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LEAD ARTICLE

CAS introduces Pioneer Initiative progress at press conference

The State Council Information Office held a press conference to introduce the progress and achievements made in the first phase of the Pioneer Initiative in Beijing on September 16. >> **PAGE 2**

HOT ISSUE

China and Russia launch their Year of S&T Innovation with NICA-focused collaborative agreement

On August 26 China and Russia kicked off their Year of Scientific and Technological Innovation, which involves 1000 plus scheduled scientific activities. >> **PAGE 3**

SCIENCE STORY

An exciting opportunity to explore science and work in an international environment

The PIFI program has given me the wonderful opportunity to establish a close link with the ancient Chinese culture, its history, and its varied cuisine, and even to learn its language. >> **PAGE 10**

Edited by Bureau of International Co-operation, Chinese Academy of Sciences
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CAS introduces Pioneer Initiative progress at press conference

The State Council Information Office held a press conference to introduce the progress and achievements made in the first phase of the Pioneer Initiative in Beijing on September 16.

According to CAS President Bai Chunli, the academy made major scientific and technological achievements as well as landmark progress in the first phase of the initiative.

He attributed these achievements to the academy's comprehensive advantages of multi-disciplinary institutionalization and the great efforts made by a large number of CAS scientists.

"We've successfully accomplished the goals and tasks of the period, with a large collection of scientific and technological achievements in various industries, including quantum information and condensed matter physics," Bai said.

He also cited scientific achievements in some strategic fields such as deep space and deep sea, which supported economic and social development in China.

In addition, the academy took part in a group of large scientific device development programs, including the country's Five-hundred-meter Aperture Spherical Telescope (FAST) in Guizhou Province, which is the world's largest single-dish radio telescope, and the China Spallation Neutron Source in Dongguan, Guangdong Province.

In Bai's introduction, he unveiled data showing that CAS contributed to 14 of the 22 technological breakthroughs mentioned in President Xi Jinping's New Year speech.

Among the seven first prize winners of the National Natural Science Award, CAS captured three as most important contributor and one as main contributor, accounting for 57 percent of the country's total.

In the international *Nature Index* ranking CAS has placed first among the global scientific and educational institutions for eight consecutive years. In the annual "Top Ten Scientific and Technological Progresses in China" selected by academicians of CAS and the Chinese Academy of Engineering, CAS took part in 32 sub-items, accounting for 53 percent of the nation's total.

Its transfer and transformation of scientific and technological achievements helped enterprises achieve a total of 2.44 trillion yuan ($357.77 billion) in sales revenue and brought additional profits and tax totaling 298.3 billion yuan.

Bai said that the academy has greatly improved its scientific and technological innovation capacity and nurtured a number of leading and top-notch talents in science and technology circles.

A press conference is held to introduce the progress and achievements made in the first phase of the Pioneer Initiative in Beijing on September 16.
[IMAGE: SCIO.GOV.CN]

It has completed the pilot program of building national high-end think tanks, which provided strong support for national macro decision-making, he noted, adding that the international influence and competitiveness of a number of CAS research institutes have been greatly improved.

According to its deployment plan, the Pioneer Initiative will be carried out in two phases, and the academy is expected to be a pioneer in making great scientific and technological progress, producing more innovative talent and becoming an influential scientific think tank for China as well as a world-class research institute by 2030.

Bai said the academy is working on a plan for the goals and tasks of the second phase, which will include further reform on systems and mechanisms, and clearer positioning of research institutes. It vows to facilitate China's goal of growing into a leading innovation-driven country by 2035 and a strong power in science and technology by 2050.

At the press conference, Bai also briefed the media on the progress of the academy's international cooperation and exchange as well as on research on COVID-19 prevention and control. CAS Secretary-General Wang Keqiang outlined the construction of scientific innovation centers in Beijing, Shanghai and the Guangdong-Hong Kong-Macao Greater Bay Area.

Xie Pengyun, director of the CAS development planning bureau, reported on the progress and achievements of building an influential scientific think tank for China at the event.

Source: China Science Daily

China-Russia Sci-tech Years kicks off. [IMAGE: XINHUA]

China and Russia launch their Year of S&T Innovation with NICA-focused collaborative agreement

On August 26 China and Russia kicked off their Year of Scientific and Technological Innovation, which involves 1000 plus scheduled scientific activities. President Xi Jinping and Russian President Putin sent their congratulations to the Year's opening.

A bilateral scientific collaborative agreement to deepen their joint work on a NICA mega science facility was signed by Huang Wei, Vice Minister of the Chinese Ministry of Science and Technology and G. V. Trubnikov, First Vice-Director of the Joint Institute for Nuclear Research (JINR) at the online opening ceremony. The signing ceremony was held in the presence of Chinese Vice Premier Sun Chunlan and Russian Deputy Prime Minister Tatyana Golikova.

As a facilitator, Hefei Institutes of Physical Science (HFIPS) has made enormous efforts to reach bilateral collaboration on the NICA project which involves participation by seven Chinese sci-tech institutes. And HFIPS is one of the Chinese parties chosen to construct MJ-level high temperature superconductor energy storage magnet systems (HTS SMES) as part of the NICA mega science facility.

