

N0.541

CHINA SCIENCE AND TECHNOLOGY

NEWSLETTER

The Ministry of Science and Technology
People's Republic of China

N0.541

March 20, 2009

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INTERNATIONAL COOPERATION

New Formula Calculates Inhomogeneity Polarization

Not long ago, SHI Junren, a researcher at Chinese Academy of Sciences Institute of Physics, and NIU Qian working for the University of Texas at Austin jointly proposed a formula to calculate the inhomogeneity-induced polarization. The findings were published in the recent issue of *Physics Review Letters*.

The new formula is designed to calculate the electric polarization of materials with large space structures, such as the magnetic structure of multiferroics. Researchers also found that the electric polarization defined by the formula is of a topological uncertainty. The uncertainty is closely associated with another effect driven by inhomogeneity. The new

formula provides a new approach for calculating ferroelectrics, and an exhaustive link between microscopic models and the macroscopic polarization. The study was funded by Chinese National Natural Science Foundation.

Classical Pressure Theory Challenged

MA Yanming at Jilin University National Laboratory of Superhard Materials, in collaboration with Mikhail Erements of Max-Planck-Institut für Chemie and Artem R. Oganov at Laboratory of Crystallography under ETH Zurich Department of Materials, has achieved breakthroughs in studying phase changes of sodium structures under a high pressure. They reported the experimental observations of a pressure-induced transformation of Na into an optically transparent phase at ~200 GPa in journal *Nature* published on March 12, 2009.

Ma first made a theoretical prediction that metal alkali sodium would be made into an insulator with a wide bandgap under pressure. The sodium insulator would be of a simple but unique crystal structure, or a six-coordinated, highly distorted double-hexagonal close-packed structure. A research team, led by Erements, experimentally confirmed the phase change using a range of advanced experimental means. The study was funded by the National 973 Program initiated by the Chinese Ministry of Science and Technology.

Hybrid Kelp from Chinese and Russian Parents



PANG Shaojun, a research fellow at CAS Institute of Oceanology, and his coworkers, in collaboration with Far East Institute of Marine Biology in Russia, have derived new hybrid kelps from their Chinese and Russian parents selected from China, Dalnegorsk (44 ° N), and Vladivostok (43 ° N). The hybrid sporophytes were the products of 6 hybrid treatments (See the picture). The offspring of the new kelp hybrid species are now grown on an experimental basis in the selected marine areas in China.

China-Russia Joint Mars Probe

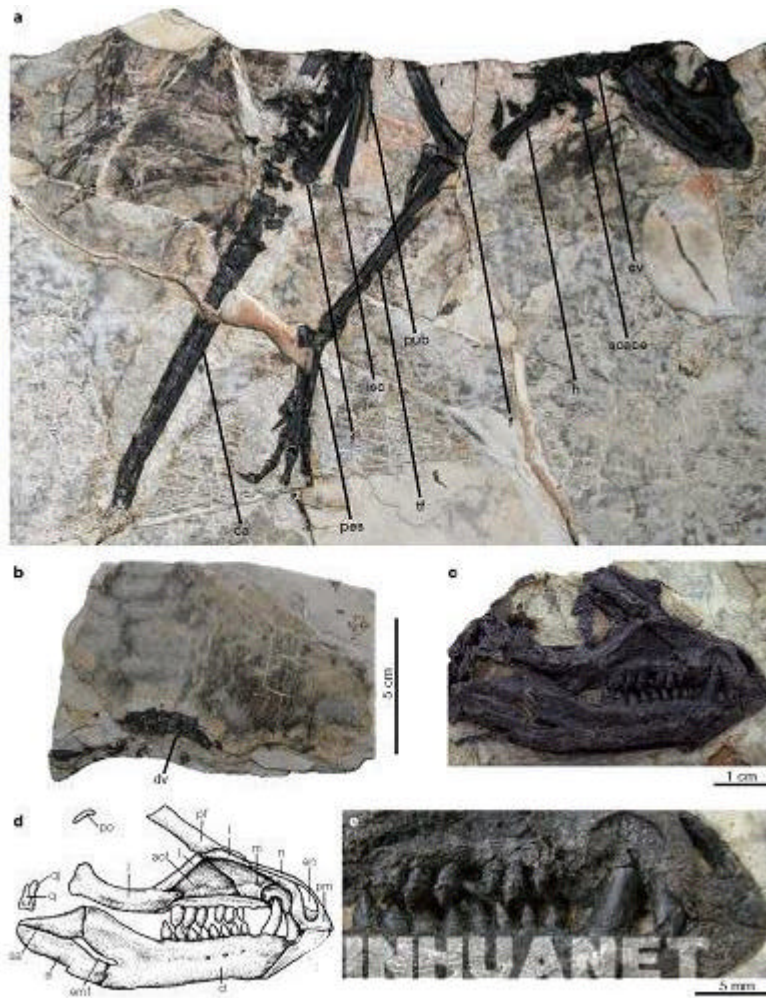
A forum was held on March 6, 2009 at the CAS Space Center, to discuss China-Russia joint Mars probe, or Firebug I. WU Jijie, the lead scientist for the probe, and director of CAS Space Center, introduced the scientific missions of Firebug I. They will be conducted to understand space magnetic fields, troposphere, and distribution/variation of particles across Mars, escape of atmospheric particles above Mars, Mars' terrains and relief, dust storms, and gravitational fields in the equator. Firebug I probe will be equipped with four scientific probe instruments to collect the said data. At the present stage, the probe is under a comprehensive test for electric performance, environment adaptability, and EMC, before rolling off the assembly line in the mid 2009.

