

Guidelines for Application of
ILE Collaborative Research for FY2025
(1 April 2025 – 31 March 2026)

October 30, 2024

Institute of Laser Engineering,
Osaka University

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1. Outline of Call for Applications

Institute for Laser Engineering (ILE), Osaka University was approved as a Joint Usage/Research Center for laser energy science in 2010.

We have facilities that can be used for researches that are related to laser science in a wide range of interdisciplinary academic fields, including high energy density science using GEKKO XII, which is the only large-scale laser device in Japan, and LFEX laser with petawatt output. We look forward to proposals for a variety of challenging research topics, which include but not limited to the use of such facilities, but also the promotion of collaboration among researchers and scientists from all over the world. We also expect emerging challenges that can be developed in the future.

As a Joint Usage/Research Center that is open to the world, our institute has accepted collaborative research from overseas researchers. For this reason, overseas researchers also participate as technical committee members in the project screening from FY2018. We will continue to establish a system that is suitable as an international base after a trial period. We ask for your understanding and cooperation in advance.

For research applications, please specify the relevant research area and select a research method among the following: use of large laser facility (GEKKO XII and LFEX), use of medium-sized devices, individual collaborative research, and workshop proposals. When applying for a research application, please make sure to discuss the details of the research (experimental method, implementation period, purpose, and application subject) with the host researcher at ILE.

2. Research Fields

Nine research areas have been established since FY2019 for the development of high-energy density scientific research using high-power lasers. Each research area will hold a study group to promote information exchange and collaborative relationships between collaborators and to facilitate joint use and joint research.

When applying for collaborative research, please specify the relevant research field.

List of Research Fields

(For details of each research field, please refer to Section 8. Details of Research Fields.)

-
1. High Energy Density Science
 - Laser Astrophysics
 - High Pressure / Laser Earth & Planetary Science
 - High Magnetic Field Science
 - Quantum Beam Science
 - Plasma Science

 2. Laser Science and Optics
 - Terahertz Science
 - Power Laser Science
 - Laser & Optical Material

 3. Initiative
 - Physical Informatics

 4. General Subjects
-

Representatives of each research field are selected by the Collaborative Research Technical Committee established under the Collaborative Research Steering Committee. Please consult with the contact scientist before applying for each field. If it is determined during the selection process that the proposal is more appropriate to a different research field, the proposal may be selected for that research field.

Separately from the Research Fields 1-4, we accept the following collaborative researches (Please note that for these researches, the application procedure is different from the above Research Fields 1-4).

Other Collaborative Research

- Paid Usage Collaborative Research

The large laser facility of ILE can be used for a fee. Whether the research content does not conflict with defense technology or security export control will be judged by the Industry-Academia-Government Collaboration Issues Committee. Please contact the contact scientist for details.

Contact scientist: Keisuke Shigemori (Professor)

- Simultaneous Use of High-Power Nanosecond Laser HERMES and X-ray Free Electron Laser SACLA

For information about research applications that use the high-power nanosecond laser HERMES (ILE) and the X-ray free electron laser SACLA (RIKEN Harima Branch), please visit the SACLA website (<https://sacla.xfel.jp/?lang=en>).

* Separately from the present open call, we are accepting collaborative researches that require contracts in collaborating with researchers in companies or national research institutes, and collaborative researches for paid use. Please contact us for details.

3. Research Methods

When applying for collaborative research, please specify the relevant research method from the list below. When an application proposal is accepted, the joint research expenses and machine time will be allocated according to the screening results.

List of Research Methods

(For details of each research field, please refer to Section 8. Details of Research Methods.)

-
- A Collaborative Research using the Large Laser Facility -GEKKO XII and LFEX
 - B1 Collaborative Research using Medium Size Lasers and Computer Code
 - B2 Individual Collaborative Research
 - C Workshop related to Laser Science and High Energy Density Physics
-

For research method A, you can choose to apply as a general research or as an exploratory research. For details, please refer to “A. Collaborative Research using the Large Laser Facility -GEKKO XII and LFEX” in Section 9. Details of Research Methods.

4. Schedule of Application

October 30, 2024	Start of accepting applications	Applicants enter application information and uploads the application form through the Collaborative Research Application System (https://collabo.ile.osaka-u.ac.jp/)
November 28, 2024	Application deadline	
December 6, 2024	Liaison Scientists application deadline	Liaison scientists enter application information through the in-house Collaborative Research Application System (https://collabo-local.ile.osaka-u.ac.jp/)
Early March, 2025	Notification of screening results	Screening results are posted in the Collaborative Research Application System (Aveilable for the principal investigator, applicant, and liaison scientist.)

