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समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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Press Information Bureau
Government of India

Ministry of Defence

Tue, 29 Dec 2020 4:20PM

DRDO Young Scientists laboratory develops quantum based technology for random number generation

Random numbers have essential roles in many fields, such as Quantum Communication, cryptography (key generation, key wrapping, authentication etc.), scientific simulations, lotteries and fundamental physics experiments. The generation of genuine randomness is generally considered impossible with classical means. Quantum Mechanics has the inherent potential of providing true random numbers and thus has become the preferred option for the scientific applications requiring randomness.

DRDO Young Scientist Laboratory for Quantum Technologies (DYSL-QT) has developed a Quantum Random Number Generator (QRNG) which detects random quantum events and converts those into a stream of binary digits. The Laboratory has developed a fiber-optic branch path based QRNG. Branch path based QRNG is based on the principle that if a single photon is incident on a balanced beam splitter, it will take either of the beam-splitter output paths randomly. As the path chosen by photon is random, the randomness is translated to sequence of bits.

QRNG system developed by the laboratory has passed the global randomness testing standards viz. NIST and Die-harder Statistical Test Suites at the speed of ~150 kbps after post-processing. The generated random numbers are also evaluated and verified using DRDO's indigenously developed Randomness Testing Statistical Test Suite of SAG. With this development India enters the club of countries who have the technology to achieve the generation of random numbers based on the Quantum Phenomenon.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1684381>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Tue, 29 Dec 2020 4:20PM

डीआरडीओ की युवा वैज्ञानिक प्रयोगशाला ने रैंडम नंबर के सृजन के लिए क्वांटम आधारित प्रौद्योगिकी विकसित की

क्वांटम संचार, क्रिप्टोग्राफी (कोड तैयार तैयार करना आदि), वैज्ञानिक सिमुलेशन, लॉटरी तथा मूलभूत भौतिकी प्रयोगों जैसे विभिन्न क्षेत्रों में रैंडम नंबर की अनिवार्य भूमिका होती है। आमतौर पर वास्तविक रैंडम नंबर को सृजित करना पारंपरिक तरीके से असंभव माना जाता है। क्वांटम मैकेनिक्स में सही क्वांटम संख्या प्रदान करने की अंतर्निहित क्षमता है। इस प्रकार यह रैंडम नंबर की आवश्यकता वाले वैज्ञानिक अनुप्रयोगों के लिए पसंदीदा विकल्प बन गया है।

डीआरडीओ क्वांटम टेक्नोलॉजीज (डीवाईएसएल-क्यूटी) यंग साइंटिस्ट लेबोरेटरी ने एक क्वांटम रैंडम नंबर जेनरेटर (क्यूआरएनजी) विकसित किया है, जो रैंडम क्वांटम घटनाओं का पता लगाता है और उन्हें बाइनरी अंकों के रूप में परिवर्तित करता है। इस प्रयोगशाला ने फाइबर-ऑप्टिक ब्रांच पाथ आधारित क्यूआरएनजी विकसित किया है। ब्रांच पाथ से जुड़ा क्यूआरएनजी इस सिद्धांत पर आधारित है कि यदि किसी संतुलित बीम स्प्लिटर पर एक भी फोटॉन की घटना होती है, तो यह बीम-स्प्लिटर आउटपुट पाथों में से किसी एक को रैंडम के रूप में लेगा। जैसा कि फोटॉन द्वारा चुना गया पाथ रैंडम है, रैंडम नंबर अनेक बिटों के अनुक्रम में बदल जाता है।

प्रयोगशाला द्वारा विकसित क्यूआरएनजी प्रणाली ने प्रक्रिया पश्चात एनआईएसटी और ~ 150 केबीपीएस की गति से डाई-हार्ड सांख्यिकीय टेस्ट सूटों जैसे वैश्विक तौर पर मान्य रैंडम नंबर संबंधी परीक्षण मानकों को पूरा किया है। डीआरडीओ द्वारा स्वदेशी रूप से विकसित रैंडमनेस टेस्टिंग स्टैटिस्टिकल टेस्ट सूट ऑफ एसएजी का उपयोग से सृजित रैंडम नंबर का मूल्यांकन और सत्यापन भी किया जाता है। इस विकास के साथ भारत ने उन देशों के समूह में प्रवेश किया है जिनके पास क्वांटम फेनोमेनन के आधार पर रैंडम नंबर सृजित करने की प्रौद्योगिकी मौजूद है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1684456>

DRDO facility develops Quantum Random Number Generator

The DRDO Young Scientist Laboratory for Quantum Technologies (DYSL-QT), a DRDO facility based in Mumbai, has developed a QRNG which has the ability to detect random quantum events and convert those into a stream of binary digits

By Sushant Kulkarni

DAYS after successfully testing the Quantum Key Distribution technology, the Defence Research and Development Organisation (DRDO) has achieved another milestone in quantum technology by successfully developing a Quantum Random Number Generator (QRNG), the Ministry of Defence said on Tuesday.

