The University of Science and Technology of China (USTC) is one of the most important innovation centres in the country, and is always ranked among its best universities. It is particularly strong in fields such as quantum manipulation, nanotechnology, high-temperature superconductivity, speech processing, fire science and life sciences.

The USTC takes the lead in many major science projects, such as quantum satellite research and dark-matter detection. It is also an active contributor to significant international projects, such as the International Thermonuclear Experimental Reactor (ITER) and the European Organization for Nuclear Research (CERN).

In 2013, the USTC won more than 20 renowned awards in science and technology. For example, a team of USTC physicists led by Professor Xianhui Chen received the first prize in Chinese Natural Science for their contributions to the field of superconducting materials; for the previous three years, there had been no recipients of this prize.

Some of the latest research highlights are described below.

**PHYSICS AND CHEMISTRY**

**High-energy physics at the particle colliders**

A team led by Professor Zhengguo Zhao in the School of Physical Sciences made weighty contributions to the study of diboson production, triple-gauge boson couplings and the discovery of Higgs particles via the ATLAS experiment at the Large Hadron Collider (LHC) of CERN. Zhao also greatly contributed to the observation of the Zc particles that were suggested to represent the charmed multiquark states, using the Beijing Spectrometer (BESIII) at the Beijing Electron Positron Collider (BEPCII), and, for the first time, observed over 10 new decay modes of the charmonium states cJ and c. As a result of these outstanding achievements, Zhao was elected as an academician of the Chinese Academy of Sciences (CAS), which is the highest academic honour in the country.

**Inorganic solid-state chemistry**

Professor Yi Xie and her group at the Hefei National Laboratory for Physical Sciences at the Microscale (HFNL) pioneered research into the design and synthesis of inorganic functional solids with efforts to modulate their electron and phonon structures. Xie established the methodology known as the “synergetic use of binary characteristic structures” for the synthesis and assembly of inorganic functional materials, proposed a strategy for modulating the electron and phonon transport properties with phase transitions at the nanoscale, developed new high-efficiency thermoelectric materials systems, and discovered the relationship between the fine/electronic structures and the thermoelectric/optoelectronic properties of two-dimensional semiconductor crystals. As a female scientist, Xie is the youngest academician of the CAS among those elected in 2013.

**Carbon aerogels sop up hydrocarbons**

A team led by Professor Shuhong Yu at the HFNL is pursuing carbon aerogel...
production from biomass. The team selected bacterial cellulose pellicles — a commonly used, inexpensive, nontoxic form of biomass consisting of a tangled network of cellulose nano fibres — as a precursor for the production of ultralight carbon nanofibre aerogels on a largescale. This biomass can easily be produced on an industrial scale through microbial fermentation.

**QUANTUM INFORMATION AND QUANTUM TECHNOLOGY**

The Synergetic Innovation Centre for Quantum Information and Quantum Physics (SIC–QIQP), head by Professor Jianwei Pan, was established and financially supported by the Chinese Ministry of Education. It focuses on bringing together teams of multidisciplinary researchers to form a dynamic national network for developing scalable quantum technologies.

**Foiling quantum hackers**

A research team led by Professor Qiang Zhang and Professor Tengyun Chen at the SIC–QIQP successfully demonstrated the measurement-device-independent quantum key distribution by developing up-conversion single-photon detectors with high efficiency and low noise. The new quantum-encryption method provides the ultimate security against hackers in real-world cryptography applications, and greatly improves the security of quantum-encryption systems. This research was selected as one of the Highlights of the Year in *Physics* by the American Physical Society.

**A milestone in satellite-based quantum communication**

A collaborative team led by Professor Chengzhi Peng at the SIC–QIQP achieved comprehensive and direct verification of quantum communication between satellites and ground stations. This research lays the necessary technical foundations for a global quantum-communication network based on ground–satellite quantum communication by launching the quantum science experimental satellite of China.

**Optical spectroscopy goes intramolecular**

A team led by Professor Zhenchao Dong at the SIC–QIQP reported an optical spectroscopic-imaging approach that achieves subnanometre resolution and resolves the internal structure of single molecules. This development could lead to new techniques for probing and controlling nanoscale structure, dynamics, mechanics and chemistry. This research was listed among China’s top 10 science news stories in 2013.

**ENVIRONMENTAL AND EARTH SCIENCES**

**Penguins thrived in Antarctica during the Little Ice Age**

New research led by Professor Liguang Sun in the School of Earth and Space Sciences showed that penguin populations in the Ross Sea of Antarctica spiked during the short cold period, called the Little Ice Age, which occurred between AD1500 and 1800. These results run contrary to previous studies that found increases in Antarctic penguin populations during warmer periods and decreases during colder periods, suggesting that populations living at different latitudes in the Antarctic might respond differently to climate change.

**Uncovering the mystery of subduction zone earthquakes**

Based on analytical data from four of the highest magnitude subduction zone megathrust earthquakes, the conclusion was drawn that low-frequency radiation is closer to the trench at shallower depths and high-frequency radiation is farther from the trench at greater depths, in general. This scientific breakthrough was achieved by a team led by Professor Huajian Yao.

**LIFE SCIENCES**

**New evidence for curing type 2 diabetes**

Research teams led by Professor Rongbin Zhou and Professor Zhigang Tian in the School of Life Sciences revealed a new mechanism through which omega-3 fatty acids inhibit inflammation and prevent type 2 diabetes. The research results were published in *Immunity* in June 2013 and highlighted in the same issue of the journal.

**Identifying liver-resident natural-killer cells with immune memory**

A team also led by Professor Zhigang Tian identified liver-resident natural-killer (NK) cells that possess unique immune memory characteristics absent from normal NK cells.

**LincRNA-p21 as a novel key player in regulating the Warburg effect**

A research team led by Professor Mian Wu and Professor Yide Mei, at HFNL and the School of Life Sciences, has revealed a novel mechanism whereby lincRNA-p21 regulates the Warburg effect under hypoxic conditions. They demonstrated, for the first time, that lincRNA-p21 is an important regulator of the Warburg effect, and also identify lincRNA-p21 as a valuable therapeutic target for cancer.