www.thep-center.org

Thailand Center of Excellence in Physics

PHYSICS IS THE KEY TO SCIENCE AND TECHNOLOGY

History

The first brainstorming session of physicists from all over the country took place on 28-29 May 2005, initiated and coordinated by the Office of the Higher Education Commission (OHEC), Ministry of Education. After that, there were several joint meetings to establish the Center of Excellence in Physics project, under the continuous support of OHEC.

The project to establish the center of excellence in physics was approved by the National Higher Education Commission at its meeting on 14 July 2005.

In the process of being approved by the Cabinet Screening Committee, the project to establish the Center of Excellence in Physics has been further refined under the close consultation of experts from the National Economic and Social Development Council.

Later, in the meeting on August 1, 2006, the Cabinet decided to broaden the establishment of the Academic Excellence Centers by adding five additional fields, including physics. In the meeting on 12 June 2007, the Cabinet addressed the necessity of enhancing and fortifying the educational and research infrastructure in physics to serve as a cornerstone for the advancement of science and technology, as well as the development of the nation's human resources.

The project was finally approved by the Cabinet on 27 November 2007, to be the 9th Center of Excellence affiliated with the Office of Graduate Studies and Research in Science and Technology (OGS) under the Office of the Higher Education Commission (OHEC), Ministry of Education (MOE).

Action plan

Operation of the Center of Excellence in Physics Phase 1 (2008-2012) and Transition Phase (2013-2015)

A total of 27 network laboratories located in 13 higher education institutions, conducting discipline-based research projects across 5 physics research centers, namely:

- Research Center in Thin film Physics
- Research Center in Particle Beams and Plasma Physics
- Research Center in Nanoscale Physics
- Research Center in Integrated Physics
- Research Center in Computational and Theoretical Physics

The Center of Excellence in Physics has operated

- Enhance the potential of physics research
- Create skilled physicists whose quality meets international standards
- Develop and expand physics knowledge to maximize benefit.

Action plan

Operation of the Center of Excellence in Physics, Phase 2 (2016-2020)

The significance of the strategy for producing research outcomes and skilled physicists has been emphasized since the initial phase through the implementation of a **demand-driven** research project. This approach utilizes the nation's research needs as a framework for operations, focusing on the production of research that possesses.

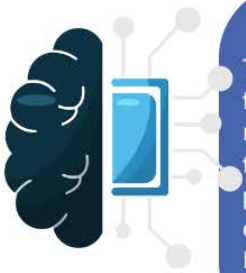
- **Economic impact**
- **Social impact**
- **Industrial impact**

The research project is carried out across 7 research programs, specifically:

1) **Research Program in Physics Education**
2) **Research Program in Physics for Energy and Environment**
3) **Research Program in Physics for Society and Medicine**
4) **Research Program in Physics for Agriculture**
5) **Research Program in Physics for Industry**
6) **Research Program in Fundamental Physics**
7) **Research Program in Research Equipment and Special Business**

At present the Center operates as an agency affiliated with the Office of Graduate Studies and Research Development Projects in Science and Technology under the Division of Promotion and Coordination for Science, Research and Innovation Benefits (DPR), Office of the Permanent Secretary, Ministry of Higher Education, Science, Research and Innovation (MHESI) since May 2021.

Target of ThEP



Frontier research and beyond

To serve as a repository and think tank of physics-based knowledge, functioning as a critical asset in competitive arenas and facilitating advanced research that fosters opportunities for significant advancements, spin off to the new frontier in science, research, and innovation. This endeavor aims to promote sustainable, holistic national development, focusing on the development of physics align with the country's direction: High Energy Physics, Earth and Space System, Condensed Matter Physics and Quantum Simulator.

A hub for Smart physics citizen and ASEAN's hub of physics

To serve as a crucial mechanism in advancing the strategy for developing human resources and expertise, including creating a new generation for the future society in science, research and innovation, both domestically and in relation with the global community. Fostering international recognition as a nation with expertise in advanced physics at the forefront of ASEAN. This initiative contributes to positioning Thailand as a collaborative partner in academic and research endeavors with the international community across all dimensions, thereby enhancing its role in the global community.