The DRDO Young Scientist Laboratory for Quantum Technologies (DYSL-QT), a DRDO facility based in Mumbai, has developed a QRNG which has the ability to detect random quantum events and convert those into a stream of binary digits.

The facility has developed a fiber-optic branch path based QRNG.

Branch path-based QRNG relies on the principle that if a single photon falls on a balanced beam splitter, it will take either of the beam-splitter output paths randomly. As the path chosen by the photon is random, the randomness is translated to a sequence of binary digits, also called bits.

Random numbers have essential roles in various fields ranging from quantum communication, cryptography applications like key generation, key wrapping, authentication along with scientific simulations, lotteries and fundamental physics experiments. The generation of perfect randomness is generally considered impossible with classical methodologies. Quantum mechanics has the inherent potential of providing true random numbers and thus has become the preferred option for scientific applications requiring randomness.

A press statement from the Defence Ministry read, “The QRNG system developed by the laboratory (DYSL-QT) has passed the global randomness testing standards of NIST and Die-harder Statistical Test Suites at the speed of around 150 kbps after post-processing. The generated random numbers are also evaluated and verified using DRDO’s indigenously developed Randomness Testing Statistical Test Suite of SAG. With this development, India enters the club of countries which have the technology to achieve the generation of random numbers based on the Quantum Phenomenon.”

On December 8, the DRDO announced that their Quantum Key Distribution (QKD) technology underwent a successful trial between two laboratories in Hyderabad, where the quantum technology-based security was validated for a range of 12 km long over a fibre optic channel. QKD is primarily a mechanism to undertake secure communication, which utilises a cryptographic protocol involving various components of quantum mechanics. The technology enables two communicating sides to come up with random secret keys shared by both of them and known exclusively to them, and only they can use it to encrypt and decrypt messages, thus achieving highly secure communication.

DYSL-QT is one of the five YSLs (Young Scientist Laboratories) of the DRDO which are working on five different technologies. The other facilities are Artificial Intelligence (DYSL-AI) Bengaluru, Cognitive Technologies (DYSL-CT) Chennai, Asymmetric Technologies (DYSL-AT)



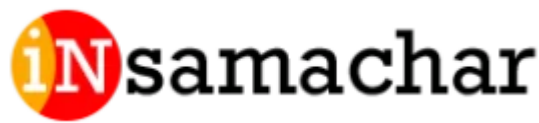
The facility has developed a fiber-optic branch path based QRNG.

Kolkata, Smart Materials (DYSL-SM) Hyderabad. These five facilities were dedicated to the nation by Prime Minister Narendra Modi in January this year.

Various facilities of the DRDO are currently working on various quantum technology-based applications. In December last year, an international symposium on Quantum Information Technology (ISQIT 2019) was organised in Pune by Defence Institute of Advanced Technology (DIAT) of the DRDO, the National Technical Research Organisation (NTRO) and Joint Advanced Technology Centre (JATC) of Indian Institute of Technology, Delhi.

Quantum Technologies concerns the study, control and manipulation of quantum principle-based systems with the goal of achieving information processing, secure communication and superior sensors beyond the limits of the classical systems. It is a deeply interdisciplinary field, lying in the cross-over of areas such as quantum physics, condensed matter physics, computer science, mathematics and electrical and electronics engineering.

<https://indianexpress.com/article/india/drdo-facility-develops-quantum-random-number-generator-7125231/>



Wed, 30 Dec 2020

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<https://insamachar.com/drdo-young-scientific-laboratory-developed-quantum-based-technology-for-generating-random-numbers/>

Wed, 30 Dec 2020

‘Chinese air force heavily deployed in Ladakh theatre in support of PLA’: IAF Chief

The air Chief said the likely reasons for China’s actions along India’s northern borders could include planned escalation and an attempt to establish border claim lines and start border talks on the new positions

By Rahul Singh

New Delhi: Indian Air Force Air Chief Marshal RKS Bhadauria on Tuesday said that China has heavily deployed the People’s Liberation Army Air Force (PLAAF) to support its army in the Ladakh theatre along with a large number of radars and missiles, even as he listed out the possible Chinese objectives for its actions at the northern border.

The air chief said the likely reasons for China’s actions along India’s northern borders could include planned escalation and an attempt to establish border claim lines and start border talks on the new positions, military signalling, domination efforts with escalation control and deployment and training of their Western Theater forces in real war-like scenarios wherein the Galwan Valley incident was an overreach.

Speaking at an event organised by the Vivekananda International Foundation, Bhadauria said China’s aim could also possibly be fine-tuning its strategy to enhance its military technologies and recognize and fill gaps to get its forces to synergise the structures the Chinese military has created over the last two decades.

“In any case, all of the above (possible objectives) appear to have happened irrespective of what was the starting objective. It could also be a totally military-dominated misadventure that escalated given the rapid decrease in trust deficit in post-Covid scenario... and possibly due to the loss of face (for the Chinese), the action later continued to escalate,” Bhadauria said.

