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Mon, 13 Sept 2021

India to conduct first user trial of Agni-V missile

While single-warhead missiles are generally launched against one target, the MIRVed missiles can dispense warheads against multiple targets

By Hemant Kumar Rout

Bhubaneswar: India is set to conduct the first user trial of nuke capable intercontinental-range ballistic missile (ICBM) Agni-V signalling its early induction in the armed forces. Elaborate preparation has started at a defence facility off Odisha coast for the mission by the Strategic Forces Command of Indian Army. As per the schedule learnt by TNIE, the 5,000-km range missile is likely to be flight-tested on September 23.



File photo of Agni-V missile

Initially planned to be inducted in 2020 after the hat-trick pre-induction trials in 2018, the process was reportedly delayed due to Covid-19 pandemic that affected some important tests of the missile with multiple independently targetable reentry vehicles (MIRV). The mission has been planned close on the heels of the successful trial of Agni Prime missile, the first of the new class of Agni series of missiles, developed by DRDO. The three-stage solid-fuelled weapon with advanced guidance and new generation propulsion was fired with multiple independently targetable reentry warheads on June 28.

Defence sources said the next trial of Agni-V missile assumes significance as it may be equipped with the MIRV capable of carrying multiple warheads. Though the MIRV capability of the missile was secretly tested during a multi-satellite launch, no live launch has been conducted so far. “For the first time, the indigenous MIRV technology was tested successfully in Agni P missile with the weapon delivering two manoeuvrable warheads at two separate locations. The MIRV capability of Agni-V will give India the much needed deterrence,” said the sources.

While single-warhead missiles are generally launched against one target, the MIRVed missiles can dispense warheads against multiple targets. The technology will minimise the requirement of a number of missiles providing an edge in battle preparedness. A senior defence official said the induction process of the most potent game changer Agni-V has begun and the successful user trial would pave the way for its serial production. The canisterised missile is equipped with a ring laser gyroscope based inertial navigation system and micro inertial navigation system.

Developed by DRDO, the missile is capable of hitting targets in all Asian countries and parts of Africa and Europe. With a wiring of around seven-km, the 17-metre long, 2-metre wide, three-stage, solid-fuelled missile can carry a payload of 1.5 tonne and weighs around 50 tonne. India is the eighth country to have intercontinental ballistic missiles after the US, UK, Russia, China, France, Israel and North Korea.

<https://www.newindianexpress.com/states/odisha/2021/sep/13/india-to-conduct-first-user-trial-of-agni-v-missile-2357942.html>

DRDO to partner with AU in setting up of food testing lab

DFRL Associate Director holds talk with Vice-Chancellor

Visakhapatnam: The Defence Research and Development Organisation (DRDO) will partner with Andhra University for the setting up of the Food Testing Lab (FTL) in the university.

Associate Director of the Mysore-based Defence Food Research Lab (DFRL) R. Kumar visited the AU and held talks with Vice-Chancellor P.V.G.D. Prasad Reddy in this regard on Monday. The V-C gave details of the proposed lab to Dr. Kumar. He said that organising food testing was being taken up by AU for the first time. The lab, to be set up with Rashtriya Uchchatar Shiksha Abhiyan (RUSA) funds, would conduct analysis and research apart from testing of food. He also explained about the progress of the pharma testing and genetic testing labs, being set up by the university. He expressed optimism that the partnership with the DRDO would help in conducting research, which could meet the needs of the nation.

The DFRL Associate Director spoke on the technical know-how and basic requirements for the testing lab. A preliminary decision was taken to conduct joint research and to make fruits of food technology available to the common people and an MoU would be reached in the near future in this regard.

Rector K. Samata, Registrar V. Krishna Mohan, Science College Principal K. Srinivasa Rao, Research and Development Dean K. Basavaiah and Academic Dean N. Kishore Babu were present.

<https://www.thehindu.com/news/national/andhra-pradesh/drdo-to-partner-with-au-in-setting-up-of-food-testing-lab/article36443771.ece>

Groundnut processing centre to come up at OTRI

MP and MLA to inspect the site today

Anantapur: The Defence Food Research Laboratory (DFRL)-sponsored groundnut processing centre that will double up as an incubation centre for the prospective entrepreneurs from the district will be set up at the Oil Technological Research Institute (OTRI), close to the District Collectorate.

