



○ Partner Countries

UK	Core Institution	Rutherford Appleton Laboratory	
	Co-Chair (name and title)	Central Laser Facility • Professor • Peter Norreys	
	Cooperating Institutions	Imperial College London University of Oxford University of York Queen's University Belfast University of Strathclyde University of Essex	Number of Cooperating Institutions  6

France	Core Institution	Ecole Polytechnique (CNRS)	
	Co-Chair (name and title)	Senior Scientist • Michel Koenig	
	Cooperating Institutions	Uniersite Pierre et Marie Curie Commissariat Energie Atomique CEA/DAM Île-de-France, Bruyères-le-Châtel Observatoire de Paris-Meudon Laboratoire pour l'Application des Lasers de Puissance (CNRS) ENSMA University of Bordeaux 1	Number of Cooperating Institutions  7

US	Core Institution		
	Co-Chair (name and title)		
	Cooperating Institutions	University of California, Berkeley Ohio State University Princeton University University of Texas, Austin Lawrence Berkeley National Laboratory Lawrence Livermore National Laboratory Sandia National Laboratory University of Michigan Rice University University of Rochester University of Nevada, Reno General Atomics Purdue University University of Maryland Los Alamos National Laboratory	Number of Cooperating Institutions  14

## Objectives of Research Exchange (including the five years after the project finishes)

Recent progress of high power laser technologies enables us to access high energy density conditions, which have been never realized before. This high energy density condition is defined as an extreme condition having an enormously greater amount of energy density than the conventional physics studies (e.g. solid state physics, material sciences, and hydrodynamics) have dealt with. The purpose of this project is establishing an international research and an educational network to pursuit the high energy density science.

Making the best use of achievements though 2-years-“Integrated Action Initiative”, we will strategically pioneer the high energy density sciences as new domains of interdisciplinary research. The expeditions are made by applying focused and cross-sectional approaches to the following five categories: a) Relativistic Plasma Physics, b) High Pressure Condensed Matter, c) Warm Dense Matter, d) Laboratory Astro Physics, e) Plasma Photonics. The ICHEDS should play a role of one of “the global core centers” in the area of high energy density science, powered by virtual center capabilities to exchange related information and form a network of the next-generation researchers in order to enable joint use of high-power laser facilities all over the world.

## Results to the present

Under the project “International Collaboration for High Energy Density Science (ICHEDS)” supported by JSPS Core-to-Core Program, we have strategically explored the high energy density sciences. The expeditions were made by applying focused and cross-sectional approaches to the following five categories: a) Relativistic Plasma Physics, b) High Pressure Condensed Matter, c) Warm Dense Matter, d) Laboratory Astro Physics, e) Plasma Photonics. Joint researches have been made by using high-power laser facilities all over the world under this program. The ICHEDS has played a role of one of “the global core centers” in the area of high energy density science, powered by virtual center capabilities to exchange related information and form a network of the next-generation researchers.

### Joint Research

In 2009 FY, we have sent a total of 68 scientists and students abroad in the Strategic Research Network Project, which is about 1.5 time as many as the total number of scientists and students per year in the Integrated Action Initiative Project. 2 matching funds have been also additionally approved for another two years in UK and 3 years as PICS project in France, which must more stimulate our international collaborations on high energy density sciences (IC-HEDS). Joint experiments on 1)relativistic plasma, 2)high pressure condensed matter, 3)warm dense matter, 4) laboratory astrophysics and 5) plasma photonics have been carried out by using high-power laser facilities at Osaka University in Japan, Rutherford Appleton Laboratory in UK, Ecole Polytechnique LULI in France, Lawrence Livermore National Laboratory and University of Michigan in US. The results have been published in more than 30 papers of major scientific journals such as Phys. Rev. Letts and presented at international conferences.