“The important issue is that we recognize what they (China) have really achieved and whatever four or five points I mentioned have been actioned in the real sense,” the IAF chief said.

Responding to a question, he said the frontier People’s Liberation Army Air Force (PLAAF) was deployed fully to support the Chinese army and it also had a large presence in the “second tier.”

“Their deployment has been very strong. We have taken every action that we were required to take and cater to such situation and be sure that we will handle it,” Bhadauria said.

The IAF chief said that the air force’s robust actions in the Ladakh theatre had “stopped the Chinese in their tracks and they remained there.” He said India’s most important national security challenge was to understand China, its possible game plan and the deepening and evolving Sino-Pak relationship.



Air Chief Marshal RKS Bhadauria (ANI)

“We are aware that China’s main aspirations are clearly on the global front and regional domination is part of the route to global leadership. Any serious India-China conflict is not good for China at the global front. If Chinese aspirations are global, then it does not suit their grand plans and therefore it is important to understand what could be their possible objectives for their actions in the north (Ladakh sector),” he said.

He said the evolving uncertainties and instability at the global geopolitical front provided China with a chance to demonstrate its growing power and also revealed the inadequate contribution of major powers to global security.

He said budgetary constraint was an issue for the military.

“While we have our needs, we have factored in the current constraints and we are aware that it will take a while for the economy to get back and for us to have the kind of budget we had earlier... We can’t expect we will have some unlimited budget even with the security scenario in the north. The current budget will not be a constraint for us in the north,” he said.

He said Sukhoi-30 fighter jets equipped with the BrahMos missile had significantly increased the reach of the air force and no territory in the so-called ‘string of pearls’ area was out of the IAF’s reach. China’s ‘string of pearls’ refers to strategic attempts to surround India with facilities that can be upgraded to military bases.

On the Ayni airbase in Tajikistan that gives India a strategic footprint in central Asia, the IAF chief said, “It’s an area that gave us a huge capability in terms of being able to operate from there... it has resulted in not only a lot of goodwill but also has a lot of strategic importance and it is going well.”

On the possibility of joint air exercises between the air forces of India, the United States, Australia and Japan (their navies carry out the Malabar drill), the IAF chief said, “The Quad as an execution hasn’t happened so far for the air forces but as a plan of action, it is possible that it will come up soon. At the trilateral level, exercises have happened... between air forces of two Quad countries and observers from a third.”

China has been wary of the Quadrilateral security dialogue or Quad that was revived in late 2017 by India, the US, Australia and Japan, and these suspicions have increased since the four countries upgraded the forum to the ministerial level last year.

<https://www.hindustantimes.com/india-news/chinese-air-force-heavily-deployed-in-ladakh-theatre-in-support-of-pla-iaf-chief/story-duR2XbH4hNKlfGAg19RwhN.html>



Wed, 30 Dec 2020

Pakistan has become pawn in Chinese policy: IAF chief RKS Bhadauria

In an address at a seminar organised by think-tank Vivekananda International Foundation, he said Pakistan’s dependence on China is going to increase as the country is set to reel under a Chinese debt-trap

New Delhi: Pakistan has increasingly become a pawn of China and the withdrawal of American forces from Afghanistan has opened options for Beijing to expand its influence in the region through Islamabad, Chief of Air Staff Air Chief Marshal RKS Bhadauria said on Tuesday.

In an address at a seminar organised by think-tank Vivekananda International Foundation, he said Pakistan’s dependence on China is going to increase as the country is set to reel under a Chinese debt-trap.

Air Chief Marshal Bhadauria said India’s “most important” national security challenge is to understand China, its “possible game plan” and the deepening and evolving Sino-Pak relationship.

“Pakistan has increasingly become a pawn in Chinese policy. Under an increasing CPEC (China-Pakistan Economic Corridor) related debt trap, we are going to witness further military dependencies in the future,” he said.

“The US exit from Afghanistan has opened increased options for China in the region -- both direct and through Pakistan -- allowing it a possible entry into Central Asia, a region that they have been eyeing for long,” the IAF chief added.

The Air Chief Marshal said coercion and economic dependence are being used as tools for making weaker countries accept one-sided actions, in an apparent reference to China.

“We are now witnessing a rise in attempts to alter the status quo through wanton disregard or selective interpretation of established international laws and norms. Coercion and economic dependence are being used as tools for making weaker countries accept one-sided actions, thereby undermining the established order itself at the international level,” he said.

“Fragile states find it convenient to align with dominant powers to ensure regime survival, thereby affecting the regional security scenario further and something we need to increasingly factor in in our national security matrix,” he added.

Replying to a question on possible military cooperation among India, the US, Japan and Australia under the Quad or Quadrilateral coalition, he did not rule out such a possibility and indicated that discussions are underway.

“Quad, as a kind of execution, has not happened so far. But as a plan of action, it is possible,” he said.

