

○ **Partner Countries**

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|----|---------------------------|---|---|
| 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 |

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| 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 |

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| US | Core Institution | University of California, San Diego | |
| | Co-Chair (name and title) | Associate Professor, Farhat Beg | |
| | 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 NASA | Number of Cooperating Institutions 16 |

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 pursue the high energy density science.

Making the best use of achievements through 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 2010 FY, we have sent a total of 80 scientists and students abroad in the Strategic Research Network 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 (ICHEDS). 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 ones in UK, in France and in US. "Fast Ignition and High energy density science" (October, 2010, Japan), "Japan-US Workshop for mixed phases in HED state" (November, 2010, Las Vegas, US), "the 4th Japan-UK workshop on High Energy Density Science" (January, 2011, UK), "the 2nd Japan-UK Winter school on High Energy Density Science "(January, 2011, UK), "the 3rd France-Japan Workshop on High Energy Density Plasmas" (January, 2011, France), and "the 1st France-Japan Winter School on High Energy Density Plasmas" (January, 2011, France). By using support for young scientists, summer school on high energy density sciences was held in Japan under the planning and management mainly by students (August. 2010, Kobe). This event must have been effective for graduate students to be young scientists having an international leadership.

Taking account of successful of the workshop and winter school in UK, France and US, we have decided to have UK-France-US-Japan, joint workshop and winter school in Japan in 2011FY.

Researcher Exchanges

Exchanged of young scientists and students have been also well promoted in the program and joint experiments have been also used to foster global leader of the next generations. Some of them also attended international conferences such as 2nd International Conference on Laser Peening (April, 2010, San Francisco), 52nd Annual Meeting of the Division of Plasma Physics (November, 2010, Chicago) and so on.

Summary of FY 2011 Exchange Plan

Joint Research

Using effectively and systematically ultra intense lasers and high power lasers in Japan, in USA, at Rutherford Appleton Laboratory in UK, and at LULI in France, we will advance the joint research. Moreover, as for the calculation code in each country, we would like to develop common code for effective and efficient research. In our project, we will make joint research with the condition of joining young scientists and doctoral course graduate students.

Seminar

We are planning 2 workshops held in Japan.

- 1) " the Workshop on High Energy Density Laser Peening " (October, 2011, Japan)
- 2) " the UK-France-US-Japan Workshop on High Energy Density Matter " (November, 2011, Japan)

Additionally, as a special event by "Young humane resources", One School will be held, in November, Japan.

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.

For giving the opportunity of attending the international conference and standing at the stage of presentation, young researchers (doctoral course graduate student etc.) will be dispatched to 7th International Symposium on Beamed Energy Propulsion (ISBEP 7) (April 10 – 14, 2011, Ludwigsburg, Germany.), the Conference on Lasers and Electro-Optics (CLEO201) (May 1-6, 2011, Baltimore, US), the 3rd International Conference on High Energy Density Physics (ICHED 2011) (May 17 - 20, 2011, Lisbon, Portugal), The European Conference on Lasers and Electro-Optics and the XIIth European Quantum Electronics Conference (CLEO®/Europe-EQEC) (May 22-26, 2011, Munich, Germany), The 38th IEEE International Conference on Plasma Science (ICOPS) (June 26-30, 2011, Chicago, US), International Conference on Processing & Manufacturing of Advanced Materials, Session: Dynamic Behaviour of Materials (August 1-5, 2011, Canada), SPIE Optics and Photonics (August 21-25, 2011, San Diego, US), 53rd Annual Meeting of the APS Division of Plasma Physics (November 14-18, 2011, Salt Lake City, 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 School (October, 2011, Japan).