

The Important Research Institutions in the Huazhong University of Science and Technology

1 Wuhan National Laboratory for Optoelectronics

The Wuhan National Laboratory for Optoelectronics (WNLO) was co-established by the Ministry of Education, Hubei Provincial Government and the Wuhan Municipal Government. It was among the first five national laboratories authorized in November 2003 by the Ministry of Science and Technology, which also approved the feasibility plan for its construction in November 2006. The Laboratory is managed by Huazhong University of Science and Technology (HUST) and collaborates with the Wuhan Research Institute of Posts and Telecommunications (WRI), the Wuhan Institute of Physics and Mathematics (WIPM), which is affiliated to the Chinese Academy of Sciences (CAS) and the Huazhong Institute of Electro-Optics.

WNLO is an experimental park of 60 mu, in which the Experimental Building of Optoelectronics (45000 m²) is located. The research is focused on fundamental photonics, integrated optoelectronics and micro-nano fabrication, laser science and technology, optical network and communication, optoelectronic measurements and instrumentation, optoelectrical information storage, biomedical photonics and optoelectronic medical devices, organic optoelectronics, and advanced optoelectronic materials and energy optoelectronics. WNLO is home to 36 academic research groups and is dedicated to advanced optoelectronic research to meet the national need for advanced technology.

WNLO currently has a solid and hardworking research team and is well structured. The laboratory park has a total of 388 research members of which 160 are full-time faculty and 228 are adjunct faculty including 5 academicians from CAS and CAE, 2 overseas academicians, 2 chief scientists of the National Basic Research Program of China, 7 finalists of the “One-thousand Talents Program” from the CPC Department of Organization, 12 Cheung Kong Scholars from the Ministry of Education, 5 winners of the “National Outstanding Youth Foundation”, 5 professionals selected by the “Hundred Talents Program” of CAS, 2 winners of the “China Youth Science and Technology Award”, 5 national candidates of the “Ten Millions of Talents Project in New Century”, 21 professionals selected from the “New Century or Cross Century Excellent Talents”, 41 visiting and guest scientists, 2 innovation teams selected by the Ministry of Education and 2 provincial innovation teams. The laboratory park has also engaged academicians from the American Academy of Science, the Royal Academy of Science, the Royal Swedish Academy of Science and the Society of the British Royal Institute of Technology as overseas partners. Currently, the lab has 268 doctoral candidates and 487 graduate students participating in a variety of research projects.

Since its establishment in 2003, WNLO has a series of remarkable achievements in different research areas. Between 2004 and 2009, WNLO won 83 various awards of which 1 is the National Natural Science Awards of the second class, 2 are Nation Science and Technology Progress Awards of the second class, 1 is a State International Science and Technology Cooperation Award, 16 are ministry or provincial awards of the first class and 1 is the National Industry Association award of the first class, and 3 are Science and Technology Awards of the first class from the China Shipbuilding Industry Corporation. The laboratory has acquired 224 patents of invention, 103 utility patents, 24 software copyrights and declared 347 patents of various kinds between 2004–2009. Between 2006 and 2009, 623 scientific papers were published in SCI journals of which 24 are in *Optics Letters* and 52 in *Optics Express*. Both these journals are authoritative in the optical field. WNLO has accumulated much knowledge to its advantage in the laser science and technology, biomedical photonics, optical communication, terahertz optoelectronics, energy optoelectronics and organic optoelectronics fields, and an array of scientific achievements has allowed it to take a global leading position.

WNLO now has collaborative relationships with more than 40 major research institutions, universities and businesses in the world. It was awarded the title “Innovation Base for Introducing Talents” by the Ministry of Education and the State Administration of Foreign Experts Affairs in 2007 and the “Innovation and Business Base for Overseas High-qualified Talents” by the Organization Department of the CPC Central Committee in 2008. WNLO has also been approved as a “State-level International Joint Research Center” by the Ministry of Science and Technology and the State Administration of Foreign Experts Affairs. On average, it engages over 60 overseas researchers and more than 10 foreign academicians annually. It has hosted more than 10 international conferences including the International Photonics and Optoelectronics Meeting (POEM) and set up the “Wuhan Optoelectronic Forum”—a platform for high-level academic exchange.

WNLO is a major component of the State Scientific & Technological Innovation System in China and is also the innovation and research base of Wuhan Optics Valley of China (WOVC). WNLO is positioned as a research base for the State Scientific & Technological Innovation System, an innovation base for optoelectronics, a training base for high-level and inter-disciplinary scientists and engineers, and a base for academic exchange and cooperation in the field of optoelectronics. WNLO is committed to promoting the development of China’s optical industries and enhancing its competitiveness by providing powerful scientific and technological support.

2 Wuhan National High Magnetic Field Center

The Wuhan National High Magnetic Field Center (WHMFC) is a national research institute based on one of the twelve National Major Science and Technology Infrastructure Projects in the “National Eleventh Five-Year Plan” funded by the Chinese National Development and Reformation Committee; Currently the primary function of the center is the development of a pulsed high magnetic field facility and associated instrumentation for research and applications. It is the first major science and technology infrastructure project that is developed by a university under the direct leadership of the Ministry of Education.