Without naming China, Air Chief Marshal Bhadauria also referred to the “debt-trap diplomacy” to achieve geopolitical goals by ensnaring the recipient countries with loans that cannot be repaid.

He said it has allowed “foreign created and controlled” ports and facilities very close to the Indian mainland and island territories. “With the new PLA doctrines underscoring the importance of developing force projection capabilities to counter US global dominance, there is a direct impact of such development on our security matrix,” he said.

“For example, what happens if China was to use one of such launching pads for an action against us in a conflict situation? Does the third country port or launching pad become a target for us or not? What are the implications? It is something we need to factor in, it is something that needs to go into our planning process and thinking process,” he said.

Talking about national security challenges, the IAF chief said there are very few major states that still have unsettled borders to the extent India does to its north.

“On our northern borders, the Himalayan barrier, which separated South Asia from China, has been literally flattened by the massive infrastructural development and the time it takes to travel large distances has really shrunk,” he said.

“The western border has been active from the day Pakistan was created. In addition to the terrorism inflicted upon us through proxy actions, we have been thwarting continuous attempts by our adversary to breach our territory and sovereignty on many occasions,” he said.

The IAF chief said the Indian Ocean and the Indo-Pacific regions are witnessing a tectonic shift in the strategic sphere as the maritime trade and the economic centre of gravity drift towards them.

“With the West and the US in a strategic retreat for the last couple of years, it has opened up a window of opportunity for a geo-strategic realignment and this is being largely shaped by China. China’s rapid economic growth and expanding economy has allowed it to invest heavily into military technology and research and development,” he said. PTI MPB RC

<https://www.hindustantimes.com/india-news/pakistan-has-become-pawn-in-chinese-policy-iaf-chief-rks-bhadauria/story-AcU8FvsR6eieG2W4c7P8KN.html>



Indian Air Force (IAF) Chief of Air Staff Air Chief Marshal Rakesh Kumar Singh Bhadauria during a sortie in the indigenous Light Combat Helicopter (LCH), in Bengaluru. (PTI)

China may use its ‘pawn’ Pakistan to enter Afghanistan: IAF Chief RKS Bhadauria

Indian Air Force chief RKS Bhadauria has said that Pakistan is a pawn of the Chinese policy and Beijing may use its borders to enter Afghanistan once US troops exit

By Abhishek Bhalla

New Delhi: Pakistan is becoming a pawn of Chinese policy and could be used by Beijing to enter Afghanistan after the exit of US forces, Indian Air Force Chief RKS Bhadauria said on Tuesday explaining the objectives behind China’s aggression in Ladakh and the continuing standoff at the Line of Actual Control.

“Pakistan is increasingly becoming a pawn in Chinese policy. Under the increased Chin- Pakistan Economic Corridor debt trap, we are going to further witness military dependency,” he said.

Speaking about China’s global aspirations and dominance through military, the IAF chief said Beijing is also eyeing Afghanistan and touched upon the possibility of China using Pakistan to gain entry into the war-torn country after the exit of US forces.



Air Chief Marshal RKS Bhadauria (PTI)

“US exit from Afghanistan has opened options for China in the region, both direct and through Pakistan allowing it entry into Central Asia, a region they have been eyeing for long,” he said.

In the context of China’s dominance in the region, the Indian Air Force chief referred to the possible objectives of the Chinese aggression this year in Ladakh that has led to a standoff and an unprecedented military build on both sides since early May.

“China’s aspirations are on the global front and regional domination is a part of the route. Any serious China-India conflict is not good for China at the global front and does not suit their goal,” Air Chief Marshal Bhadauria said.

He added that an important national security challenge is to understand China, their game plan and deepening and evolving Sino-Pak relationship.

Speaking about the possible objectives for China to engage in a military standoff and change the status quo in Ladakh, he said that it could be military signaling or domination efforts with adequate escalation control.

“Was it deployment and training of their western theatre forces in a war-like scenario where Galwan was an overreach or was it to fine-tune and enhance their military technologies and fill the gaps or it could be planned to start border talks for new positions or was it just a misadventure that got escalated?” he asked.

He also said India needs to maintain effective capabilities to counter any misadventure if the situation so arises. “Our western border is active since the establishment of Pakistan, now new fronts, areas are also active,” he said.

Speaking about the focus on maximum technology in warfare, he said new drone technology and unmanned aircraft are part of new modern warfare.

“So, military strategy can't be based on erstwhile ground mobilisation future warfare to focus more on technological warfare,” the Air Force chief said.

<https://www.indiatoday.in/india/story/china-may-use-its-pawn-pakistan-to-enter-afghanistan-iaf-chief-rks-bhadauria-1754309-2020-12-29>



Press Information Bureau
Government of India

Ministry of Defence

Tue, 29 Dec 2020 01:14PM

Indian Army's Outreach to startups in Emerging Technologies: Supporting Atmanirbharta

In a major push to support Atmanirbharta and to promote an innovation ecosystem, the Indian Army, in collaboration with the Society of Indian Defence Manufacturers (SIDM), conducted an outreach webinar for startups in emerging technologies. 89 startups pitched their indigenously developed innovations, ideas and proposals to Indian Army through virtual presentations in webinar format from 17 to 28 Dec 2020.