Developing Physics-Based Technologies and Innovations

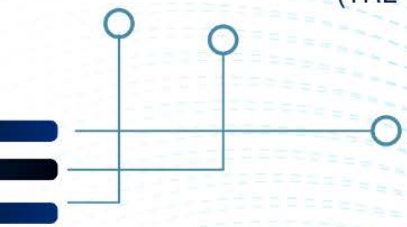
To enhance the nation's competitiveness, a crucial mechanism for attracting foreign investment, which in turn fosters economic development—particularly at the grassroots level—this approach is vital for alleviating the country's poverty and inequality problems.

DRIVING TOWARDS GOALS

Thailand has world-class award-winning physicists whose research, technologies, and physics-based innovations serve as a foundation for the development of advanced research, technology, and innovative inventions. This positions the country as a potential leader in science, research, and innovation, capable of fostering startup companies that leverage advanced technology and innovation, thereby supporting the 13 objectives outlined in the 13th National Economic and Social Development Plan. The Center of Excellence in Physics must enhance its role to align with the new objectives set forth in the Science, Research, and Innovation Plan 2023-2027.

To date, the Center of Excellence in Physics, an agency affiliated with the Office of Graduate Studies and Research Development Projects in Science and Technology under the Division of Promotion and Coordination for Science, Research and Innovation Benefits (DPR), Office of the Permanent Secretary, Ministry of Higher Education, Science, Research and Innovation (MHESI), has been operational for over 15 years. It has successfully integrated and collaborated with research institutes and educational institutions both domestically and internationally through consortium networks and partnerships to cultivate research personnel, researchers, and research outcomes, as well as technology and physics-based innovations. This has resulted in a database of prominent researchers and research findings, both nationally and internationally, including the advancement of physics-based research tools that have gained widespread acceptance in Thailand and beyond.

Furthermore, the study and advancement of technologies prepared for application in national development have been undertaken. The research initiatives of the Center of Excellence in Physics have fostered the potential for technology readiness, progressing from the laboratory level (TRL 1-3) to the practical level (TRL 6-9).



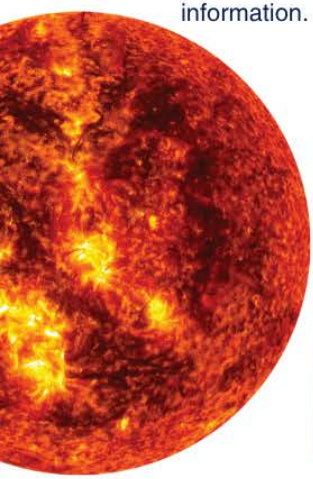
FRONTIER RESEARCH AND BEYOND

1 HIGH ENERGY AND PLASMA PHYSICS

The Center of Excellence in Physics has facilitated the establishment of the Infrared Free-Electron Laser and Femtosecond Laser Experiment Stations at Chiang Mai University, aimed at enhancing the infrastructure for advanced scientific and technological endeavors in the country. This initiative seeks to create the first central laboratory for the application of electron accelerators, mid-infrared free-electron lasers (MIR-FEL), and terahertz (THz) technology in Thailand and the ASEAN community, while also fostering the development of new researchers and highly skilled professionals in the particle accelerator sector.

2 EARTH AND SPACE SYSTEMS

The Center of Excellence in Physics has facilitated the establishment of the Digital Innovation Center for Observation, Monitoring and Warning of Space Weather Hazards Project, which serves as a hub for the presentation and provision of space weather information. This initiative focuses on the warning, monitoring, and warning of impacts resulting from severe solar events, employing information technology to manage space data from a global network of cosmic ray and high-energy particle monitoring stations located on the surface, underground, and in space. It encompasses data analysis, modeling for space weather forecasting and impact assessment, as well as the dissemination of space weather warning information.



The Space Weather Warning Center Project is presently engaged in collaborative research and development with a range of agencies and institutions, both domestically and internationally. These include Mahidol University, Panyapiwat Institute of Management, the National Astronomical Research Institute (Public Organization), IceCube Neutrino Observatory, University of Delaware, University of Hawaii, Shinshu University, Korea Astronomy and Space Science Institute, and Korea Polar Research Institute, etc.