It is one of the key goals of the giant project with the aim to compensate for load fluctuations as well as to suppress frequency fluctuations, and then to ensure the safety of the NICA accelerator in case of accident, thereby improving stability of the system.

A flagship project of JINR, NICA is a mega science facility to produce heavy-ion colliding beams with a complex of superconducting rings.

JINR has been a long-time friend of HFIPS, especially in superconducting technology. Back in 2012, HFIPS and JINR started their partnership by collaborating on superconducting current leads.

For nearly eight years, collaboration between the two sci-tech institutions has blossomed. They jointly built the China-Russia Superconducting Proton Research Center in 2015 under an overall NICA-EAST collaborative framework, and their collaboration has never stopped. They took the institutional-level collaboration up to a higher level by building China's Belt and Road Superconducting Proton Research Center.

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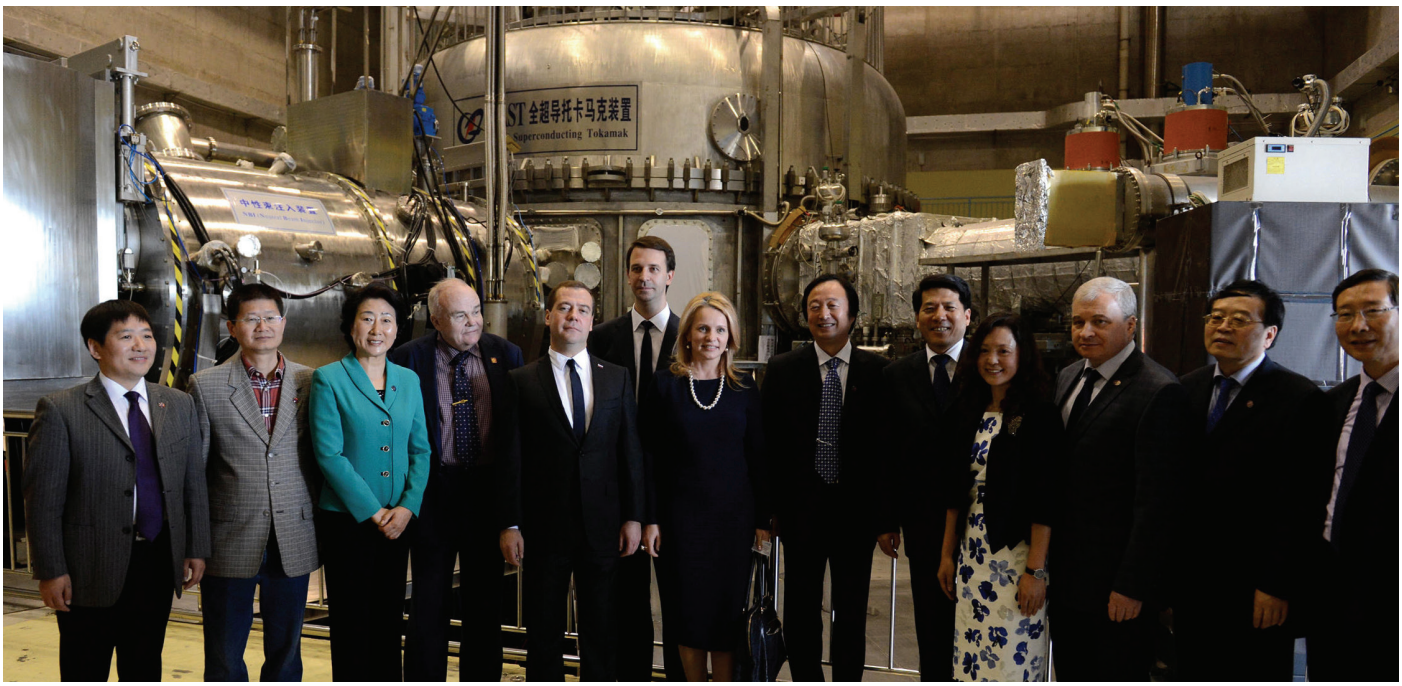

Former Russian Prime Minister Dmitry Medvedev visits ASIPP. [IMAGE: HFIPS]

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Besides the deep collaboration in superconducting technology, HFIPS has built and been expanding its joint work with Russia scientific institutions and universities in other research areas.

The China-Russia Research Center for Atmospheric Optics was built last year to push further its collaboration on Lidar atmospheric detection with the Institute of Atmospheric Optics (IAO) under the Russian Academy of Sciences. Several collaborative agreements, focusing on high-power supply, accelerators, medical equipment and special crystals, were achieved last year. The High Intensity D-T Fusion Neutron Generator (HINEG) opened up a new chapter of collaboration with Russian partners in neutron research.

Russia has always been a great sci-tech partner of China. HFIPS has been sticking to its Russia-collaboration strategy to expand and extend its joint efforts with Russian partners. Both sides are looking forward to more sci-tech collaboration in the near future.