JNTU Anantapur Vice-Chancellor G. Ranga Janardhana along with Anantapur MP Talari Rangaiah and Urban MLA Anantha Venkatarami Reddy will inspect the site on Tuesday.

At a meeting on the JNTU premises on Monday, the trio discussed setting up of the groundnut processing unit with a 200 kg per day capacity for which the technology and machinery would be given by the DFRL.

Meanwhile, the JNTUA submitted an ₹8-crore proposal to the Union Ministry of Road Transport and Highways to establish Advanced Highway & Transportation Research Centre at the JNTUA. University Registrar C. Sashidhar, Director FDC P.R Bhanu Murthy participated in the virtual meeting on Monday, in which the Ministry sought some changes in the proposal and wanted it to be submitted soon. The Registrar said the field of Highway Engineering was developing at a rapid pace with the availability of new technologies and equipment, hence setting up a quality assessment centre with a well-equipped lab was essential.

<https://www.thehindu.com/news/national/andhra-pradesh/groundnut-processing-centre-to-come-up-at-otri/article36443097.ece>

India fast-tracks its stealth fighter program; incorporates key Russian tech missing in western jets

By Parth Satam

The designs, specifications, and configuration for the Light Combat Aircraft (LCA)-Mk2 and the Advanced Medium Combat Aircraft (AMCA) have been finalized, and the roll-out for the first models for the test flights will begin in 2023 and 2024.

Also, the Indian Air Force (IAF) will procure another 350 aircraft over the next decade. Girish Deodhare, Programme Director (Combat Aircraft) and Director, Aeronautical Development Agency (ADA), and IAF chief Air Chief Marshal RK Singh Bhadauria made the announcements at an event by the Center for Air Power Studies (CAPS) and Society of Indian Defence Manufacturers (SIDM) in Delhi.



Indian Defence Minister Rajnath Singh inspecting the AMCA model (file photo)

Deodhare said while steel cutting is expected to begin soon for the Tejas Mk-2, the fifth-generation stealth-capable AMCA has been assigned a preliminary design while its final configuration has been frozen.

“The detailed design is complete and we are in the critical design review stage and metal cutting should start very shortly. Roll-out of the LCA Mk-2 is planned next year and the first flight in early 2023. We are well on track to achieve these goals,” Deodhare said.

Tejas Mk-2

The LCA Tejas Mk-2 is said to be a “whole other plane”, which is likely to fall in the 4++ generation category. It would be a heavier plane, 1,350 mm longer than the Mk-1A, featuring front swept-back canards; longer range, combat radius, and endurance.

It would carry a payload of 6,500 kg compared to the 3,500 kg of LCA Mk-1A; and a first-of-its-kind indigenously developed an on-board oxygen generation system, Dr. Deodhare said.

The LCA Mk-2 would also be capable of firing foreign origin missiles like the air-to-surface Scalp, Crystal Maze, and Spice-2000 bombs, along with the Indian-made Astra Mk-1 Beyond Visual Range (BVR) missile.

The Astra Mk-1 has already been tested from the LCA, and the Mk-2 would obviously be able to fire the enhanced Astra Mk-2 as well, which will have a longer range, better guidance system, seeker anti-jamming mechanisms.

In February, the Defence Ministry inked a Rs 48,000-crore deal with the state-run Hindustan Aeronautics Ltd. (HAL) to supply 83 LCA Mk-1A jets to the IAF.

This was followed by an August \$716 million between HAL and the US-based General Electric (GE) Aviation for 99 F404 aircraft engines and support services to power the Mk-1A.

The Mk2 will be powered by a more powerful GE-414 engine. Order for 83 Mk-1A is expected to be completed by 2028-29.

The IAF has one squadron of the LCA in Initial Operational Clearance (IOC) configuration while the second squadron in Final Operational Clearance (FOC) configuration is underway. HAL’s new assembly line promises to increase production from eight aircraft a year to 16.

The AMCA

The AMCA, on the other hand, would be a 25-tonne twin-engine stealth aircraft with an internal weapons bay, a diverterless supersonic intake, and can carry 1,500 kg of internal payload and 5,500-kg external payload with 6,500 kg of internal fuel.

Deodhare said the configuration had been frozen, preliminary service quality requirements finalized and preliminary design review completed.

“We are moving to critical design review by the middle of next year with the roll-out planned in 2024 and first flight a year later in 2025,” he added.