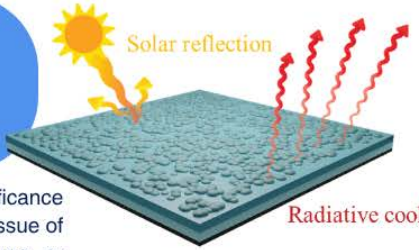
CONDENSED MATTER PHYSICS

3

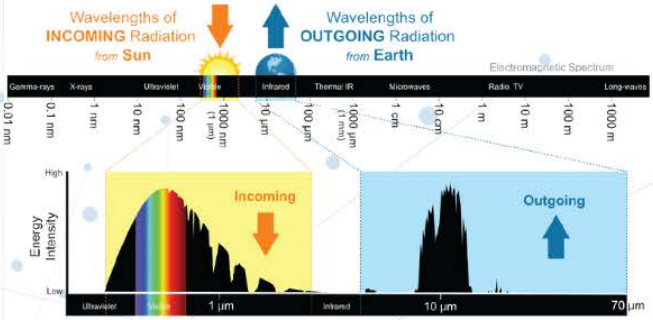
Emerging solar cell technology

The Center of Excellence in Physics facilitates research on innovative solar cell technologies that can be rapidly mass-produced, possess an extended lifespan, require minimal maintenance, are more cost-effective than silicon solar cells, and can be adapted for practical applications.

Thin-film thermoelectric materials for cooling



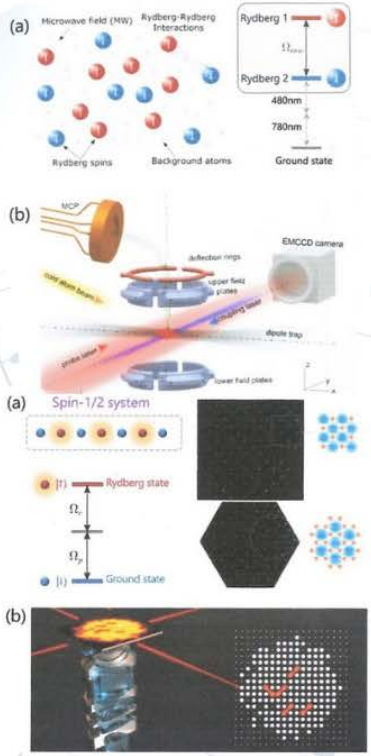
The Center of Excellence in Physics recognizes the significance of advancing physics-based technologies to address the issue of elevated temperatures within vehicles, enclosed structures, or sealed containers resulting from sunlight exposure. This technology aims to ensure that the internal temperature does not exceed 25 degrees Celsius.

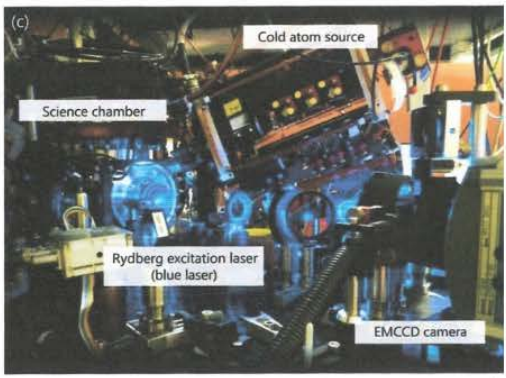


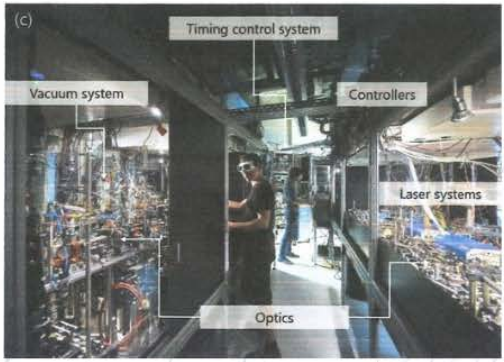
https://geographicbook.com/what-is-atmospheric-window-in-remote-sensing/

4 QUANTUM SIMULATION USING RYDBERG ATOMS

Quantum systems are employed to simulate physical phenomena that are too intricate for classical computers. The researchers intend to utilize cold atoms in the Rydberg state, which possess the capability to engage in a diverse array of interactions and communicate over extended distances, rendering them ideal for complex quantum modeling, including quantum magnetism, topological edge states, quantum transport, and many-body spin dynamics.