The proposals focused on the field of Drones, Counter Drones, Robotics, Autonomous Systems, Artificial Intelligence (AI), Quantum computing, Blockchain technology, 3D printing, Nanotechnology and Medical applications.

The webinars, organised by the Army Design Bureau (ADB), received a massive response where 13 proposals were shortlisted for further examination based on their viability and applicability for the Indian Army. Prospective users and domain specialists from Army Headquarters and Army Training Command attended the event.

Speaking on the occasion, the Deputy Chief of Indian Army, Lt Gen SS Hasabnis, underlined the importance of self-reliance in the defence sector and called upon the defence industry, particularly the startups to invest in emerging and niche technologies. The Deputy Chief also assured the startups that the Indian Army will assist and handhold them in co-developing innovations and technologies which can enhance the operational capabilities of the Army.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1684327>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Tue, 29 Dec 2020 1:14PM

उभरती हुई प्रौद्योगिकियों में स्टार्टअप्स तक भारतीय सेना की पहुंच: यह पहुंच आत्मनिर्भरभारत की मदद करेगी

आत्मनिर्भर भारत की मदद करने और नवाचारी पारिस्थितिकी तंत्र को बढ़ावा देने के लिए भारतीय सेना ने भारतीय रक्षा विनिर्माताओं की समिति (एसआईडीएम) के सहयोग से उभरती हुई प्रौद्योगिकियों में स्टार्टअप्स के लिए एक पहुंच वेबिनार का आयोजन किया। 17 से 28 दिसंबर, 2020 तक इस वेबिनार प्रारूप में 89 स्टार्टअप्स ने वर्चुअल प्रस्तुतियों के माध्यम से भारतीय सेना को अपने स्वदेशी रूप से विकसित नवाचारों, विचारों और प्रस्तावों से अवगत कराया।

इन प्रस्तावों में ड्रोन, काउंटर ड्रोन, रोबोटिक्स, ऑटोनॉमस सिस्टम्स, आर्टिफिशियल इंटेलिजेंस (एआई), क्वांटम कंप्यूटिंग, ब्लॉकचेन टेक्नोलॉजी, 3 डी प्रिंटिंग, नैनोटेक्नोलॉजी और मेडिकल एप्लिकेशन के क्षेत्र में ध्यान केंद्रित किया गया है।

आर्मी डिज़ाइन ब्यूरो (एडीबी) द्वारा आयोजित इस वेबिनार में व्यापक प्रतिक्रिया प्राप्त हुई। 13 प्रस्तावों को भारतीय सेना के लिए उनकी व्यवहार्यता और उपयुक्तता के आधार पर आगे के परीक्षण के लिए छांटा गया है। सेना मुख्यालय और सेना प्रशिक्षण कमान के संभावित उपयोगकर्ता और इस क्षेत्र के विशेषज्ञों ने इस आयोजन में भाग लिया।

इस अवसर पर भारतीय सेना के उप-प्रमुख लेफ्टिनेंट जनरल एसएस हसबनीस ने रक्षा क्षेत्र में आत्मनिर्भरता के महत्व पर जोर दिया और उन्होंने रक्षा उद्योग, विशेष रूप से स्टार्टअप्स का, उभरती और उच्च प्रौद्योगिकियों में निवेश करने का आह्वान किया। उन्होंने स्टार्टअप्स को यह भी आश्वासन दिया कि भारतीय सेना सह-विकासशील नवाचारों और प्रौद्योगिकियों में उनकी सहायता और मदद करेगी, जो सेना की परिचालन क्षमताओं को बढ़ा सकती है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1684335>



Press Information Bureau
Government of India

Tue, 29 Dec 2020 3:35PM

Mission SAGAR III - INS Kiltan arrives at Sihanoukville, Cambodia

Indian Naval Ship Kiltan arrived at Sihanoukville Port, Cambodia on 29 December 2020 as part of ongoing Mission Sagar-III. The ship will deliver 15 Tons of Humanitarian Assistance and Disaster Relief (HADR) Stores for the flood-affected people of Cambodia, which will be handed over to Cambodia's National Disaster Management Committee (NDMC). This assistance is reflective of the deep people-to-people connect between the two friendly countries.

Mission Sagar-III is part of India's HADR assistance to Friendly Foreign Countries during the ongoing pandemic. This Mission is being undertaken in accordance with Hon'ble Prime Minister Narendra Modi's vision of SAGAR (Security And Growth for All in the Region) and reiterates India's position as a dependable partner, and the Indian Navy as the Preferred Security Partner and First Responder. The Mission also highlights the importance accorded to ASEAN countries and further strengthens the existing bonds.