Source: Chinese Academy of Sciences

China-Russia joint research center on superconducting protons and atmospheric optics is founded in Hefei. [IMAGE: HFIPS]

Novel transparent broadband electromagnetic interference shielding materials developed

The Flexible Optoelectronic Material Group (Song Group) led by Professor Song Weijie of the Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS) has proposed and successfully fabricated visibly transparent electromagnetic interference (EMI) shielding materials with high EMI shielding effectiveness (SE) and visible transmittance. The study was published in *ACS Applied Materials & Interfaces* (ACS Appl. Mater. Interfaces).

The development of microwave wireless communication facilitates people's daily lives but also brings about more a complex electromagnetic environment. The emerging 5G and 6G wireless telecommunications working at higher frequencies and larger bandwidths will definitely provide an avenue to the Internet of Things (IoT), automated driving and smart cities, while also challenging the EMI shielding materials. Novel EMI shielding materials need to be developed to prevent unwanted high-frequency microwave signals.

Recently, researchers at NIMTE developed visibly transparent EMI shielding materials using an ultrathin silver layer sandwiched by oxides (SLSO) as building blocks. The samples with a double-sided SLSO (D-SLSO) structure exhibited an EMI SE of over 60 dB for 10-40 GHz with a visible transmittance close to 90 percent which is comparable to those of bare polyethylene terephthalate (PET) and glass substrates.

In addition, the dual role of D-SLSO structure was clarified: it not only enhances EMI shielding via a Fabry–Pérot resonant cavity for microwave electromagnetic waves (EMWs), but also functions as an antireflection coating for visible EMWs.

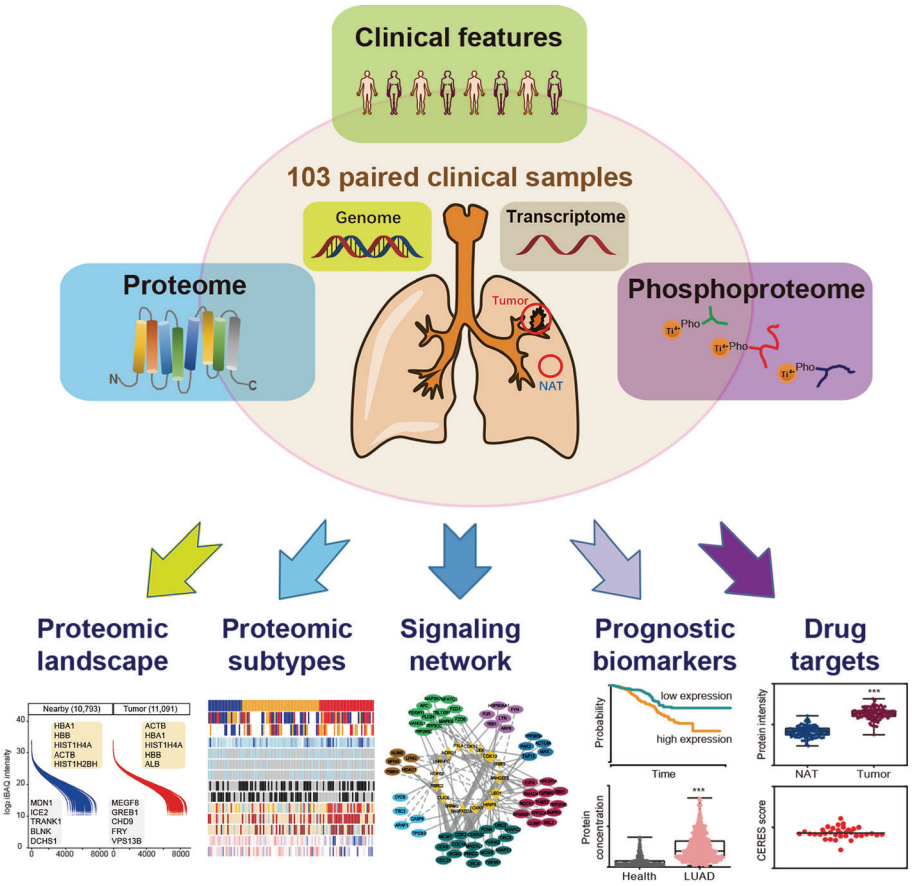
The research group has been devoted to the optimization and large-area fabrication of D-SLSO EMI shielding materials. D-SLSO materials with a width of 600 mm have been successfully produced at a pilot plant facility.

Moreover, the effectiveness and the stability of the transparent EMI shielding materials have been confirmed through applications in radio frequency (RF) devices.

This work was supported by the National Natural Science Foundation of China (No. 61875209 and 61774160), the Zhejiang Natural Science Foundation (No. LY19F040003), the Ningbo Natural Science Foundation (No. 2018A610142), the Program for Ningbo Municipal Science and Technology Innovative Research Team (No. 2016B10005), and the Ningbo Key Laboratory of Silicon and Organic Thin Film Optoelectronic Technologies.

