

## How to get to Nakamozu Campus (east gate)

### Nankai Railway Koya Line:

From Shirasagi Station, approximately 1000m southwest  
(about a 20-minute walk).

### Nankai Railway Koya Line:

From Nakamozu Station, approximately 1,500m southeast  
(about a 25-minute walk).

### Subway Midosuji Line:

From Midosuji Nakamozu Station (Exit 5), approximately 1,500m southeast  
(about a 25-minute walk).

### Nankai Bus:

Take the bus (bound for Kitanoda Eki Mae, Route 31 or 32,32-1) at Nankai Railway Koya Line Nakamozu Station or Subway Midosuji Line Nakamozu Station (about a 6-minute ride) and get off at the Fudai Kenkyujyo Mae stop.

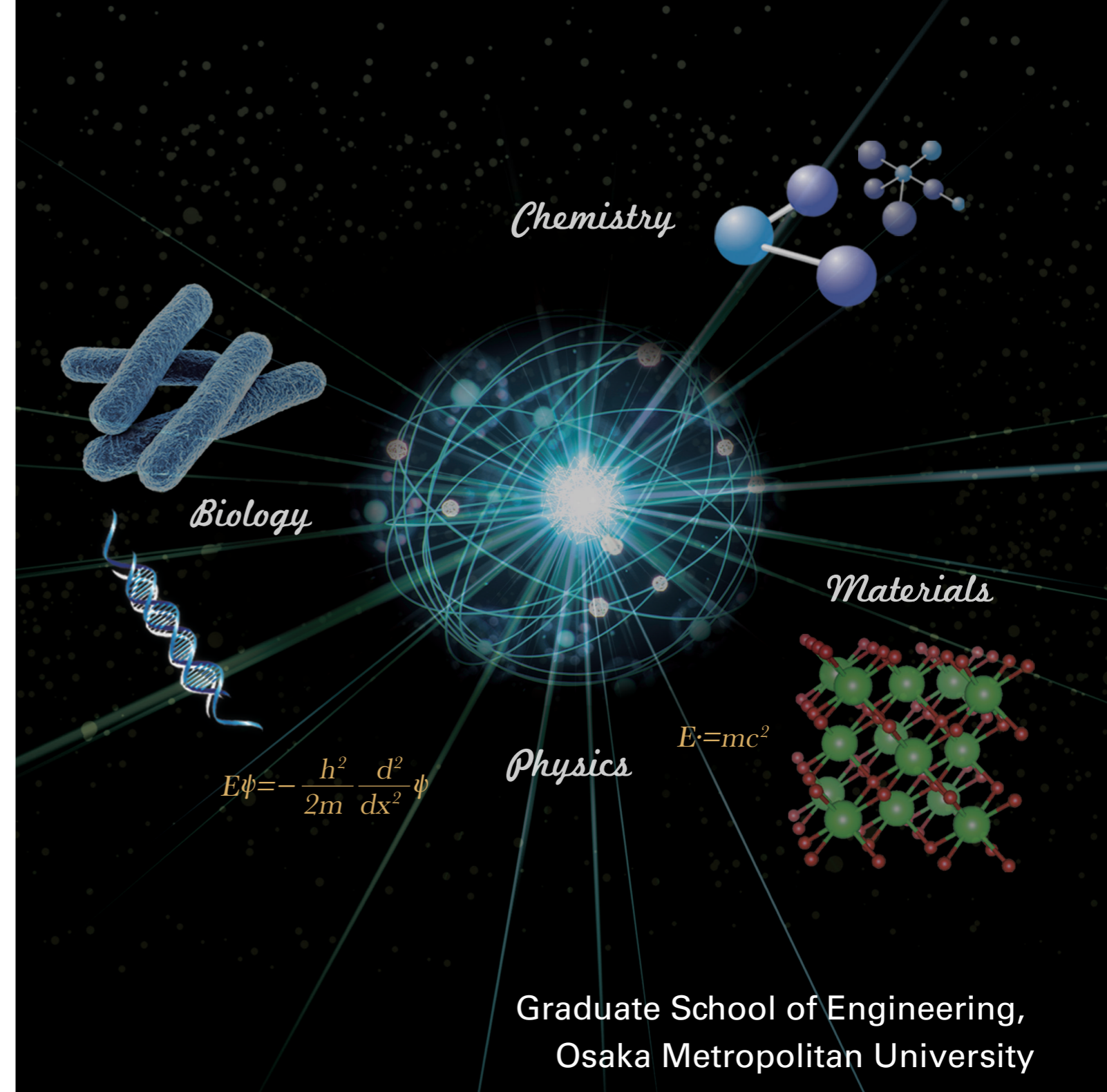
### Nankai Bus:

Take the bus (bound for Kitanoda Eki Mae, Route 31 or 32,32-1) at Nankai Honsen Sakai Station (about a 25-minute ride) or JR Hanwa Line Mikunigaoka Station (about a 15-minute ride) and get off at the Fudai Kenkyujyo Mae stop.



Osaka  
Metropolitan  
University

**Osaka Metropolitan University**, Graduate School of Engineering  
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Graduate School of Engineering,  
Osaka Metropolitan University

## Department of Quantum and Radiation Engineering



Osaka  
Metropolitan  
University

# What is quantum and radiation engineering?

Quantum and radiation engineering is a research field in which new science and technology such as radiation, quantum beams and nanotechnology are applied to various fields.

Quantum radiation is currently widely used in medical fields such as X-ray diagnosis, cancer treatment and sterilization, in industrial fields such as non-destructive testing, ultra-fine processing, semiconductor technology and polymer polymerization, and in agricultural fields such as breeding. Quantum beams from accelerators are also widely used in today's innovative scientific research fields, where they are applied to advanced analysis and the development of new materials.

To manage such cutting-edge science and technology, it is necessary to acquire a broad knowledge of the applied fields in addition to advanced knowledge of quantum science and radiation. Furthermore, the human resources with knowledge of radiation protection, laws and regulations, food, and environmental safety, etc. are increasingly required.

Our department provides university students and working adults who have studied in various research fields with state-of-the-art research guidance in the fields of physics, chemistry, biology, medicine and materials, with our cobalt gamma irradiation facility and large clean-room facilities, and also trains highly specialized engineers and researchers who can play a leading role in various fields related to radiation.

The department trains highly specialized engineers and researchers who can also play a leading role in various radiation-related fields.

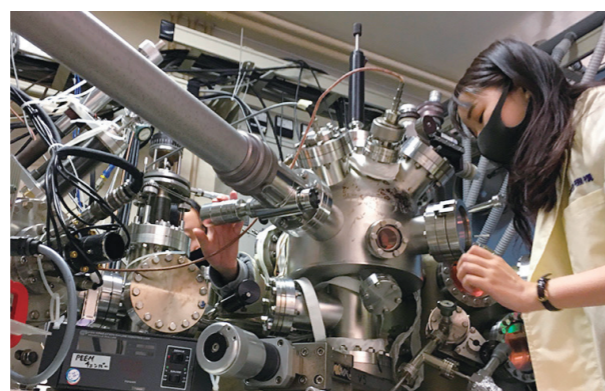
The department offers various lectures on the fundamentals of radiation, biological effects, safety management, material effects as well as quantum and nanoscience.



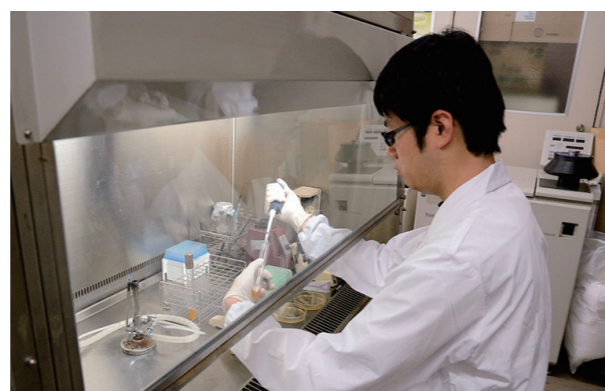
Ion implantation experiment using an ion accelerator



Focused ion beam apparatus installed in the clean room



X-ray Photoelectron Spectroscopy experiment for nano-materials at Photon Factory



Experiment for microbial control within clean bench securing biosafety

## SUBJECTS

Advanced Quantum Science  
Advanced Radiation Safety and Control  
Radiation Chemistry·Bio-applied Science and Technology  
Advanced Radiation Medicine and Protection  
Advanced Science of Quantum Physical Properties  
Advanced Science and Technology by Particle Beam  
Advanced Devices for Quantum and Radiation Engineering  
Advanced Nuclear Energy Technology

