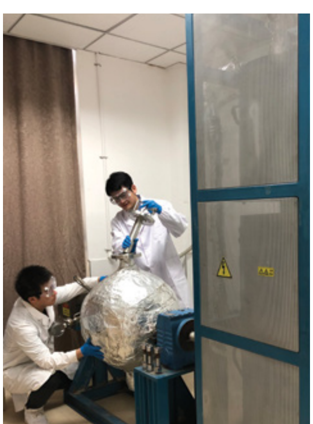
POWERING INNOVATION

Studies by XMU physicists and energy researchers pave the way for a better future.

Research into some of the most complex issues in physics and energy science defines Xiamen University (XMU) College of Physical Science and Technology (CPST) and College of Energy (CoE). Their laboratories have supported original fundamental findings, as well as new energy technologies.

Transcending physical limits

Stars, galaxies, and black holes are the focus of XMU astrophysicists. A team led by Weimin Gu proposed using China's Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST) to search for stellar-mass black holes, leading to the identification of multiple candidates. Their analysis suggests that hundreds of stellar-mass black holes can be found this way. Using space telescopes, Taotao Fang's team detected absorption of X-rays by oxygen atoms, and helped locate the universe's so-called 'missing baryons'. XMU astrophysicists, led by Tong Liu, also study intergalactic, interstellar star formation, and physical mechanisms of gamma-ray bursts and fast radio bursts, shedding light on neutron stars and black holes.

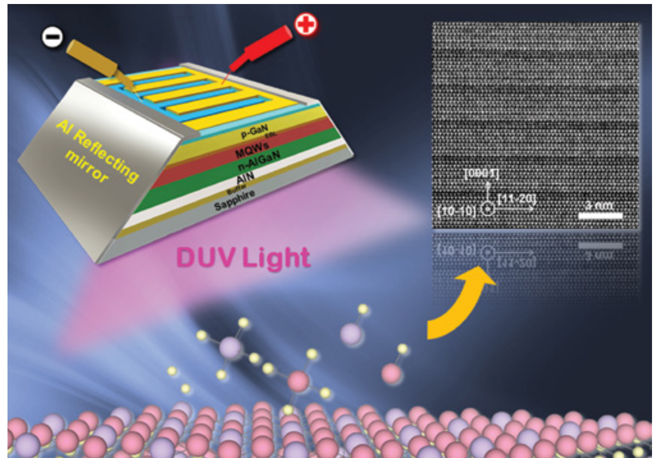


Experiments to develop treatments to exploit biomass for chemicals and fuels

Physicists at CPST have also been advancing fundamental theories, including the Einstein-Podolsky-Rosen Paradox, proposed in 1935 to demonstrate inherent contradictions in quantum theory. Extending this experiment, which gave an example of quantum entanglement, CPST's Lixiang Chen and his team produced pairs of entangled photons with radial position and radial momentum, which were found to be correlated in measurements. The radial properties of photons could be harnessed with other entangled variables for applications in quantum communication and optical micromanipulation.

Based on studies of entangled photon pairs, Chen's team has also developed a facial recognition technique that finds matches by looking for correlations between light beams imprinted with image information.

Practical applications are also central to research by CPST's Junyong Kang, who leads a team that studies group III nitrides and their potential as semiconductor materials.



Revealing the underlying structure of group III nitrides for their potential as semiconductor materials

To enable wider applications of deep ultraviolet (DUV) light-emitting diodes (LEDs) based on aluminium gallium nitride (AlGaN), they proposed a new mechanism for regulating the wave vector of DUV light, solving the problem of poor light-extraction efficiency. They also developed a super-lattice structure that enables high magnesium doping efficiency in p-type AlGaN semiconductors, achieving record-low electrical resistivity. These results are promising for developing AlGaN-based optoelectronics for industries ranging from IT to biomedicine.

Pushing new frontiers in energy studies

Energy efficient LEDs have also attracted the attention of CoE researchers. One team explored the use of near-UV LED as the light source to excite red-green-blue (RGB) tri-colour phosphors and form white light. Using rare earth materials, they developed an RGB phosphor that can be excited with the same LED, achieving high quantum efficiency. The patented technology has led to high colour rendering warm-white LEDs, which avoid leaking harmful blue light.

CoE's irradiation effect research team developed Xiamen Multiple Ion Beam In-situ TEM Analysis Facility, a national first. This advanced multi-beam facility consists of a transmission electron microscope (TEM) coupled to a 400kV implanter, and a 50kV hydrogen/helium coaxial ion source for *in-situ* irradiation studies. It enables characterizing irradiation effects and evaluating material radiation damage, supporting the development of radiation-resistant nuclear materials. It has potential applications in the development of spacecraft, nuclear medicine, semiconductors, and energy catalysts.

As a renewable energy source and abundant raw material for various chemical products, biomass is studied at CoE. A team seeks to maximize the socioeconomic value of biomass by developing scalable cascade utilization strategies. They proposed a holistic system from pre-treatment to high-value products for lignocellulosic biomass to allow efficient use. Their series of techniques for fractionating biomass into its main components of cellulose, hemicellulose, and lignin, and further chemical and biological conversion have led to publications and patents, as well as production lines for dietary fibre products, bulk materials and biofuels. ■