The AMCA will have stealth and non-stealth configuration and will be developed in Mk-1 and Mk-2 variants. While the Mk-1 will have the GE414 engine, the AMCA Mk-2 will have an advanced super-cruise capable engine to be developed later along with a foreign partner, according to Deodhare.

The AMCA Mk-2 will fly by 2035. The manufacturing and production of the aircraft will be through a special purpose vehicle that would have private industry participation.

Deodhare also said the Twin-Engine Deck Based Fighter (TEDBF) to fly off Indian Navy’s carriers is also making progress, with all the various programs having a commonality of systems.

IAF chief Bhadauria, a former test pilot himself, said the 123 Tejas fighters on order, including 83 improved Mk-1A fighters, will make the “core of the aerospace industry in terms of budget and ecosystem.”

The Tejas LCA, he added, has effected a “level of automation achieved for the aerospace industry to be able to act fast.”

Air Vice-Marshal N Tiwari also countered criticism about the delay in the LCA Tejas, saying the first 4-5 years in the Tejas fighter’s design and development cycle went into setting up testing and production facilities for manufacturing the aircraft.

“Today, if we are ready to move forward in developing a next-generation fighter, it is because the Tejas program gave us a core critical mass,” said Tiwari.

Tiwari, who has flown more than 200 sorties as a Tejas test pilot, said the LCA is anything but obsolete. “Its unstable design, quadruplex flight control system, computerized utilities management system, and an airframe made of composite materials make it contemporary even today,” he said.

Aerodynamically unstable designs mean the airflow around the plane is not smooth, which also ironically makes it more maneuverable. This is, however, achieved by a highly efficient flight control system, computer, and a digital fly-by-wire mechanism.

“Tejas squadron pilots are uniformly happy with the plane. (It) incorporates the best of the Russian and the western design philosophies,” Tiwari added.

He pointed to the Russian autopilot systems, which allows Russian pilots to return their jets to level flight by merely pressing a button – a mechanism facility that western fighters, such as the Mirage 2000 lack. This feature has been incorporated into the Tejas fighter.

<https://eurasianimes.com/india-fast-tracks-its-stealth-fighter-program-incorporates-key-russian-tech-missing-in-western-jets/>

Webinar on career opportunities in defence technology held at Amity

New Delhi: Amity University organized a webinar on Career Awareness Programme, “M.Tech. in Defence Technology” in collaboration with Ladakh Science Foundation.

Mr. Tsering Tashi, Founder Director, Ladakh Science Foundation & Deputy Project Director, Navigation Spacecrafts, ISRO, Bengaluru said MTEch in Defense technology program will provide employment as well as research opportunities in the area of defense. He said students of Ladakh should be encouraged to participate because at present the participation of private sectors in the space sector is increasing, initially ISRO was a pioneer in the field of space, but now the new space policy has opened doors for the private sectors also. Now, even private sectors can also launch new satellites. MTEch in Defense technology course will be helpful for government and private sectors in space industries. Dr. Tashi advised the students to do Mtech in Defense technical program because this course is the need of the hour. He expressed pleasure in sharing, that many Ladakhi students have shown interest in this innovative programe and thanked Amity for bringing this program to Ladakh.

Speaking on the topic, Role of Youth in Defense Research and Development, Mr Shabir Ahmad, Scientist ‘F’ (Joint Director, IRDE, Dehardun) at Defence Research & Development Organization (DRDO) – Instruments Research & Development Establishment (IRDE) said, “today I am representing the scientific community of Ladakh here, the people of Ladakh play an important role in the field of defence. The Ladakh Scout Regiment is a part of the proud Indian Army who have shown their courage in many battles. We cooperate with the Indian Army by working in DRDO or other defense related institutions. Through this program, the knowledge of MTEch Defense Technology started by Amity University and technical inputs from DRDO will provide opportunities to the students of our Ladakh so that they can increase their educational qualifications and have higher possibilities of opportunities in the field of research and development in the area of defense. This is a great opportunity for the students who want to make a career in the field of Defense Technology. These students will get the opportunity to work in DRDO and other defense laboratories during the course of teaching, from which they will get practical information”. He advised the students of Ladakh that they should take advantage of the opportunity provided by Amity.

