

Project No.:19003
Core Institution in Japan: Osaka University

**JSPS Core-to-Core Program -Strategic Research Networks-
FY2009 Research Report**

Project No.	19003
Research Theme	High Energy Density Science
Duration of Project	April 1st, 2009 – March 31, 2012 (36 months)
Core Institution in Japan	Osaka University

Implementing Organizations

Country	Japan
Core Institution	Osaka University
Co-Chair (name and title)	Graduate School of Engineering, Osaka University · Professor · Ryosuke Kodama
Number of Cooperating Institutions	17
Cooperating Institutions	Tohoku University Utsunomiya University, Univ. of Electro- Communications Tokyo University Tokyo Institute of Technology Yokohama National University Nagoya University Kyoto University Hiroshima University Ehime University, Setsunan University The Graduate School for the Creation of New Photonics Industries National Institute for Fusion Science National Institute of Advanced Industrial Science and Technology Japan Atomic Energy Agency National Institute of Materials Science Kumamoto University

Country	U.K.
Core Institution	Rutherford Appleton Laboratory
Co-Chair (name and title)	Central Laser Facility · Professor · Peter Norreys
Number of Cooperating Institutions	6
Cooperating Institutions	Imperial College London University of Oxford University of York Queen's University Belfast University of Strathclyde University of Essex
Matching Fund	Science and Technology Facilities Council (STFC) · Photon Science Department Program

Country	France
Core Institution	Ecole Polytechnique (CNRS)
Co-Chair (name and title)	Laboratoire pour l'Utilisation des Lasers Intenses (LULI) · Senior Scientist · Michel Koenig
Number of Cooperating Institutions	7
Cooperating Institutions	Unite 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
Matching Fund	①CNRS·LULI ②CNRS·PICS

Country	U.S.
Core Institution	University of California San Diego
Co-Chair (name and title)	Engineering science · Associate Professor · Farhat Beg
Number of Cooperating Institutions	14
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
Matching Fund	①DOE OFES·Fast Ignition ②National Science Foundation·US·Japan Collaboration

Result of Program Implementation

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.

Achievements in FY2009 (Self Review)

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 times 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.

We have made an academic agreement between Osaka University and LULI to promote the joint experiments and exchange students. Consequently, experiments on laboratory astrophysics and high pressure condensed matter have been efficiently carried out by using systematically laser facilities in Japan, UK and France. Our original plasma photonic devices, which have been invented in Japan, have been demonstrated in the facilities in France and made a joint experiment of Japan-France-UK at Rutherford Appleton Laboratory in UK.

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.

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.

Future Plan (Measures toward Achieving Research Objectives)

In the framework of the Integrated Action Initiative Project in the core to core program, we have successfully achieved joint researches and seminars on high energy density sciences with UK, France and US as a bilateral corporation. Now we are continuing this high level of activities with UK, France and US as a multilateral cooperation in the framework of the Strategic Research Network Project. Joint experiments on Laboratory astrophysics, high pressure condensed matter and plasma photonics have been especially carried out with Japan-UK-France as a multilateral cooperation. We would like to promote these multilateral collaborations to US and other fields in the future.

Joint workshops are now established as regular meetings with UK, France and US. We will add winter or summer school for young scientists and students to the workshop, which must be effective and efficient for the promotion of international collaborations in the community. Young scientists, who have a potential as a global leader, will be fostered through a lot of joint researches as well as the schools attached with the workshop.