RESEARCH AND DEVELOPMENT

Dinosaur with Primitive Feathers Found in China



Reconstructed image of Confucius therizinosaur Beipiaosaurus.



Fossilized Confucius therizinosaur *Beipiaosaurus*.

Chinese scientists reported in the journal *Nature* published on March 19, 2009 that the fossil specimens they have found in the west part of Liaoning show that feathers evolved and diversified on dinosaurs long before dinosaurs evolved into birds. According to XU Xing, a co-author of the paper, and a research fellow at Laboratory of Evolutionary Systematics of Vertebrates under CAS Institute of Vertebrate Paleontology and Paleoanthropology, fossil feathers have previously been found in the specimens of theropod dinosaurs from the Early Cretaceous (some 100 million years ago) sediments of western Liaoning in China. However, all of the feathers that have been documented so far are composite structures formed by multiple filaments, either diverging from a common base, or branching from along the length of a main central stem.

Xu and co-workers have found a novel feather type in the specimens of the basal therizinosaur *Beipiaosaurus* that were unearthed at the same location. The feathers, each represented by a single filament, are found on its head, neck, trunk and tail.

Researchers suggest that these single filaments are the primitive form of advanced feathers seen on other theropod dinosaurs, indicating that such structures had already been there, even before 200 million years ago where dinosaurs came into being. The filaments and their derivatives have so far been only found in theropod dinosaurs, asserting the fact that birds are evolved from theropod dinosaurs.

Expedition Boat Returned with Rich Findings



Ocean I scientific expedition boat returned to China on March 17, after completing its 20th mission. Since launched into oceans on May 22, 2008, the boat has traveled across both the Pacific Ocean and the Indian Ocean, with a journey as far as 46,000 sea miles on a combined basis, making the trip the longest in both duration and journey in the country. The expedition has discovered 11 seafloor hydrothermal areas, and 4 abnormal seafloor hydrothermal areas.

Scientists found 5 new active seafloor hydrothermal areas in a fast expanding ridge in the east Pacific. 4 of them run as long as 21km in total, falling into the category of super large seafloor hydrothermal area. 6 more were found in a slowly expanding ridge in the southwest part of the Indian Ocean, including a multi-metal sulphides area sitting on

mantle rocks, the first discovery of such structure in the world. In addition, scientists have found a 'white chimney' hydrothermal area made of calcium carbonates, and an inactive seafloor hydrothermal area that was extremely difficult to spot.

New Progresses for Antiviral Response Study

A research team, led by SHU Hongbing at Wuhan University College of Life Sciences, has landed another major breakthrough by revealing that ubiquitin ligase RNF5 regulates antiviral responses by mediating degradation of the adaptor protein MITA. In September 2008, researchers identified MITA as an adaptor that links virus-sensing receptors to IRF3 activation. In the current study, researchers show that the E3 ubiquitin ligase RNF5 interacts with MITA in a viral-infection-dependent manner. They further found that virus-induced ubiquitination and degradation of MITA by RNF5 occurred at the mitochondria. Overexpression of RNF5 inhibited virus-triggered IRF3 activation, IFN β 1 expression, and cellular antiviral response, whereas knockdown of RNF5 had opposite effects. These findings, published in March 12, 2009 issue of journal *Immunology*, have provided new clues for understanding the precision regulating mechanisms of natural immunity.

Island Uses Renewable Energy for Power Supply

An independent power generation plant with combined solar, wind, and wave energies, developed by CAS Guangzhou Institute of Energy, was recently put into operation on Dangan Island in Zhuhai. The development has made the self-supply of electric power and fresh water needed by 300 island residents possible. Applied with an array of patented technologies, the new system is advanced and unique in system integration, typhoon resistance, and energy utilization. In addition to its power generation function, the new system is able to make fresh water using its surplus energy.