We will not be able to replace or accept the application form after the deadline.

5. Application Procedure

Please submit your application through the Collaborative Research Application System (<https://collabo.ile.osaka-u.ac.jp/>) on or before the due date. Please note that we do not accept applications by email. For the input items in the Collaborative Research Application System, please refer to Section 6. Application through ILE Collaborative Research Application System.

It is necessary to have a host researcher (liaison scientist) for the application. Please select one researcher at the Institute of Laser Engineering Osaka University as the host researcher. Please discuss the research content, research method, implementation period, etc. with the host researcher beforehand. For host researchers, please be sure to enter your application information from the joint research reception system (<https://collabo-local.ile.osaka-u.ac.jp/>) within the designated period. Students are not eligible to apply as principle investigators or host researchers.

Consultation service for the application of high-power laser research is available. Contact the office pldx-user-office@ile.osaka-u.ac.jp

Necessary documents for the application

Research Method A: Application form (pdf file) *

Research Methods B1, B2, and C: Application form (pdf file) and collaborator list (Excel file)

Application format

Please download the application form and the format of the collaborator list from the following web page:
<https://www.ile.osaka-u.ac.jp/eng/collaboration/application/index.html#download>

The application form (MS Word file) is different for each research method. Please use the format that matches your research method. In order to prevent garbled characters and image distortion when sending, please convert to PDF (maximum 20 MB) before submitting. Please submit the collaborator list for the research methods B1, B2, or C in Excel format.

Students who meet the following criteria are eligible to apply for Research Method A as Student Principal Investigators (Student PIs).

- (1) Students who are and will be enrolled in graduate school, at the time of application and throughout the fiscal year of the project.
- (2) Consent from the Student PI's supervisor must be secured. He/she must be included in the List of Collaborators as a role of "supervisor" (Research Method A application form section 4). Consent form for Student PI (section 7) must be signed by the supervisor.
- (3) One supervisor can recommend only one Student PI. The supervisor is required to participate in the experiment on site and supervise the student PI adequately.

6. Application through ILE Collaborative Research Application System

Applications for collaborative research should be made through the Collaborative Research Application System (<https://collabo.ile.osaka-u.ac.jp/>). Please apply on or before the due date. Anyone can make an application, but please note that information of the principal investigator and the liaison scientist (host researcher at ILE) are required. For necessary information, see the following section **Enter application information**.

Login to the Collaborative Research Application System

Access the page <https://collabo.ile.osaka-u.ac.jp/>, enter your email address in the box labeled 'Email address', and click SIGN IN. A one-time password will be sent to the email address you entered. Log in with the password and

the email address you entered.

Move to the web page for proposal application

Click “Proposal Application” on the top page to move to the proposal application page.

Enter application information

The proposal application page has the following items. Items marked with (*) are required items. Enter them, upload the application form at the end and the click submit button to complete the submission.

- Research Title
English*, Japanese

- Principal Investigator
E-mail address*, ILE-ID, Name*, Name in Japanese, Institution*, Position*, Post address*, TEL

- Liaison Scientist
Select from the list*

- Research Field
Select from the list*

- Research Method
Select from the list*

- Has the principal investigator applied or recommended someone to the Osaka University Kondo Prize?
Select from the following.*
 - Yes, the PI has applied in the past, or going to apply in this fiscal year.
 - Yes, the PI has recommended someone in the past, or going to recommend someone in this fiscal year.
 - No, the PI has never applied or recommended.

- Does any of the members of this collaborative research belong to an institution outside Japan?
Yes / No*

- Necessary funds (JPY) (Only for Research Methods B1, B2, and C)
Enter the amount in Japanese yen*

- Facility (Only for Research Method B1)
Select one of the facilities (medium size lasers and computer code) from the list*
If you will use the “THz Spectroscopy Advanced Measurement System”, please select “THz characterization system (contact: Prof. Nakajima)”.

(If you select Research Method A, please enter the following 8 items.)

