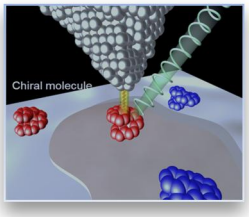




Shigenobu OGATA
Professor, Department of Mechanical Science and Bioengineering, Graduate School of Engineering Science
Theoretical Solid Mechanics, Computational and Theoretical Materials Science,
First Principles Study of Mechanical Properties of Materials, Computational Mechanics,
Design of Functional Nano-structures using Carbon Nanotube, Multi-Scale Modeling of Materials

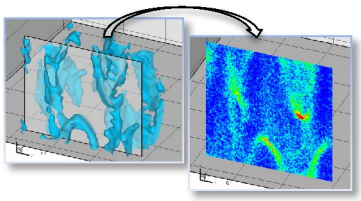
Heiji WATANABE
Professor, Department of Material and Life Science, Graduate School of Engineering
Nano-electronics, Applied Surface Science
Advanced Si-based LSI, SiC-based power devices, Material characterization by synchrotron radiation, Bio-nano process

Takashi KUBO
Professor, Department of Chemistry, Graduate School of Science
Structural Organic Chemistry, Physical Organic Chemistry Research on Syntheses and Functional Properties of Novel Organic Molecules



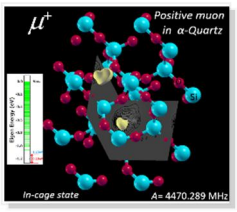
Yuji KUWAHARA
Professor, Department of Precision Science & Technology, Graduate School of Engineering
Surface Chemical Physics, Soft Material Devices, Synchrotron Radiation, Nanoscience

Hidehiro YASUDA
Professor, Department of Materials and Manufacturing Science,
Graduate School of Engineering & Research Center for Ultra-High Voltage Electron Microscopy
Materials science by in-situ transmission electron microscopy, Nanoparticle physics,
Irradiation-induced phenomena by ultra-high voltage electron microscopy

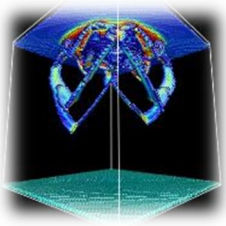


Toshitsugu TANAKA
Professor, Department of Mechanical Engineering, Graduate School of Engineering
Multiphase Flows, Gas-Solid Flows, Mechanics of Granular Flows,
Discrete Particle Modeling of Dense Gas-Solid Flows, Multiscale Modeling of Gas-Solid Flows

Nobuya MORI
Professor, Department of Electrical, Electronic and Information Engineering,
Graduate School of Engineering
Semiconductor Physics, Quantum transport and electron-phonon interaction in semiconductor nano structures,
Non-equilibrium Green's function method applied to device simulation,
Electron transport in semiconductor superlattices under magnetic fields,
Electronic and optical properties of semiconductors under free-electron laser irradiation



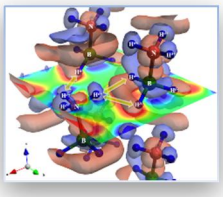
Tetsusei KURASHIKI
Invited Associate Professor, Department of Management of Industry and Technology,
Graduate School of Engineering
Image Based Analysis-Design System for Bio Material, Mechanical Characteristics of Advanced Textile Composites, Disaster Mitigation Simulation in Urban Areas



Hajime KIMIZUKA
Associate Professor, Department of Mechanical Science and Bioengineering,
Graduate School of Engineering Science
Computational Materials Science, Computational Mechanics,
Atomistic Modeling of Thermal and Mechanical Properties of Solid Materials,
Characterization of Hydrogen Diffusion Kinetics in Solid, Molecular Simulations of Polymer Systems

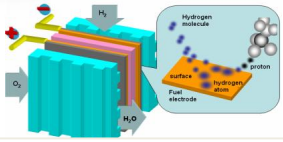
Hiroshi NAKANISHI
Assistant Professor, Department of Applied Physics, Graduate School of Engineering
Theoretical Physics, Solid State Physics, Surface Physics, Computational Physics,
Computational Materials Design, Quantum dynamics of surface reactions,
Computational Materials Design Copymart, Nano-physics of surface nano-structures

3rd Core Realization of New Generation Functional Materials



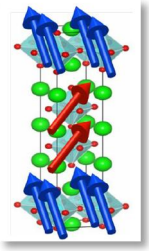
Tamio OGUCHI (Chair of the 3rd Core)
Professor, The Institute of Scientific and Industrial Research
Condensed Matter Theory, First-Principles Electronic Structure Calculation,
Spin-Orbit Driven Properties, Transition-Metal Oxides, X-Ray Absorption Spectroscopy,
Secondary Batteries, Spintronics, Ferroelectrics, Materials Informatics

Hideaki KASAI
President, National Institute of Technology (Akashi College)
Condensed Matter Physics at the Nanoscale Electric properties of carbon nanotubes (CNTs),
Hydrogen-surface reaction dynamics, Spintronics nanomaterials and nanodevice design

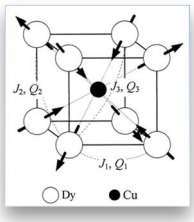


Atom scale reactions in Fuel cell

Tomoyuki KAKESHITA
Professor, Department of Materials and Manufacturing Science, Graduate School of Engineering
Materials Science Effects of high magnetic field, High stress, low temperature
and their combination on structural transformation and magnetic transition

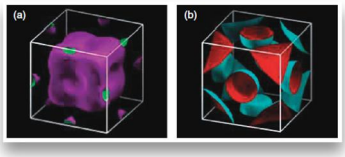


Takeshi FUKUDA
Professor, Department of Sustainable Energy and Environmental Engineering,
Graduate School of Engineering
Advanced plasma engineering, Quantum energy engineering