For more information, please contact:
Huang Ye
E-mail: huangye@nimte.ac.cn
Ningbo Institute of Materials Technology and Engineering

Source: Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences



A comprehensive proteomic map of human lung adenocarcinoma

Chinese scientists conduct major lung cancer analysis

Chinese scientists have conducted a comprehensive proteomic analysis of lung adenocarcinoma, a major lung cancer. They did this to understand the pathological mechanism of the disease and plan precise treatments.

Jointly conducted by researchers from the Shanghai Institute of Materia Medica under the Chinese Academy of Sciences (CAS) and the cancer hospital of the Chinese Academy of Medical Sciences, as well as other institutions, the research was published in the journal *Cell*.

The proportion of non-smokers among lung adenocarcinoma patients is significantly higher than in other types of lung cancer, and the pathogenesis of lung adenocarcinoma is more complex. A comprehensive proteomic study of lung adenocarcinoma is key to understanding the disease, discovering drug targets, and developing treatments.

Researchers spent more than six years carrying out comprehensive proteomic analyses of tumor tissues from 103 lung adenocarcinoma patients through interdisciplinary research of proteomics, bioinformatics, cancer biology, and clinical medicine.

They obtained a comprehensive molecular landscape of the disease, revealed molecular characteristics closely related to the prognosis of patients, and identified two major gene mutations of lung adenocarcinoma in the Chinese population.

Tan Minjia, one of the researchers, said the study provides drug targets and prognostic biomarkers which are expected to be applied clinically for the treatment of lung adenocarcinoma. It has application value in guiding patients' clinical medication and improving survival times.

He Fuchu, Member of CAS, said the research marks an important achievement of the China Human Proteome Project and indicates the importance of proteomics in precision medicine.

For more information, please contact:
Prof. Tan Minjia
E-mail: mjtan@simm.ac.cn
Shanghai Institute of Materia Medica, Chinese Academy of Sciences

Source: Xinhua

Series progress achieved in ceramic based solid-state Li-fluoride conversion batteries

Compared with traditional lithium ion batteries (LIBs), lithium metal batteries (LMBs) have the potential advantage of high energy density in view of the use of Li metal anode with ultrahigh theoretical specific capacity (3860 mAh·g^{-1}) and lowest electrochemical potential (-3.04 V vs. standard hydrogen electrode). For LMBs, apart from traditional Li-containing polyanion frameworks and layered oxide materials, emerging Li-free fluoride materials with higher theoretical energy density can also be adopted as cathodes. Liquid electrolytes are used as the Li-ion transmission medium in general LMBs, and they usually contain Li salts and organic solvents. Due to the side reactions of liquid medium and the flammability of organics, this type of battery has certain safety risks. Using a solid-state instead of a liquid electrolyte as the Li-ion conductor can improve the safety and stability of LMBs and expand the temperature range of LMB operation.

Garnet-type doped $Li_7La_3Zr_2O_{12}$ (LLZO) emerges as the candidate oxide solid electrolyte because of its high Li-ion conductivity at room temperature (up to 10^{-3} S·cm^{-1} at state-of-art), stability against Li metal, and facile synthesis process with economic raw materials. However, LLZO still suffers from some disadvantages when in contact with metallic Li: (1) LLZO is unstable when exposed to air, and Li_2CO_3 and LiOH passivation layers form on the surface of LLZO. They would degrade the wettability of Li on LLZO substrate and the corresponding Li/LLZO interfacial impedance. (2) The limited contact area between Li and irregular LLZO grains would make the current distribution inhomogeneous, leading to selective Li mass deposition on the LLZO surface and even rapid Li dendrite growth along the grain boundaries of LLZO. These factors would cause a quick degradation of voltage polarization performance or electrochemical failure and even short circuits in LLZO-based solid state LMBs (SSLBs). Thus, it is quite urgent to explore proper strategies to modify the anode/ garnet interfaces.