SMART PHYSICS CITIZEN

ASEAN'S HUB OF PHYSICS

HUB OF TALENTS FOR PARTICLE ACCELERATORS

Particle Accelerators
HUB OF TALENTS

Hub of Talents for Particle Accelerators focuses on developing human resources with specialized expertise, fostering a collaborative network among institutions and research units, as well as disseminating knowledge and improving the database of particle accelerators and technologies related to the production and application of particle accelerators. Its objective is to generate knowledge through practical experience and collaborative experiments at both established and emerging research institutes. It aims to facilitate groundbreaking research within the country and to generate new insights that cannot be achieved by any single entity independently.

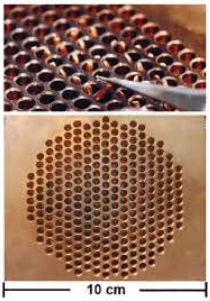
For more information

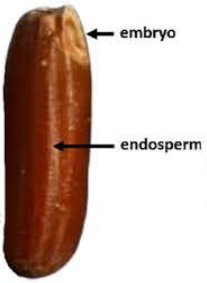
CREATING PHYSICS-BASED TECHNOLOGIES AND INNOVATIONS

1. ENHANCING THE VALUE OF AGRICULTURAL PRODUCTS

RESEARCH PROGRAM IN PHYSICS FOR AGRICULTURE

Enhance and expand the technological capabilities of the nation's agricultural sector by improving and developing new rice strains that exhibit superior productivity and disease resistance, optimizing natural rubber production processes, introducing innovative solutions for farmers to address plant disease problems, and implementing methods to boost the productivity of beef and dairy cattle for Thai farmers.

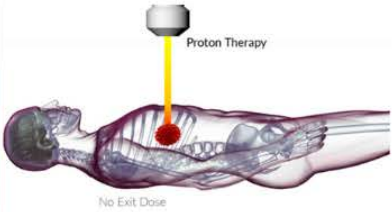




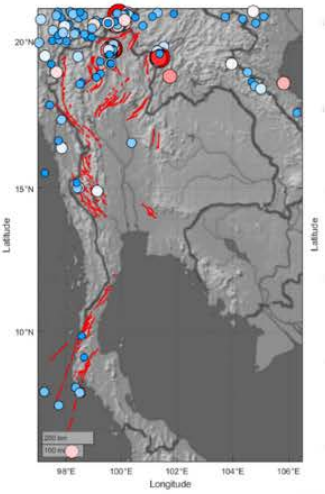
2. HEALTH, MEDICINE AND SOCIETY (PLASMA, INCINERATOR, EARTHQUAKE)

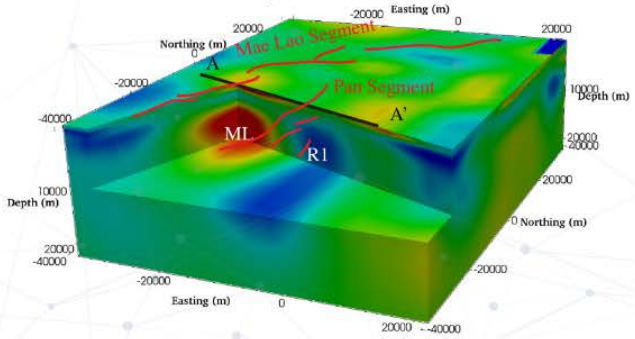
RESEARCH PROGRAM IN PHYSICS FOR SOCIETY AND MEDICINE

Focus on improving public health through the usage of plasma bioscience and biosensors to elevate health-related quality of life.



Ensuring the safety of individuals residing in earthquake-prone regions, by using **tele-seismic waves** and **magnetotelluric techniques** which facilitate the surveying and examining the fault structure that cause seismic activity. This will help in identifying land that were historically sites of tectonic plates subduction. This technique will be applied to areas in both northern and southern Thailand, which have different millions of years geological histories and are at risk of earthquakes.





Partner universities

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