Advanced Quantum and Radiation Measurement  
Advanced Sociology of Radiation  
Advanced Seminar in Radiation Measurement  
Advanced Radiation Engineering and Materials Science  
Advanced Quantum Energy Science  
Advanced Laser Engineering  
Advanced electron and ion beam technology

# Research introduction

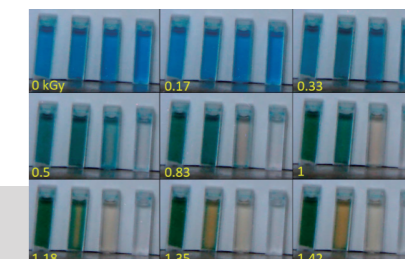
Our department is organized into five research groups: Radiation Metrological Science, Quantum Beam Materials Science, Radiation safety management, Quantum nano material science and Quantum radiation chemistry biology.

## Radiation Metrological Science Research Group

Philosophy of our research group is "to measure radiation" and "to analyze with radiation". We are currently engaging to develop real-time measurement of gamma irradiation effects in heavy dose environment and several interesting phenomena is newly found. In addition, we also develop new radiation detectors for use in medical and high-dose radiation fields.

**Keywords:** radiation detection, radiation detector development, radiation simulation, radiation physics

Direct observation of blue color dye deformation and silver nanoparticle formation (yellow color) in gamma-irradiated water solution.

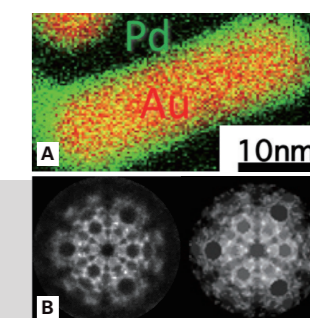


## Quantum Beam Materials Science Research Group

We are trying to clear the elementary processes of interactions between various quantum radiations and matter, develop analytical techniques for matter using these reactions, and develop new functional materials.

**Keywords:** Quantum beam, Radiation effects, Functional materials, Surface science, Nano structure

**A** Au-Pd core-shell nanorods synthesized in water by gamma-ray irradiation.  
**B** Mapping of scattered particles from insulator surfaces in a real-space lattice (radius 0.8 nm). Left and right pictures are shown experiments and simulations, respectively.



## Radiation Safety Management Research Group

Basic study on safety system protocol relating with radiation source or radiation generator is our final target. Safety usage of crookes tube in high school education, heat road control in nuclear fusion reactor and effect of radiation damage, accurate dose calibration of ultra violet light or atmospheric plasma, and so on are included in this target.

**Keywords:** Radiation management, Crookes tube, Fusion plasma surface interaction, Biological effect of plasma and ultra violet light

Crookes Tube for Elementary Education

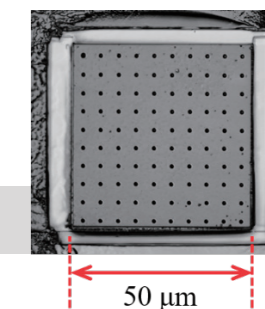


## Quantum Nano Material Science Research Group

We are exploring new physics phenomena and developing new devices by nano-fabrication of superconducting crystals by using quantum beam. And we are also investigating energy conversion materials in order to establish society which does not use fossil fuel.

**Keywords:** Nano-Fabrication, Superconductors, Energy Conversion Materials

Anti-dot structure of a superconducting crystal fabricated by ion-beam



## Quantum Radiation Chemistry Biology Research Group

We aim to develop efficient combined sterilization methods by comparing inactivation mechanisms of bacterial spores and the appearance of injured bacterial cells of heat, deep ultraviolet light,  $\gamma$ -ray and antimicrobial agents with each other, which have been utilizing to decontaminate foods and sterilize medical supplies. We also investigating the microorganisms capable of removing heavy metals, and the effects of low-dose gamma ray irradiation on organisms.

**Keywords:** Radiation Biology, low-dose radiation, Radiation protection, Radiation sterilization, Food irradiation, Food science.

Fluorescence microscopic analysis of respiratory activity of *Escherichia coli* cells by gamma irradiation.