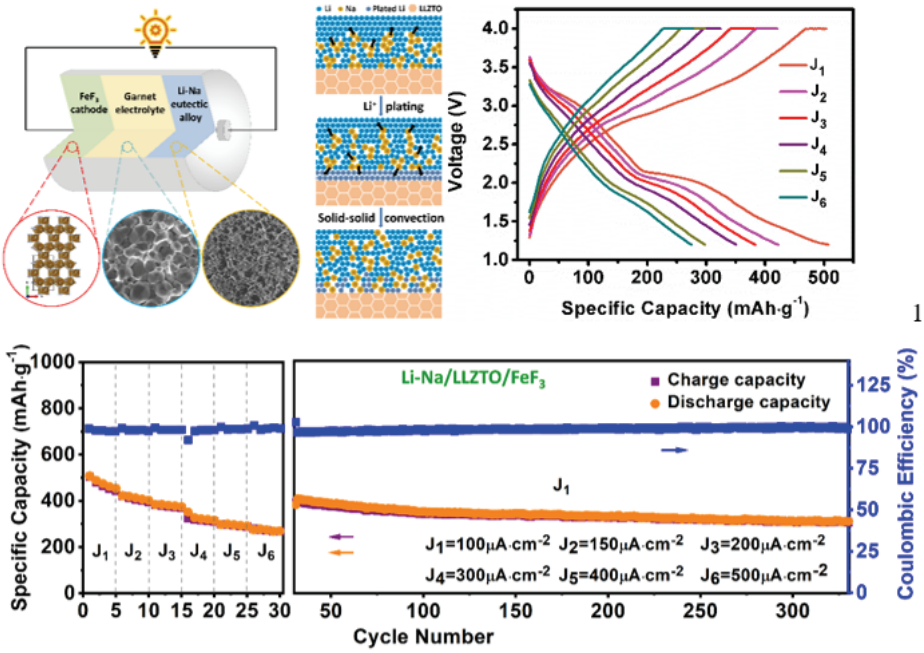


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Fig 1: Architecture of Li-Na/LLZTO/FeF_3 solid state battery; Schematic of solid-solid convection process between Na and Li domains during Li plating; Rate and cycling performance of as-assembled Li-Na/LLZTO/FeF_3 full cell

Recently, a research team led by Professor Li Chilin at the Shanghai Institute of Ceramics, Chinese Academy of Sciences, made a series of progressive steps in the interface modification of ceramic-based solid-state electrolytes and the performance activation of corresponding solid state batteries based on Li fluoride conversion reaction.

This team proposed the idea of an "eutectic alloy induced solid-solid convection" mode to modify the LLZO/Li interface, which achieved a self-healing interlayer at the solid-solid interface during the electrochemical process. On this basis, ceramic-based solid-state batteries based on conversion-type iron trifluoride (FeF_3) cathode exhibit excellent cycling and rate performance.

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Metallic Na and Li belong to the same main group and possess similar chemical properties, and metallic Na is soft and easy to handle. From the Li-Na binary phase diagram, it is clear that Li and Na can form an eutectic alloy in almost any ratio, so there is no need to specifically adjust the Li-Na ratio. This method is simpler and more flexible than other alloy modification methods reported in the literature. The Li-Na eutectic alloy enables the formation of a good interfacial contact with LLZO. Due to the concentration gradients of Na and Li crystal domains, solid-solid convection is prone to occur between the alloy and pure Li phase, so that a relatively stable homogeneous alloy state can be maintained at the electrolyte/anode interface. Benefiting from this eutectic interlayer, the modified symmetric cells exhibit low interfacial resistance (< 20 Ω·cm^2) and ultralong cycling performance (> 3500 h) with small overpotential at 60 °C. Moreover, interface-wetted solid-state Li-Na/LLZTO/FeF_3 cells achieve impressive electrochemical performance, e.g. high discharge capacities of 507.3, 422.0, 383.4, 350.6, 297.6, and 275.1 mAh·g^{-1} at 100, 150, 200, 300, 400, and 500 μA·cm^{-2}, respectively. This work is published in *ACS Energy Letters* 2020, 5, 1167-1176, DOI:10.1021/acsenergylett.0c00383.

The team also proposed a "candle soot annealing ceramic" mode to achieve LLZO/Li interface engineering, which significantly removed the passivation layer on the ceramic surface and realized the ultra-long performance of the conversion-type lithium fluoride solid-state batteries. The carbonate passivation layer forms on the electrolyte surface when exposed to moisture in air, leading to the poor contact of LLZO pellet with Li anode and huge interfacial impedance. They adopted a flexible and effective vapor deposition method to address the interfacial issue between garnet pellet and Li by inserting a candle soot interlayer. With the assistance of spontaneous high temperature circumstance, the carbonate passivation layer on LLZO is reduced by the hydrocarbon particles with radical groups when the ceramic pellet is annealed above a candle flame. Afterwards, an ultrathin candle soot layer deposits on the ceramic surface, and it can be endowed with ionic conductivity after lithiation. The candle soot modified LLZO pellets establish intimate contact with Li, leading to homogeneous Li deposition during charge/discharge cycling. The candle soot with graphitic-like structure converts to LiC_6 domains when fully reacting with Li, which is well known as an ionic/electronic mixed conductor. When cycled at 100 μA·cm^{-2}, the Li/CS-LLZTO/FeF_3 a full cell delivers an initial capacity as high as 500 mAh·g^{-1} and can be maintained for 1500 cycles. Moreover, it also delivers a highly reversible capacity at 201.0 mAh·g^{-1} even after 700 cycles under the current density of 200 μA·cm^{-2}, benefiting from the excellent stability and durability of lithiated candle soot interlayer. This excellent performance is superior to those of Li-FeF_3 batteries with liquid electrolytes. This work is published in *ACS Applied Materials & Interfaces,* 2020, 12, 33729-33739, DOI:10.1021/acsami.0c08203.