### Seminar

As for Seminar, one workshop was held in Japan and one in UK, one in France and two in US. "US-Japan Workshop on High Energy Density Plasmas" (March. 2010, , USA · San Diego) "Workshop on diagnostics related to High Energy Density Plasmas"(November 2009, USA · Atranta), "2nd Japan-France Workshop on High Density Energy Science" (March. 2010, France · Paris), "the 3rd Japan-UK workshop on High Energy Density Science" (January. 2010, Japan · Noboribetsu).

"The 1st Japan-UK Winter School on High Energy Density Science” was held to promote fostering of young researchers and student. The school was held after the workshop, which gained a good reputation from France as well as UK. Taking account of successful of the workshop and winter school in Japan, we have decided to have a similar workshop and winter school in France and UK in 2010FY.

### Researcher Exchanges

Exchanged of young scientists and students have been also well promoted in the program and joint experiments have been also used to forester global leader of the next generations. Some of them also attended international conferences such as 17th International Pulsed Power Conference, European Physical Society Conference, The 238th ACS National Meeting, The Sixth International Conference on Inertial Fusion Sciences and Applications (IFSA 2009, NIF/Jupiter User Group meeting, 51st Annual Meeting of the Division of Plasma Physics and so on.

## Summary of FY 2010 Exchange Plan

### Joint Research

By using ultra intense lasers and high power lasers in Japan, in USA, at Rutherford Appleton Laboratory in UK, and at LULI in France, we will effectively and systematically promote joint researches in the project. We will also use the opportunities of the international joint research, especially experiments using such high power lasers, to foster international young scientists and doctoral course graduate students.

### Seminars

We are planning 4 workshops related to U.K., France, and U.S. teams. One will be held in Japan, others in US, UK and France.

- 1) "Fast Ignition and High energy density science" (October, 2010, Japan)
- 2) "Japan-US Workshop for mixed phases in HED state" (November, 2010, US)
- 3) "the 4<sup>th</sup> Japan-UK workshop on High Energy Density Science" (January, 2011, UK)
- 4) "the 3<sup>rd</sup> France-Japan Workshop on High Energy Density Plasmas" (January, 2011, France)

We have also plane of 2 winter school in UK and France coupled to the work shops

- 1) "the 2nd Japan-UK Winter school on High Energy Density Science "(January, 2011, UK)
- 2) "the 1st France-Japan Winter School on High Energy Density Plasmas " (January, 2011, France)

Additionally, as a special event for fostering of young scientists and students, One Summer School on high energy density sciences will be held on August in Japan. The school will be organized by committee consisted of students and young scientists and invite international lectures.

### Researcher Exchanges

Researcher exchange will be performed through the dispatch for the above-mentioned joint research and seminar participation. Especially joint experiments are expected to encourage on-site level exchange by participation of young researchers and doctoral course graduate students. Moreover, young researchers (doctoral course graduate students) will be dispatched to Oxford University in UK, LULI in France, and etc. for few months (Young humane resources). For giving the opportunity of attending the international meeting and standing at the stage of presentation, young researchers (doctoral course graduate student etc.) will be dispatched to The 2<sup>nd</sup> International Conference on Laser Peening (April 19-21, 2010, San Francisco, US), the 37<sup>th</sup> European Physical Society (EPS) conferences on Plasma Physics (June 21-25, 2010, Dublin, Ireland), 32<sup>nd</sup> International Free Electron Laser Conference (August 23-27, 2010, Malmö, Sweden), 31<sup>st</sup> European Conference on Laser Interaction with Matter (September 6-9, 2010, Budapest, Hungary), 4<sup>th</sup> International Conference on Superstrong Fields in Plasmas (October 03-09, 2010, Varenna, Italy), 52<sup>st</sup> Annual Meeting of the APS Division of Plasma Physics (November 8-12, 2010, Chicago, US), and others. Furthermore, Japanese coordinator is going to core and main cooperating institutions in Europe, and U.S. to discuss and start the action for strategical international relationship.

Besides these plans, As young humane resources' event, young scientists, mainly graduate students will be dispatched to a jointly held Summer School (August, 2010, Japan) and winter school (January, 2010, UK and France).