- Is your proposal document written in English? If so, the review will be done by international reviewers.
Yes / No*

- Do you apply this proposal as an exploratory research?
Yes / No*

- Please select the target room and laser you use in this research.
 Select from the following.*
 Target room 1, LFEX only
 Target room 1, GXII only (Spherical beam arrangement)
 Target room 1, LFEX + GXII
 Target room 2, GXII only (Monodirectional beam arrangement)

- For continued research applications, please select which year this proposal will correspond to.
 2nd year / 3rd year or more than 3rd year / Not a continued research*

- Regarding the scientific papers written in your proposal document, please input the number of papers which present results obtained using the large laser facility at ILE (GEKKO-XII and/or LFEX).
 Enter the number*

- Please input the number of Fundings/Research Grants written in your proposal document.
 Enter the number*

- Regarding the scientific papers written in your proposal document, please input the number of papers which are categorized as the following (1)-(4). Please refer to Journal Citation Reports (<https://jcr.clarivate.com/JCRLandingPageAction.action>) for impact factors (IF).
 Enter the number corresponding to each (1)-(4).*
 (1) IF less than 1, or not listed in Journal Citation Reports.
 (2) IF 1 or more and less than 5.
 (3) IF 5 or more and less than 15.
 (4) IF 15 or more.

- Critical scheduling issues for your experiment
 You can write critical scheduling issues here.

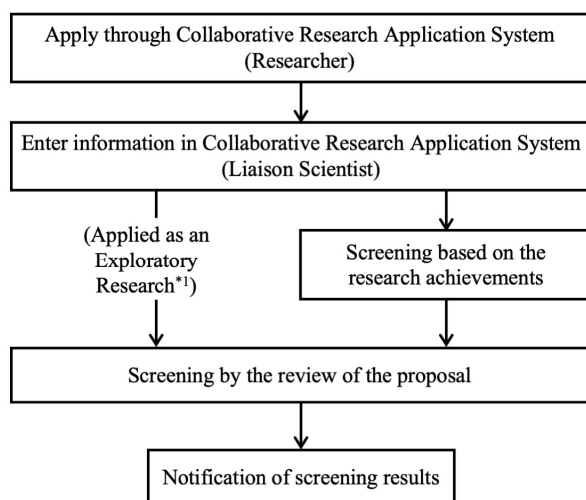
7. Review Process

Each submitted proposal will be evaluated and ranked by multiple reviewers. Applications written in English are evaluated by reviewers including overseas researchers. The Collaborative Research Technical Committee will deliberate the proposal based on the evaluation report from the reviewers. The screening will also consider matching and positioning of the submitted research field. For Research Method A, the number of selected projects is limited to ensure sufficient machine time per research project.

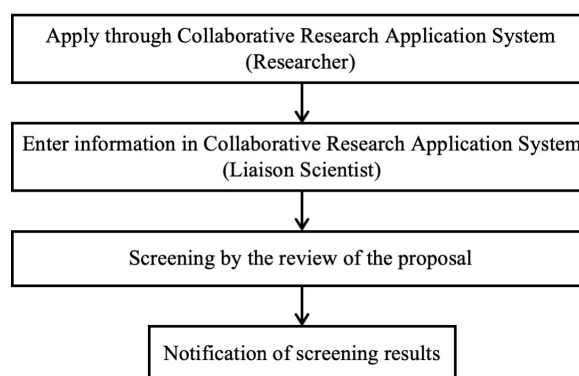
The Collaborative Research Committee will decide whether to accept or reject the proposal after the review by the Collaborative Research Technical Committee.

Flow of application and screening

Research Method A



Research Methods B1, B2, C



*1 Regarding the Exploratory Research, please see about Research Method A in Section **9. Details of Research Methods**.

8. Details of Research Fields

1. High Energy Density Science

Laser Astrophysics (Representative: Masahiro Hoshino (Professor), Contact scientist: Youichi Sakawa (Associate Professor))

Utilizing high-temperature, high-energy-density, and ultra-high flow-velocity plasmas observed only in the Universe, we aim to understand plasma physics and astrophysics using large-energy/high-power lasers in the laboratories. Many astrophysical phenomena such as collisionless shock generation, magnetic reconnection, plasma-jet collimation and instabilities are related to explosion and instantaneous energy-release. We simulate these phenomena in the laboratory using pulse lasers. Relativistic laser astrophysics, such as electron-positron plasma generation and particle acceleration using high-intensity lasers, is also an important topic of interest.

We also study theory and simulation on these topics shown above.