Historically, India and Cambodia share strong cultural ties. The relations have reinforced in recent years due to increasing engagements in all sectors. The current visit seeks to fortify the bilateral cooperation between the two countries and contribute towards security and stability in the region.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1684365>

Scientists identify electronic and structural dynamics of catalytic centers in single-Fe-atom materials

By Li Yuan

Single-atom catalyst (SAC) is a conceptual bridge between homo- and heterogeneous catalysis. It offers new opportunities for capturing the reaction intermediates by identifying the active sites, and even monitoring the dynamic behaviors of both the geometric structure and electronic environment of the catalytic sites at atomic scale.

Both the exploration of model SACs with a definite microenvironment and the development of novel operando techniques with high atomic resolution are significant, yet still challenging.

Recently, a research team led by Prof. Huang Yanqiang and Prof. Zhang Tao from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences and their collaborators reported their findings on electronic and structural dynamics of catalytic centers in single-Fe-atom materials under in situ oxygen reduction reaction (ORR) conditions.

The study was published in *Chem* on Nov. 20.

The researchers synthesized single-Fe-atom catalysts with well-controlled site density and definite N-coordination environment via a solvent-assisted linker exchange (SALE) method. They used it as the model system for electronic-level understanding of the ORR mechanism.

"We developed Operando Mossbauer spectroscopy for the first time to identify the exact structures and spin state of active atomically dispersed Fe moieties during ORR," said Prof. Huang.

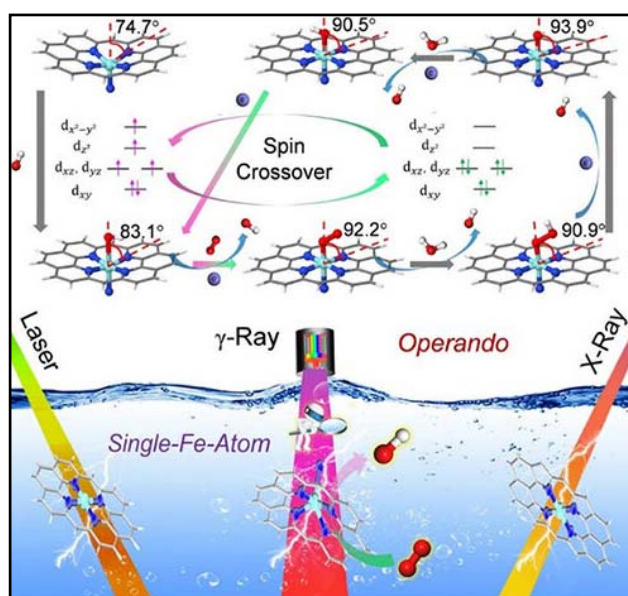
By combining with operando Raman and X-ray absorption spectroscopy (XAS) measurements, as well as density functional theory (DFT) studies, the researchers proved that the potential-relevant structural and electronic evolutions of the active single-Fe-atom moieties were via directly capturing the $*O_2^-$ - and $*OH$ -intermediates under ORR conditions.

These results provided a proof of concept for the integration of operando techniques and SACs, which might direct the way toward the electronic-level insight into the catalytic centers and reaction mechanism.

More information: Xuning Li et al. Identification of the Electronic and Structural Dynamics of Catalytic Centers in Single-Fe-Atom Material, *Chem* (2020). DOI: [10.1016/j.chempr.2020.10.027](https://doi.org/10.1016/j.chempr.2020.10.027)

Journal information: [Chem](https://chem.sciencemag.org/)

<https://phys.org/news/2020-12-scientists-electronic-dynamics-catalytic-centers.html>



The identification of the electronic and structural dynamics of catalytic centers in single-Fe-atom material by Operando Mossbauer spectroscopy. Credit: LI Xuning

Researchers discover C-H bond activation reactions at low temperature by photo-induced means

By Li Yuan

The C-H bond is very important in organic chemistry. Chemical reactions related to the breaking and further synthesis of the C-H bond require high activation energy and poor selectivity. Therefore, it's important to understand the reaction mechanism of the C-H bond.

Recently, a research team led by Prof. Yang Xueming and Prof. Ma Zhibo from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS), in collaboration with Prof. Pan Minghu from the Huazhong University of Science and Technology, discovered the C-H bond breaking reaction catalyzed by low-temperature photocatalysis on the surface of titanium oxide, and explained the reaction mechanism at the single molecule level.

The results were published in the *Journal of Physical Chemistry Letters* on Nov. 10.

The scientists used the rutile 110 surface of titanium oxide as the model system and the C-H bond molecule ethylbenzene as the model molecule.