With a proven economic performance and practical application, the system is designed with a capacity of 105 kilowatts, with 90 kilowatts from wind, 10 kilowatts from wave, 5 kilowatts from solar energy, and 100 kilowatts from backup diesel power generator. The system produces 100,000 kilowatt hours of electricity a year. The surplus energy can result in an annual production of 10,000 tons of fresh water. Experimental results show that the wind generator alone is able to meet the electricity needs for autumn, winter, and spring. Summers have to be supplemented with the power generated by diesel power generators. The system will be in a position to fully accommodate the electricity needs of the island, when the solar power generator is put into operation.

Novel Straw Gasification Technology

LI Xiujin and coworkers at Beijing University of Chemical Technology have developed a pre-handling technology that can be used to perform a quick chemical treatment to the straws at a normal temperature before anaerobic fermentation. Designed to turn straws into a 'feed' for easy digestion, the new technology can increase biogas yield by 50%-120%, creating the conditions necessary for massive commercial gasification of straws. Researchers also developed a novel reactor to address a range of technical issues concerning the small density, large volume, immobility, and poor heat conductance of straws, allowing mechanic feeding/discharging and automatic stir. Meanwhile, they have built a semi underground reactor with a solar powered greenhouse that is able to turn some solar energy and geothermal energy into biogas, greatly raised energy conversion of the new system.

The patented technology has been used in building an anaerobic biogas fermentation works in 2003 in Tai'an, Shandong, the first of its kind in the country. The pilot project provides the daily energy needed by 160 farmer households. Two more biogas works using the same technology were established in Shunyi, Beijing in 2007, and in Dezhou, Shandong in 2008 respectively, provided clean energy for 300 and 375 farmer households.

NEWS BRIEFS

New Energy Fair Opened in Beijing

Under the joint sponsorship of 13 Chinese government agencies, including the Ministry of Science and Technology, and the State Development and Reform Commission, an international fair was opened on March 19, 2009 at Beijing Exhibition Center, to demonstrate novel technologies and products in the area of energy efficiency/emission reduction and new energy. As the largest of its kind in the country, the Fair has offered an exhibition area of 23,000 square meters for government, industry, technology trade, and public education program. Some 200 enterprises and research institutes from a dozen of countries, including the United States, Japan, and Germany, and from more than 20 domestic provinces, municipalities, and autonomous regions, have made their appearances at the Fair. The event was staged with a range of consultation services for fund raising, patent, and legal affairs, facilitating technology transfer and spin-off, and promoting the revitalization and development of new energy industry. High level forums and discussion panels were also staged to facilitate international collaborations between China and other countries.

Shanghai Synchrotron Radiation Facility Ready in April

It was reported from CAS Shanghai Institute of Applied Physics that Shanghai Synchrotron Radiation Facility, a major large science project catching the world attention, will be completed of its construction and put into operation at the end of April. With an investment worth RMB 1.2 billion, the facility sits on a site of 200,000 square meters in Zhangjiang High Tech Park in Pudong, Shanghai. Three large accelerators (50MeV Linac, 3.5GeV full energy enhancer, and 3.5GeV high performance storage ring with a perimeter of 432m) have been fully tested and fine tuned for operation in a silver gray large structure with a shape like nautilus.

The project has also developed seven beam lines and experimental stations for large biological molecule crystals, XAFS, hard X-ray, X-ray image and medical application, soft X-ray spectrum, diffraction, and small angle X-ray scattering.

Injury Free Megasonic Cleaning Equipment

ACM Research, Inc. (Shanghai) has recently made the debut of a megasonic cleaning equipment for 12-inch application at an international show for Chinese made semiconductors in Shanghai. The proprietary injury free megasonic cleaning equipment is equipped with a SAPS megasonic technology that is able to control the energy emitted by megasonic waves in a precision manner (2%). With purified water, the cleaning equipment is able to reach a particle removal rate as high as 98.3%, without causing damage to microstructures. The removal rate could be further raised to 99.2%, if applied with special chemicals.

Technologies for Producing Ethylene Glycol from Coal

Thanks to an initiative started in 1982, CAS Fujian Institute of Matter Structures has developed patented technologies to produce ethylene glycol from coal at a large scale. In 2005, the Institute, in collaboration with Jiangsu Danhua Chemical and Shanghai Jinmei Chemical, embarked on a project to synthesize ethylene glycol using catalyzed oxalic ester. Three and more year efforts have resulted in a range of key technologies developed for producing ethylene glycol from coal with an annual capacity of 10,000 tons. The production line that passed technical approval on March 18, 2009 has been working smoothly for more than 1,000 hours.

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