- (a) Laser Plasma Astrophysics: Experiment
- (b) Laser Plasma Astrophysics: Theory/Simulation

High Pressure / Laser Earth & Planetary Science (Representative: Toshimori Sekine (Professor), Contact scientist: Keisuke Shigemori (Professor))

High-energy lasers can generate extreme pressure and temperature conditions beyond the limit of traditional high-pressure apparatus such as large volume press, diamond anvil cell, and light-gas gun. It can be applied to study physical properties of the Earth and planetary materials, as well as various impact phenomena of planetary surfaces. We investigate the EOS of shocked materials, high-pressure phase transitions, physical properties of solids and liquids, deformation and breaking mechanism, acceleration and impact process, degassing and vaporization of shocked materials, synthesis and chemical reaction of prebiotic materials, gravitational instability simulating core formation, and so on, using newly developed in-situ measurements and recovery methods to clarify the formation process, internal structure and evolution of the Earth and other planets including Super-Earths.

- (a) In-situ Measurements of Shock-compressed Materials
- (b) High-speed Impact and Recovery of the Sample

High Magnetic Field Science (Representative: Joao Santos (Professor), Contact scientist: Shinsuke Fujioka (Professor))

The combination of laser-produced strong magnetic field and high-energy-density plasma can open a novel field of plasma physics. The objectives of this subject are to develop an experimental platform utilizing 100 kT and to build domestic and international networks. We welcome your proposals to develop novel generation schemes of strong magnetic field, to control generation and transport of laser-accelerated beams, to understand high-energy-density-plasma physics under the strong magnetic field, and to apply the strong magnetic field to ICF and MCF plasmas. We also welcome interdisciplinary proposals, for example, plasma propulsion with strong magnetic field and x-ray spectroscopy under strong magnetic field for x-ray astronomy applications.

Quantum Beam Science (Representative: Takehito Hayakawa (Guest Professor), Contact scientist: Yasunobu Arikawa (Associate Professor))

Laser-produced plasma generates high energy particles, including ions, electrons, neutrons, and intense radiative emission ranging from extreme ultra violet (EUV) to gamma-ray. This research project aims to investigate Laser Quantum Beams mentioned above, especially on its generation mechanism, energy scaling, demonstration of applications, and improvement of performances (e.g., generation efficiency, monochromaticity, highest energy, stabilization, control of emittance, etc.). This research project will be collaboratively carried out by a few groups using facilities at ILE and possibly at other institutions. Major subjects will be

- (a) Laser-driven Particle Acceleration and Neutron Generation and Applications
- (b) Laser-driven x- or gamma-rays and Applications
- (c) Laser-driven Nuclear Physics and Application

Plasma Science (Representative: Noboru Yugami (Professor), Contact scientists: Yasuhiko Sentoku (Professor))

Research proposals on plasma science related to high energy density science are welcome for both theoretical and experimental research including basic science, laser fusion, and industrial applications.

2. Laser Science and Optics

Terahertz Science (Contact scientist: Makoto Nakajima (Associate Professor))

The development of terahertz (THz) devices such as terahertz emitter, detector, and other THz components will be performed. Various applications of THz waves using femtosecond pulsed laser such as THz time domain spectroscopy and THz imaging will also be investigated. THz properties of semiconductors, superconductors, magnetic materials, biological materials, and nonlinear optical crystals, etc. can be evaluated and utilized for THz devices. Superconducting photonics and strongly correlated electron photonics will be explored using these devices, together with the application of metamaterials which are new artificial materials to THz technology.

- (a) THz Technology
- (b) Superconducting Photonics and Strongly Correlated Electron Photonics
- (c) Metamaterials

Power Laser Science (Contact scientist: Akifumi Yogo (Professor))

Novel techniques and technology for the next high power laser operation with a high pulse energy and repetition rate are required for the advancement of science, medicine, and industry. In addition, the introduction of information and communication technology (ICT) such as AI and IoT into the next power laser increases and extends application fields due to its autonomously controlled operation for multiple purposes.

- (a) Basic technical elements and technology for the next high power laser
- (b) Phase, wavefront and spectral control
- (c) Introduction of ICT into the next power laser and its operation

Laser & Optical Material (Contact scientists: Nobuhiko Sarukura (Professor) and Masashi Yoshimura (Professor))

Next-generation light sources open infinite possibilities in optical technology for basic and applied research from environmental monitoring to high-power laser development. For example, ultrashort optical pulsed lasers in the ultraviolet (UV) to deep ultraviolet (DUV) region can be used for material processing and gas sensing applications. We are then investigating various laser and optical materials, both experimentally and theoretically, such as oxide and fluoride glasses, crystals, and nanostructures. We aim to (1) develop and characterize novel optical materials, (2) understand their properties and applications, (3) reduce detrimental crystal defects, (4) develop damage-resistant lenses, windows, and scintillators, and (5) realize high-power DUV lasers and processing machines. Together with researchers inside and outside of Japan, the general topics of our research include:

- (a) Deep ultraviolet lasers
- (b) Laser and optical materials research
- (c) Terahertz studies and applications

3. Initiative

Physical Informatics (Contact scientist: Hideo Nagatomo (Associate Professor))

Data that grows with the advancement of simulation and experimental measurement methods will be applied to information science to deepen understanding of physical phenomena, which can lead to new discoveries. Alternatively, we will conduct research such as improving the controllability of laser plasma. (If you want to link with this cross-cutting field even if you are applying in another field, please enter "Please link in the physical informatics field" in the remarks column when applying.)

4. General Subjects

The theme is based on a free conception of the researcher to use the device and the calculation code, etc. The application is examined/evaluated every single fiscal year.

9. Details of Research Methods

A. Collaborative Research using the Large Laser Facility -GEKKO XII and LFEX

Research Method A is collaborative research with host researchers to promote advanced research using large laser devices (GEKKO XII and LFEX). One application is approved for each applicant.

Application as exploratory research

When applying for an assignment, you can choose to apply as a general research or as an exploratory research. An exploratory research is a challenging research based on a creative idea. Exploratory research applications are selected without emphasizing research achievements, but only those that are determined to be particularly promising for future development will be selected. If you wish to apply, please select the application for exploratory research when you submit the application through the Collaborative Research Application System.

About the use of LFEX laser

Since FY2017, the GEKKO XII and the LFEX laser have been utilized for joint use and joint research. If you plan to conduct experiments with the LFEX laser, please consult with the host researcher (liaison scientist) and apply for large-scale facility usage (Research Method A) after fully understanding the special features of the facility.

B1. Collaborative Research using medium size Lasers and computer code

Collaborative research is also designed to promote advanced research with host researchers using medium-size devices. When submitting multiple applications for Research Method B1, please indicate the difference from the other applications in your application form. Please also fill in the necessary expenses when you submit the application through the Collaborative Research Application System (limit of 100,000 yen).

Terahertz Spectroscopy Advanced Measurement System (Contact scientist: Makoto Nakajima (Associate Professor))

Terahertz spectroscopy and measurement of various materials, such as semiconductors, insulators, dielectrics, and organic and biological materials, in the terahertz region (0.1 - 10 THz, 3 - 300 cm^{-1} , 0.4 - 40 meV) can be performed in the collaborative research. We welcome applications for material property evaluation, spectroscopy, evaluation and sensing of optical elements, etc.

We can offer temperature variable (4K-750K) measurement, imaging measurement, polarization spectroscopy, time-resolved (pump-probe) measurement, measurement under strong magnetic fields, terahertz strong excitation experiments, terahertz radiation, etc.

We also have the world's most sensitive terahertz time-domain spectroscopy (THz-TDS) system, as well as a terahertz time-domain ellipsometry (THz-TDE) measurement system that can evaluate material properties such as conduction characteristics of wide-gap semiconductors, and a terahertz-band Raman scattering measurement system (ultra-low frequency Raman scattering measurement system).

Please contact us (M. Nakajima) about the measurement of THz wave.

If you apply for collaborative research using this system, please contact the person in-charge in advance:

Makoto Nakajima (Associate Professor) E-mail: nakajima.makoto.ile@osaka-u.ac.jp
Acceptance Research Group: Ultrabroadband Photonics (UP)

Optical Property Evaluation of Laser Systems (Contact scientist: Nobuhiko Sarukura (Professor))

Supported collaborative research themes:

- Search for solid-state laser
- Search for nonlinear optical materials
- Search for scintillator materials
- Development of new optical elements
- Search for new terahertz functional materials
- Development of measurement and technology in the new wavelength range

Available equipment for the research themes stated above

- Vacuum ultraviolet-infrared streak camera
 - Titanium sapphire regenerative amplifier
 - Q-switched YAG laser
 - THz spectroscopy system
 - Fluorine laser
- etc.

If you apply for collaborative research using this system, please contact the person in-charge in advance:

Nobuhiko Sarukura (Professor) E-mail: sarukura.nobuhiko.ile@osaka-u.ac.jp
Acceptance Research Group: Laser Advanced Material (LAM)

High-Performance Computer System (Contact scientist: Hideo Nagatomo (Associate Professor))

Supercomputers

In laser plasma researches, simulation study using supercomputers is becoming important. For example, simulations can be executed relatively easier even for problems that are experimentally challenging, so we will perform a simulation study first. Sometimes it may lead to new discoveries in the process. It is also important to predict the target design and experiment results based on the simulation before performing the experiment. Simulation study also plays an important role in the early stages of experimental research, such as improving the quality of experiment measurement.