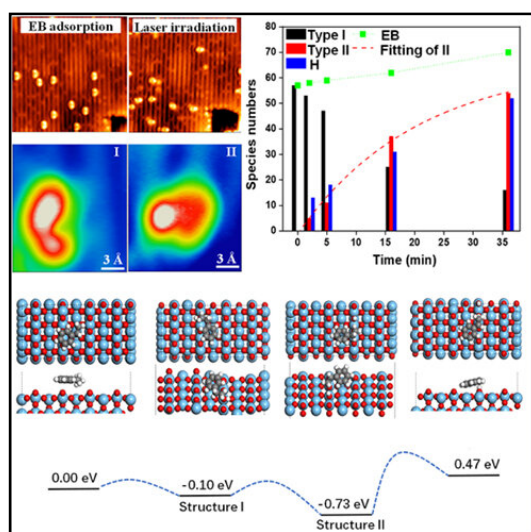
They found that ethylbenzene could be induced to remove hydrogen at low temperature (77K) only by photoinduced reaction. They also experimentally observed the images of the reaction steps by in-situ tracking single molecules.

Prof. Pan's team provided support for the theoretical interpretation of the image and confirmed the reaction process.

More information: Haiping Lin et al. In Situ Observation of Stepwise C–H Bond Scission: Deciphering the Catalytic Selectivity of Ethylbenzene-to-Styrene Conversion on TiO₂, *The Journal of Physical Chemistry Letters* (2020). DOI: [10.1021/acs.jpcclett.0c02729](https://doi.org/10.1021/acs.jpcclett.0c02729)

Journal information: [Journal of Physical Chemistry Letters](https://phys.org/news/2020-12-c-h-bond-reactions-temperature-photo-induced.html)

<https://phys.org/news/2020-12-c-h-bond-reactions-temperature-photo-induced.html>



High-resolution STM visualizing the intermediate states of the reaction and the reaction pathway of EB dehydrogenation on TiO₂. Credit: WANG Haochen

Researchers achieve sustained, high-fidelity quantum teleportation

A viable quantum internet—a network in which information stored in qubits is shared over long distances through entanglement—would transform the fields of data storage, precision sensing and computing, ushering in a new era of communication.

This month, scientists at Fermi National Accelerator Laboratory—a U.S. Department of Energy national laboratory affiliated with the University of Chicago—along with partners at five institutions took a significant step in the direction of realizing a quantum internet.

In a paper published in PRX Quantum, the team presents for the first time a demonstration of a sustained, long-distance teleportation of qubits made of photons (particles of light) with fidelity greater than 90%.

The qubits were teleported over a fiber-optic network 27 miles (44 kilometers) long using state-of-the-art single-photon detectors, as well as off-the-shelf equipment.

"We're thrilled by these results," said Fermilab scientist Panagiotis Spentzouris, head of the Fermilab quantum science program and one of the paper's co-authors. "This is a key achievement on the way to building a technology that will redefine how we conduct global communication."

The achievement comes just a few months after the U.S. Department of Energy unveiled its blueprint for a national quantum internet at a press conference at the University of Chicago.

Linking particles

Quantum teleportation is a "disembodied" transfer of quantum states from one location to another. The quantum teleportation of a qubit is achieved using quantum entanglement, in which two or more particles are inextricably linked to each other. If an entangled pair of particles is shared between two separate locations, no matter the distance between them, the encoded information is teleported.

The joint team—researchers at Fermilab, AT&T, Caltech, Harvard University, NASA Jet Propulsion Laboratory and University of Calgary—successfully teleported qubits on two systems: the Caltech Quantum Network and the Fermilab Quantum Network. The systems were designed, built, commissioned and deployed by Caltech's public-private research program on Intelligent Quantum Networks and Technologies, or IN-Q-NET.

"We are very proud to have achieved this milestone on sustainable, high-performing and scalable quantum teleportation systems," said Maria Spiropulu, the Shang-Yi Ch'en professor of physics at Caltech and director of the IN-Q-NET research program. "The results will be further improved with system upgrades we are expecting to complete by the second quarter of 2021."

Both the Caltech and Fermilab networks, which feature near-autonomous data processing, are compatible both with existing telecommunication infrastructure and with emerging quantum processing and storage devices. Researchers are using them to improve the fidelity and rate of entanglement distribution, with an emphasis on complex quantum communication protocols and fundamental science.

"With this demonstration we're beginning to lay the foundation for the construction of a Chicago-area metropolitan quantum network," Spentzouris said.

The Chicagoland network, called the Illinois Express Quantum Network, is being designed by Fermilab in collaboration with Argonne National Laboratory, Caltech, Northwestern University and industry partners.

"The feat is a testament to success of collaboration across disciplines and institutions, which drives so much of what we accomplish in science," said Fermilab Deputy Director of Research Joe

Lykken. "I commend the IN-Q-NET team and our partners in academia and industry on this first-of-its-kind achievement in quantum teleportation.