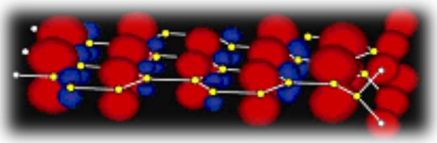


Kazuto YAMAUCHI
Professor, Department of Precision Science & Technology, Graduate School of Engineering
Ultraprecision machining, Surface characterization,
Surface figure testing, X-ray Optics, X-ray nanoscopy /spectroscopy

Michio OKADA
Professor, Department of Chemistry, Graduate School of Science
Surface chemistry, Surface reaction dynamics, Oriented molecular beams,
Low-energy ion beams

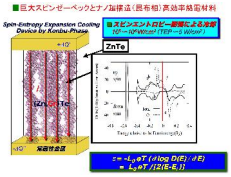


Toshiaki MUNAKATA
Professor, Department of Chemistry, Graduate School of Science
Surface Electronic Structure, Unoccupied Electronic States,
Two-Photon Photoemission, Ultrafast Surface Dynamics,
Microspectroscopy



Hiroshi KATAYAMA-YOSHIDA
Professor, Department of Materials Engineering Science, Graduate School of Engineering Science
Materials Design, Condensed Matter Theory, Computational Nano-Materials Design
Ab initio molecular dynamics excitation-induced atomic migration,
Valence control and materials design of wide band-gap semiconductors,
Materials design of high efficient photovoltaic solar-cells,
Semiconductor spintronics, Computational nano-materials design

Toshihiro TANAKA
Professor, Department of Materials and Manufacturing Science, Graduate School of Engineering
Physical Chemistry of Materials, Surface Science and Technology of Materials
Design of Materials Processing



Wilson Agerico DIÑO
Associate Professor, Department of Applied Physics, Graduate School of Engineering
Dynamical Quantum Processes, Surface Reactions/Excitations,
Many Body Effects, Cond. Matt. Phy. , Comp. Mat. /Devices/Proc. Design,
Bioinspiration/Biomimetics, Complexity/Emergence, Energy, Hydrogen

Yoshinari KAMAKURA
Associate Professor, Department of Electrical, Electronic and Information Engineering,
Graduate School of Engineering
Process and device simulation, Modeling of device characteristics and reliability

Education

◆ Quantum Engineering Design Course (Master's and Doctor's Degrees)

Quantum Engineering Design Course provides students with up-to-date and world-class research techniques related to advance quantum engineering design in response to global, technological and environmental issues. This program extends across 4 academic divisions and 11 departments, having 3 core areas, viz.,
(1) Creation of frontier mathematical methods,
(2) Elucidation of emergent material function, and
(3) Realization of new generation functional materials.
QEDC students are assigned to one of the professors of the above core areas according to their research theme. By taking advantage of this organizational network, students can carry out research and develop a human network of students from various countries and academic fields.
Students successfully finishing this 5-year course program will obtain both Master's and Doctor's Degrees.

◆ Quantum Engineering Design Course Workshops

- Quantum Engineering Design Course Master's & Doctoral Thesis Presentation and Defense, Osaka University, 30July 2015
- Quantum Engineering Design Course Doctoral Thesis Public Hearing and Defense, Osaka University, 3August 2015

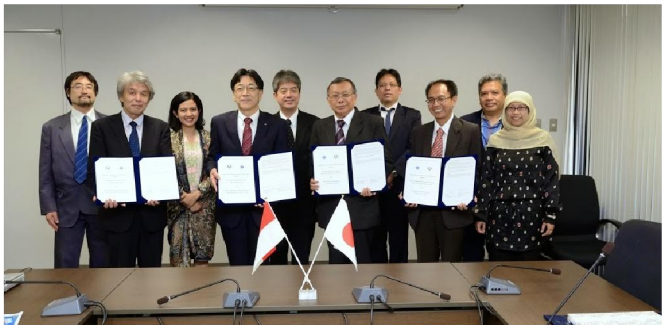
QEDC Master's & Doctoral Thesis Presentation and Defense

QEDRI Meeting & QEDC Workshop, Osaka University

- QEDC Short-Term Research Program Progress Report Presentation, 20August 2015
- Quantum Engineering Design Course Workshop, Osaka University, 4November 2015
- Quantum Engineering Design Course Workshop & Doctoral Thesis Public Hearing and Defense, Osaka University, 1-2February 2016

Recent Activities

◆ International Exchange



OU-ITB Double Degree Program Signing Ceremony

- Osaka University - Institute of Technology Bandung (ITB), Indonesia
  Double Degree Program Signing Ceremony, 19June 2014

・Osaka University - Philippine Normal University (PNU), Philippines
Double Degree Program Signing Ceremony,
25November 2014

OU-PNU Double Degree Program Signing Ceremony

OU-DLSU Double Degree Program Signing Ceremony

・Osaka University - De La Salle University (DLSU), Philippines
Double Degree Program Signing Ceremony,
3July 2015

◆ Computational Materials Design (CMD®) Workshops

・7th ASIA CMD Workshop, De La Salle University, Philippines, 19-21March 2015
・27th CMD Workshop, Osaka University, Japan, 31August-4September 2015
・7th ASIA CMD Workshop, Institute of Technology Bandung, Indonesia, 11-12November 2014
・6th ASIA CMD Workshop, Hanoi University of Science, Vietnam National University, Vietnam, 9-11December 2015
・28th CMD Workshop, Osaka University, Japan, 29February-4March 2016

7th ASIA CMD Workshop, De La Salle University, Philippines

**7th ASIA CMD Workshop,
Institute of Technology Bandung, Indonesia**

**6th ASIA CMD Workshop,
Hanoi University of Science,
Vietnam National University, Vietnam**