The total investment for the pulsed magnetic field facility is 180 million RMB. It is planned to open the new facility for external users in the year 2013. A 14 MJ capacitor bank consisting of 13 modular of 1 MJ each and 2 modular of 500 kJ each and a 100 MJ/100 MVA pulse generator power supply will be developed and built in order to generate pulsed magnetic fields in the range from 50 T to 80 T with pulse duration from 15 ms to 2000 ms. In seven experimental stations that can be used in parallel, special equipment will be provided such as low temperature cryostats (from 30 mK to 400 K), high pressure cells

and various lasers with associated optical systems. This will provide an exceptional research tool for the scientific communities in China as well as in other countries. After the facility is completed, it will provide high-level research opportunities in the research areas of physics, chemistry, life science and materials science. An experienced in-house staff will provide the necessary assistance to researchers from China and all over the world. Alongside the national laboratories at Los Alamos, Dresden, Tokyo and Toulouse, it will become one of the world's five major scientific centers providing strong pulsed magnetic fields for scientific research and practical applications.

In March 2009, the development of a 1 MJ pilot facility for experiments with pulsed magnetic fields in the range 50–60 T was concluded. In September 2009, the new buildings were finished. Up to October 2010, a 16 T PPMS, a 7 T SQUID and three of the pulsed experimental stations with cryogenic systems for liquid helium and super-fluid helium (reduced pressure) are now operational and are primarily used for studying electrical transport and magnetic properties. The center has already received a number of applications for experimental work to be done by domestic and foreign scientists; researches on superconducting and semiconductor materials are in progress.

In addition, the development of new technology for electromagnetic equipment will be further pursued. Research on engineering technology with pulsed magnets includes electromagnetic forming technology, magnetic refrigeration technology and eddy current brakes used in transportation and industry. The center will also develop an integrated experimental device for the overall post-assembly magnetization of oversized wind-driven generator.

The WHMFC attaches great importance to academic exchange and cooperation both at home and abroad. It has established good cooperative relations with the K.U. Leuven in Belgium, the High Field Laboratory Dresden (HLD) in Germany, the National High Magnetic Field Laboratory (NHMFL) in the United States, Northeastern University, Peking University, Nanjing University, Fudan University, and the Chinese Academy of Sciences. The transfer of experience and technology from other research institutions as well as independent research has led to the development of advanced magnets, power supply and other equipment by several scientific research institutions.

3 The State Key Laboratory of Coal Combustion (SKLCC)

The State Key Laboratory of Coal Combustion (SKLCC) at Huazhong University of Science and Technology was established in 1991 by the Chinese Government. SKLCC focuses on fundamental and applied R&D to develop advanced, efficient and clean coal combustion technologies and has made significant advances in relevant fields. The key research areas include:

- Coal combustion and reactive multi-phase turbulent fluid mechanics
- Advanced thermal energy utilization and conversion technologies
- Pollutant formation and control
- Diagnostics, optimization and system synthesis of thermal power equipment and systems

SKLCC is equipped with an array of advanced research facilities and instruments such as PIV, TGA-FTIR and ICP-AES, providing a full suite of analytical and testing capabilities for coal combustion R&D. SKLCC has become the principal base for fundamental research, technological development and innovation as well as education and training in combustion science and technology in China. SKLCC is open to national institutions, the coal production and power generation industry, and it has also established strong collaborations with a number of international partners in Australia, France, Japan, the United Kingdom and the United States.

4 The State Key Laboratory of Materials Processing and Die & Mould Technology

The State Key Laboratory of Materials Processing and Die & Mould Technology was established to advance the fields of material forming, novel material development and die & mould industry development. Its basic mission is to research material forming technology, die & mould technology and novel materials. Additionally, qualified personnel are educated in die & mould technology, and the academic results are communicated at home and abroad while technological improvements in the die & mould industry are promoted to contribute to the development of the national economy.

The main research focus of the laboratory is to advance the theory and methodology of material forming process simulations, digital design and manufacturing technology for the die & mould industry, rapid prototyping and rapid tooling, precision forming technology and equipment, and the fabrication as well as application of advanced materials. Research departments exist for each of the main research fields.

5 The State Key Laboratory of Digital Manufacturing Equipment and Technology (Huazhong University of Science and Technology)

Approved by the Ministry of Science and Technology of China, the State Key Laboratory of Digital Manufacturing Equipment and Technology (DMET) was established at Huazhong University of Science and Technology (HUST) in July 2006 on the basis of the Key Laboratory of Intelligent Manufacturing Technology of the Ministry of Education. Its mission is to meet the numerous demands in digital manufacturing and equipment techniques and to provide fundamental theories and innovative techniques for the manufacturing industry, especially for equipment manufacturing. Prof. Peigen Li is the honorary director and Prof. Jue Zhong is the academic committee chairman. Prof. Han Ding is the director. The main research areas cover the fundamental theory of digital manufacturing, advanced machining processes and methods, key techniques for digital manufacturing equipment and digital manufacturing systems.

DMET has made some progress in the area of multi-axis NC machining, grinding techniques and equipment, the RFID flip chip techniques and related equipment, a precise movement system for IC lithography and rehabilitation robots. DMET covers an area of 5020 m² and is equipped with advanced digital manufacturing equipments and instruments. DMET has commissioned several public open platforms for geometric measuring, dynamic testing, and digital modeling and simulation. DMET will be focusing on national significant demands and strategic goals and will be guided by three national S&T major projects listed in the "Planning Summary of National Long-term Science and Technology Development (2006–2020)". These projects are "Super large-scale integrated circuit manufacturing equipment and technique", "High-performance NC machine tool and basic manufacturing techniques", and "Large airplanes". DMET will undertake fundamental research on NC, electronic manufacturing and auto manufacturing equipment with the intention of establishing a top-ranking innovative platform and a world-renowned laboratory for digital manufacturing equipment and technology.