NEC SX-ACE Specification

Main Memory: 2 TB

Node: 32 Nodes 4 Cores/Node

Performance: 8.1 TFLOPS

Computational Simulation Code

In order to investigate the high energy density physics generated by high power lasers, computational simulation codes have been developed. As a collaborative research base, some of the simulation codes can be used for joint collaborative research by comparing various experiments and simulation. There are radiation hydrodynamic codes and Particle-in-Cell codes for relativistic laser plasma interaction. In order to select the appropriate simulation code for each problem, specialists are available for consultation.

If you apply for collaborative research using this system, please contact the person in charge in advance:

Hideo Nagatomo (Associate Professor) E-mail: nagatomo.hideo.ile@osaka-u.ac.jp

Acceptance Research Group: Physics Informatics (PIF)

B2. Individual Collaborative Research

Collaborative research projects that promote pioneering or advanced research using equipment other than those mentioned above are welcome. Proposals that would lead to future applications to Research Methods A and/or B1 are preferred. When submitting multiple applications for Research Method B2, please indicate the difference from the other applications in your application form. Please also fill in the necessary expenses when you submit the application through the Collaborative Research Application System (limit of 100,000 yen).

C. Workshop related to Laser Science and High Energy Density Physics

To hold a workshop related to laser science and high energy density physics to promote research and develop interdisciplinary fields. Please indicate the necessary expenses when you submit the application through the Collaborative Research Application System (limit of 100,000 yen).

10. Confirmation Items for Collaborative Research Application

The principal investigator must make sure that the approval of the head of the research collaborator is obtained when applying. The confirmation method at that time may be written document, email, or verbal. In addition, there is no need to submit a written document to ILE.

Based on the above, each principal investigator and research collaborator should obtain the approval of their respective directors to become a collaborator at ILE when the application is adopted.

11. Radiation Worker Registration

The vicinity of GEKKO XII target room I and pellet building 3F and 4F are designated as radiation control areas, and those who work in the control area need to be registered as radiation workers. Please register in advance at your institution.

Registration of radiation workers requires medical examinations and education and training as stipulated by law. Although it is possible to register newly at ILE, it may take some time to complete the procedure. Please keep in mind that even in this case, it is necessary to have a medical examination in advance at your institution or general hospital. In addition, those who have already registered at their institution are required to take the training (30 minutes) related to the Radiation Hazard Prevention Regulations of ILE every year.

Please consult with the host scientist if you need to register as a radiation worker.

Those who belong to institutions in Japan are required to submit the Form 2 approved by own affiliations. One form for each researcher is required.

The form (in Japanese) can be downloaded from:

<https://www.ile.osaka-u.ac.jp/eng/collaboration/format/index.html>

12. About Presentation of Research Results

For the selected projects, it is required to submit a report on the results at the end of the fiscal year, and also to report on the results at “OPTO Symposium on Photon and Beam Science”. Details will be announced after adoption.

When you present the collaborative research results externally, please specify that the research is an ILE Collaborative Research. If necessary, please mention “MEXT Project for promoting public utilization of advanced research infrastructure (Program for advanced research equipment platforms)”. Please refer to the web page below for the policies for acknowledgments, and usage of ILE logo.

<https://www.ile.osaka-u.ac.jp/eng/collaboration/logo/index.html>

13. Use of Personal Information

Except when required by law, we will not use or provide personal information for any purpose other than the purpose of use without obtaining the prior consent of the person. For details, please see the Osaka University Privacy Policy (<https://www.osaka-u.ac.jp/en/guide/information/kojinjoho>).

14. Contact Information

Quadruple Matrix Center

e-mail: kyodokenkyu.ile@office.osaka-u.ac.jp

- For research activities and accepted researchers at ILE, please refer to “Research” and “ILE Groups” on the ILE website (<https://www.ile.osaka-u.ac.jp/eng/>). The Osaka University Researcher Directory (<https://rd.iai.osaka-u.ac.jp/#/>) can be used to view the data of all faculty members at ILE.
- Please refer to “Collaborative Research” on the ILE website (<https://www.ile.osaka-u.ac.jp/eng/collaboration/application/index.html>) for procedures after the selection.