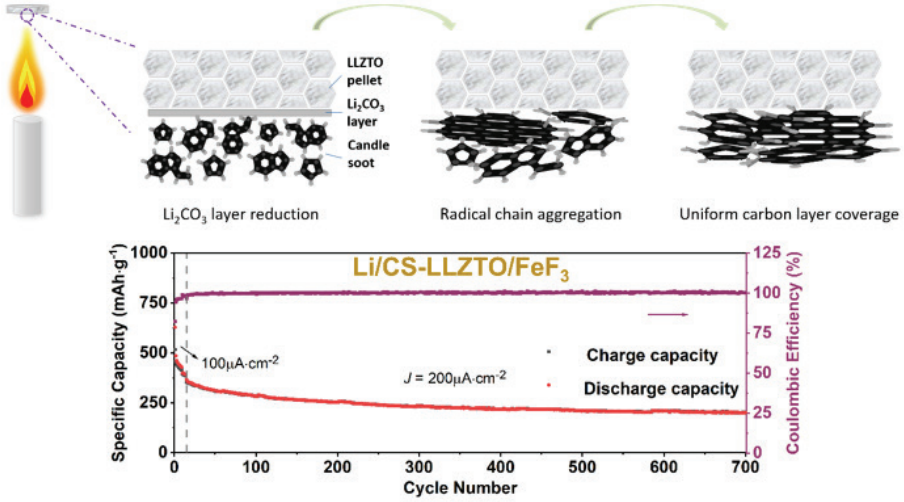


Fig2: Schematic of candle soot deposition process to modify LLZO interface and remove passivation layer; Long-term cycling performance of Li/CS-LLZTO/FeF_3 solid state cell at 200 μA·cm^{-2}

The solid-state architecture enables the better interface confinement effect on conversion products and mitigates their dissolution into electrolyte. Therefore, the active species and their electric contact are better preserved in solid-state architecture than in a liquid electrolyte system. On the other hand, the lithiated candle soot or eutectic interlayer with high mixed conductivity and superior interface wettability can efficiently prevent Li dendrites from penetrating the solid-state electrolyte. Both the factors are responsible for the potentially better cycling stability of solid-state fluoride batteries than that of some organic electrolyte systems.

For more information, please contact:
Prof & Dr. Li Chilin
E-mail: chilinli@mail.sic.ac.cn
Shanghai Institute of Ceramics, Chinese Academy of Sciences

Source: Shanghai Institute of Ceramics, Chinese Academy of Sciences

Zooming in on dark matter

Most matter in the universe is dark and completely different in nature from the matter that makes up stars, planets and people. Galaxies form and grow when gas cools and condenses at the center of enormous clumps of this dark matter, forming so-called dark matter haloes.

An international research team led by Professor Wang Jie from the National Astronomical Observatories of the Chinese Academy of Sciences (NAOC) used supercomputers in China and Europe to zoom in on a typical region of a virtual universe. It was like zooming in on an image of the Moon to see a flea on its surface.

The study was published in *Nature* on September 2.

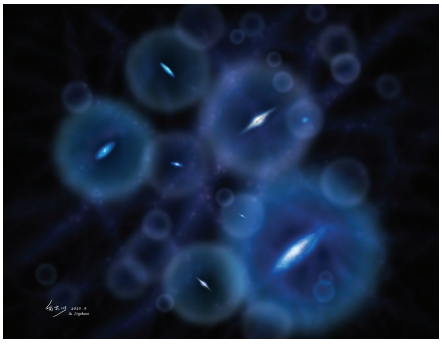
The biggest dark matter haloes in today's universe contain huge galaxy clusters, collections of hundreds of bright galaxies. The properties of such clusters, which weigh over a quadrillion (a million billion) times as much as our Sun, are well studied.

On the other hand, the masses of the smallest dark matter haloes are unknown. They are hypothesized to be about the mass of the Earth, according to current theories.

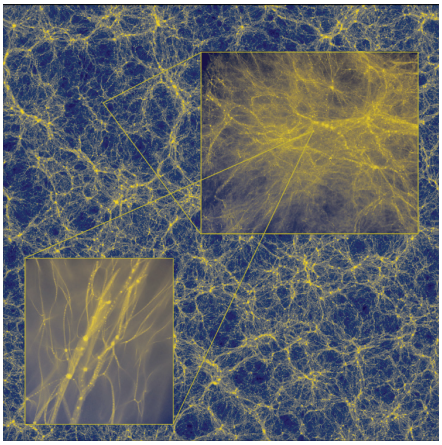
Such small haloes must be extremely numerous, containing a substantial fraction of all the dark matter in the universe. However, they have remained dark throughout cosmic history because stars and galaxies grow only in haloes more than a million times as massive as the Sun.

"These small haloes can only be studied by simulating the evolution of the universe in a large supercomputer," said Professor Wang.

The research team, based at the NAOC in China, Durham University in the UK, the Max Planck Institute for Astrophysics in Germany, and the Center for Astrophysics in the USA, spent five years developing, testing and carrying out their cosmic zoom.