More information: Raju Valivarthi et al. Teleportation Systems Toward a Quantum Internet, *PRX Quantum* (2020). DOI: [10.1103/PRXQuantum.1.020317](https://doi.org/10.1103/PRXQuantum.1.020317)
<https://phys.org/news/2020-12-sustained-high-fidelity-quantum-teleportation.html>

COVID-19 Research News

BW BUSINESSWORLD

Wed, 30 Dec 2020

Sustained Cellular Immune Dysregulation In Individuals Recovering From COVID-19: Study

Sustained cellular immune dysregulation in individuals recovering from COVID-19: Study

Birmingham [UK], December 30 (ANI): Observational clinical research of COVID-19 patients can help clinicians better understand how the previously unknown SARS-CoV-2 virus acts, and findings from recent research can better inform treatment and vaccine design. The University of Alabama at Birmingham researchers, led by first-author Jacob "Jake" Files and co-senior authors Nathan Erdmann, M.D., PhD, and Paul Goepfert, M.D., have now reported their observational study, "Sustained cellular immune dysregulation in individuals recovering from SARS-CoV-2 infection," published in the *Journal of Clinical Investigation*.

COVID-19, which has killed 1.7 million people worldwide, does not follow a uniform path. Many infected patients remain asymptomatic or have mild symptoms. Others, especially those with comorbidities, can develop the severe clinical disease with atypical pneumonia and multiple system organ failures.

Since the first cases were reported in December 2019, the SARS-CoV-2 virus that causes COVID-19 has surged into a pandemic, with cases and deaths still mounting. Ongoing observational clinical research has become a priority to better understand how this previously unknown virus acts, and findings from this research can better inform treatment and vaccine design.

In a commentary on the UAB study, published in the same issue, Phillip Mudd, M.D., Ph.D., and Kenneth Remy, M.D., both of Washington University, wrote, "The importance of these studies to provide context for the interpretation of immune responses generated by participants in COVID-19 vaccine trials, including how those responses change over time, cannot be over-emphasized. This information will be key in potential modifications to existing COVID-19 vaccines and treatments."

The UAB researchers obtained blood samples and clinical data from 46 hospitalized COVID-19 patients and 39 non-hospitalized individuals who had recovered from confirmed COVID-19 infection. Both groups were compared to healthy, COVID-19-negative controls. Importantly, most individuals in the hospitalized group had active SAR-CoV-2 viruses in their blood and were in the hospital at the time of sample collection. All individuals in the non-hospitalized group were convalescent at the time of sample collection.

From the blood samples, researchers were able to separate specific immune cell subsets and analyze cell surface markers. From this complex information, immunologists can analyze how each individual's immune system is responding during infection and during convalescence. Some of these results can reveal whether immune cells have become activated and exhausted by the

infection. Exhausted immune cells may increase susceptibility to a secondary infection or hamper development of protective immunity to COVID-19.

In addition, the researchers were able to analyze changes over time, in two ways. The first was observing changes in surface markers over time, defined as days since the onset of symptoms for non-hospitalized samples. The second was directly comparing the frequencies of these markers between the first and second clinic visits for non-hospitalized patients who had blood samples collected at two sequential timepoints.

The most surprising finding involved non-hospitalized patients. While the UAB researchers saw upregulated activation markers in hospitalized patients, they also found several activation and exhaustion markers were expressed at higher frequencies in non-hospitalized convalescent samples.

Looking at these markers over time, it was apparent that immune dysregulation in the non-hospitalized individuals did not quickly resolve. Furthermore, the dysregulation of T cell activation and exhaustion markers in the non-hospitalized cohort was more pronounced in the elderly. "To our knowledge," the researchers reported, "this is the first description of sustained immune dysregulation due to COVID-19 in a large group of non-hospitalized convalescent patients." For details of the comprehensive look at immune cells subsets during and after COVID-19 infection in hospitalized and non-hospitalized people, see the study, which includes an in-depth characterization of the activation and exhaustion phenotype of CD4+ T cells, CD8+ T cells and B cells.

The B and T cells from both patient cohorts had phenotypes consistent with activation and cellular exhaustion throughout the first two months of infection. And in the non-hospitalized individuals, the activation markers and cellular exhaustion increased over time. "These findings," Mudd and Remy said in their commentary, "illustrate the persistent nature of the adaptive immune system changes that have been noted in COVID-19 and suggest longer-term effects that may shape the maintenance of immunity to SARS-CoV-2."

A question now being explored, the UAB researchers say, is whether these observed immunologic changes are associated with symptoms experienced well beyond the acute infection, often described as "Long COVID."

Co-authors with Files, Erdmann and Goepfert in the Journal of Clinical Investigation report are Sushma Boppana, Mildred D. Perez, Sanghita Sarkar, Kelsey E. Lowman, Kai Qin, Sarah Sterrett, Eric Carlin, Anju Bansal, Steffanie Sabbaj, Olaf Kutsch and James Kobie, Division of Infectious Diseases, UAB Department of Medicine; and Dustin M. Long, Department of Biostatistics, UAB School of Public Health. (ANI)

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<http://www.businessworld.in/article/Sustained-cellular-immune-dysregulation-in-individuals-recovering-from-COVID-19-Study/30-12-2020-359599/>