An artist's impression of dark matter haloes with various mass in the universe [IMAGE: YU JINGCHUAN, BEIJING PLANETARIUM]



Simulations of formation of dark matter haloes ranging in size from Earth mass to clusters of galaxies find a universal halo density structure spanning 20 orders of magnitude in mass. [IMAGE: SOWNAK BOSE, CENTER FOR ASTROPHYSICS, HARVARD UNIVERSITY]

It enabled them to study the structure of dark matter haloes of all masses between that of the Earth and that of a big galaxy cluster. In numbers, the zoom covers a mass range of 10 to 10 to the power 30 (that is one followed by 30 zeroes), which is equivalent to the number of kilograms in the Sun.

By zooming in on the virtual universe in such microscopic detail, the researchers were able to study the structure of dark matter haloes ranging in mass from that of the Earth to a big galaxy cluster.

"Surprisingly, we find that haloes of all sizes have a very similar internal structure, i.e., they are extremely dense at the center, become increasingly spread out, and have smaller clumps orbiting in their outer regions," said Professor Wang. "Without a measure scale it was almost impossible to tell an image of a dark matter halo of a massive galaxy from one with a mass a fraction of that of the Sun."

Particles of dark matter can collide near the centers of haloes, and may, according to some theories, annihilate in a burst of energetic (gamma) radiation.

Co-author Professor Carlos Frenk from Durham University said: "By zooming in on these relatively tiny dark matter haloes we can calculate the amount of radiation expected to come from different sized haloes."

Most of this radiation would be emitted by dark matter haloes too small to contain stars, but future gamma-ray observatories might be able to detect these emissions, making these small objects individually or collectively "visible".

"This would confirm the hypothesized nature of the dark matter, which may not be entirely dark after all," said co-author Simon White from the Max Planck Institute of Astrophysics. "Our research sheds light on these small haloes as we seek to learn more about what dark matter is and the role it plays in the evolution of the universe."

The simulations were carried out in the Cosmology Machine supercomputers in Guangzhou, China, Durham, England of the UK, and Munich, Germany.

This paper can be accessed at https://www.nature.com/articles/s41586-020-2642-9

Source: Chinese Academy of Sciences

An exciting opportunity to explore science and work in an international environment

Ni hao, I am Laura Medina-Puche. I am a "Laowai" from Spain. I have been developing my postdoctoral PIFI fellowship since 2018 at the Shanghai Center for Plant Stress Biology (PSC) and the Center for Excellence in Molecular Plant Sciences (CEMPS) of the Chinese Academy of Sciences (CAS) in Shanghai.

My supervisor Professor Rosa Lozano-Duran and I are both from Spain. Besides us, there are more than 40 foreign scientists at CEMPS and PSC: Spanish, Japanese, Korean, Canadian, Greek and French PIs, Indian, Tunisian, Japanese, Egyptian, Peruvian and Pakistani postdoctoral fellows, and some international graduate students. So as you can see, our institute provides everyone with a diverse and stimulating environment. CEMPS strives to be a world-leading institute fostering ground-breaking discoveries and the development of cutting-edge technology to improve crops for the benefit of mankind. This research center operates on an academic research model that stresses the academic accomplishments of each of its investigators. Additionally, during this period I could enjoy the state-of-the-art in-house core support services that PSC also offers, including in cell biology, bioinformatics and genetics. This was ideal for the attainment of the project, because they offer not only the latest equipment and technology but also personnel of the highest qualifications who in turn offer updated training courses and help with protocols.

During the development of my project, I could combine different approaches and techniques, including cell biology, molecular biology, bioinformatics, biochemistry and virology. The PSC has actively recruited expert scientists in different fields of plant biology, thereby creating an optimal environment to nurture scientific discussion and collaboration. I had the unique opportunity to work side by side with some of these experts such as Professor Chanhong Kim, expert in chloroplast biology and biochemistry; Professor Shingo Nagawa, formerly head of the cell biology core facility team; and Professor Alberto P. Macho, expert in molecular plant-bacteria interactions. The intra-institute forged collaborations undoubtedly have strengthened this project, which has benefited from productive dialogue and discussion among the participants on a daily basis.

In addition, this postdoctoral position in such a young, dynamic, multi-cultural team as the one led by Professor Rosa Lozano-Duran has given me not only the opportunity to expand my scientific training and networking but has also contributed to my training as a mentor through the opportunity to co-supervise MSc and PhD students. Belonging to an international research group, made up of people from four different continents, has not only offered me an enriching framework for discussions about science, but also a broad vision of the world where fundamental values such as friendship, respect, and equality are present every day.

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Being a PIFI postdoctoral fellow is an once-in-a-lifetime experience. I had the opportunity to conduct high quality research with my hard-working, helpful and friendly lab colleagues with whom I share a common passion for plant science, in a respectful and pleasant work environment which made me feel at home. Without their support, it would not have been possible to carry out this project in such a fruitful way. As a result, during this period I published seven articles, I got my own grant as Young Principal Investigator from the National Natural Science Foundation of China (NSFC), I actively participated in several projects led by my supervisor Doctor Rosa Lozano-Duran, I was able to attend several in-

ternational conferences that allowed me not only to publicize my research but also to expand my network, I supervised the lab work of several students, and I could carry out outreach activities such as the celebration of the Fascination of Plants Day (FoPD) in collaboration with PSC, the Chenshan Botanical Garden, and the European Plant Science Organisation (EPSO). In addition, the PIFI program has given me the wonderful opportunity to establish a close link with the ancient Chinese culture, its history, and its varied cuisine, and even to learn its language.

Another reason that motivated me to apply for this fellowship and to settle in China was that this country is currently at the forefront of scientific investment and promotion of science. In retrospect, I strongly believe that this opportunity has been the perfect launch pad for my scientific career, which has not only boosted my academic development but has also allowed me to become a mature scientist ready to establish my own independent research group.

Source: Laura Medina-Puche,
Center for Excellence in Molecular Plant Sciences (CEMPS),
Chinese Academy of Sciences

China's Chang'e-4 probe reveals impact history of landing site on moon's far side

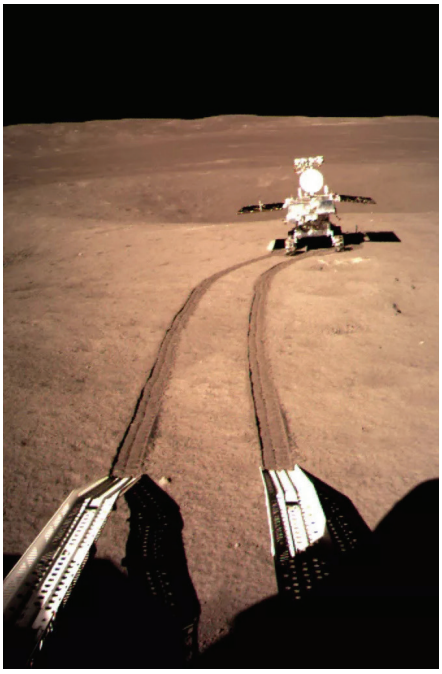
Based on data from China's Chang'e-4 probe, Chinese scientists have determined the thickness of the regolith and revealed the fine subsurface structures and evolutionary history of the probe's landing site on the moon's far side.

The study revealed that the landing area of the probe, located within the largest and oldest impact basin on the moon, had experienced multiple impact events and basalt magma eruptions.

The Chang'e-4 probe, launched on December 8, 2018, made the first-ever soft landing on the Von Karman Crater in the South Pole-Aitken Basin on the far side of the moon on January 3, 2019.

Carrying scientific instruments including lunar penetrating radar, the rover Yutu-2 has conducted scientific detection on the compositions of lunar surface materials and the subsurface structures.

Scientists from the Institute of Geology and Geophysics (IGG) under the Chinese Academy of Sciences (CAS), the Aerospace Information Research Institute under CAS, the Macao University of Science and Technology and other institutes have carried out research based on the lunar penetrating radar onboard Yutu-2 during the first three lunar days and obtained important findings on the subsurface structure of the landing area.



The Chang'e 4 robotic probe [IMAGE: CLEP.ORG.CN]

The results show that the materials detected by Yutu-2 come from the nearby Finsen impact crater rather than the basalt erupted from the lunar mantle, which fills the bottom of the Von Karman Crater. It was also revealed that the landing area had experienced multiple impact events and basalt magma eruptions.

The new discoveries are of great significance in understanding the evolutionary history of the South Pole-Aitken basin of the moon, and will add to following exploration and research on the composition and structure of the lunar interior, said Lin Yangting, a researcher with the IGG.

Asteroid impacts were an important driving force for the early evolution of the Earth. However, long-term geological tectonic activities have erased most of the traces of the impact cratering events on Earth, experts said.

Internal evolution of the moon has long ceased due to its small mass. Therefore, impact craters and the deposit profile of crater ejecta on the lunar surface record the impact history of asteroids in the earth-moon system.

According to Lin, the subsurface structure of the moon records the number and scale of large-scale impact events and magma eruptions, as well as their temporal and spatial relationships. However, the fine structure of the moon's shallow layers remains a mystery.

The modification of lunar surface materials by asteroid impacts has a direct influence on the results obtained from orbital observations and landing site reconnaissance, and affects how scientists will implement lunar sample return missions in the future, Lin said.

The study was published in the latest issue of *Nature Astronomy*.

Source: Xinhua

Researchers develop self-service vision screening instrument

Chinese researchers have developed a self-service visual acuity detector and a management system for visual health.

Users view visual targets through the lens of the vision detector and their visual acuity is evaluated based on the sizes of clearly-seen targets.

The detector's mean detection time is under one minute, according to its developer, the Suzhou Institute of Biomedical Engineering and Technology under the Chinese Academy of Sciences.

The detector can be used in schools and at home, or by visual care organizations.

The visual health management system is accessible via a WeChat mini-program, a tablet computer app and computer software. Users can check their personal vision detection data and receive follow-up vision care advice.

The vision detector and management system is expected to prevent myopia and provide management services such as detection, data collection, follow-up advice and science popularization.

Source: Xinhua