Dr. Ashok K Chauhan, Founder President, Amity Education Group said at present we all are in the age of knowledge, which is necessary to solve the problems. Science, research and innovation are the part of a strong country. This course will provide opportunities for research development in the areas of defense including missiles, defense equipment, aeronautics, combat vehicles etc. Amity is establishing India’s first planetary Science, Education and Experience Station in the Ladakh region to run several programs for Astrobiology, Space Biology research and enthusiasts to undertake mentorship and hands on training from the world’s best space scientists for Mars Exploration and Climate change studies. Apart from these programs, the station will also encouraging students to pursue STEM education and amplify awareness about space in the country.

Dr. Chauhan announced full scholarship of 100% to 3 students from Ladakh who wish to pursue program in MTEch Defense Technology. He further announced the conferring of Honorary professorship to Mr Shabir Ahmad and Mr. Tsering Tashi.

Dr. W Selwamurthy- President, Amity Science Technology and Innovation Foundation and Dr. Basant Singh Sikarwar, Professor and Head, Department of Mechanical, Engineering, Amity

School of Engineering and Technology provided detailed information about the course of M. Tech in Defense Technology program, areas of expertise and the career prospectus after success completion of the program.

<https://indiaeducationdiary.in/webinar-on-career-opportunities-in-defence-technology-held-at-amity/>

THE ECONOMIC TIMES

Tue, 14 Sept 2021

Market Movers: ACE sees stellar action; Bharti Airtel breathes sigh of relief

By Chiranjivi Chakraborty

Synopsis

In the run-up to Ganesh Chaturthi, investors of Bharti Airtel were a nervous lot given the tangible fears of another round of jostling for customers as Reliance Jio geared up to launch its JioPhone Next.

Mumbai: Action Construction Equipment (NSE 17.36%) was in action as investors scrambled to buy the company's stock, pushing the volumes on the counter to their highest level in nearly four years.

The move came post media reports that the company has won a large defence sector-related order from the Defence Research and Development Organisation and Tata Advanced Systems. The report further went on to suggest that the order is for providing missile launch vehicles for the DRDO and is in talks for more such orders from DRDO and Tata Advanced Systems.

The order win, if confirmed by the company, will be a major boost for its recently-announced ambitions of entering into defense sector equipment. The company had recently met marquee investors such as SBI Mutual Fund, White Oak Capital, Malabar, HDFC Mutual Fund and others highlighting the turnaround it is seeing post the lockdowns.

Investors seem enthused by the prospects of a new dawn as the stock rallied 16 per cent today.

Bharti Airtel exhales

In the run-up to Ganesh Chaturthi, investors of Bharti Airtel were a nervous lot given the tangible fears of another round of jostling for customers as Reliance Jio geared up to launch its JioPhone Next.

Fortunately for Airtel, the global chip shortage has thrown a spanner into Jio's plan to launch India's most affordable smartphone as the company has had to postpone the launch till near Diwali. Analysts, however, have dismissed investors' concern that the new JioPhone will dampen Bharti Airtel's new found mojo. For now, it seems the Airtel party can last a little longer as the stock ended in the green as RIL's slumped over 2 per cent.

Major breakthrough

While the attention of the world has been justifiably fixed on Covid-19, there is another pandemic that has been raging in the background, that is of 'Long COVID'.

Among those who have been infected by the virus, many have been suffering from the after-effects of the disease even after 12 months that has puzzled doctors. Advanced Enzyme Tech earlier today provided a ray of hope in dealing with this crisis after it said it had a clinical breakthrough of systemic enzymes and probiotics to resolve long Covid fatigue symptoms.

The products are getting a greater thrust from the company on the online retail channels after success in the US during the pandemic months. One hopes that the clinical breakthrough ends up being the lift for Covid patients as it was for the company's stock that rose 12 per cent.

<https://economictimes.indiatimes.com/markets/stocks/news/market-movers-ace-sees-stellar-action-bharti-airtel-breathes-sigh-of-relief/articleshow/86167819.cms>



Press Information Bureau
Government of India

Ministry of Defence

Mon, 13 Sept 2021 3:51PM

India–Africa Defence Dialogue to be held alongside every DefExpo

Key Highlights:

- *Dialogue to help build on existing partnerships between African countries & India*
- *To explore new areas of convergence for mutual engagements*
- *Manohar Parrikar Institute for Defence Studies and Analyses to be knowledge partner*
- *Raksha Mantri to host Defence Ministers of African nations in next India–Africa Defence Dialogue on sidelines of DefExpo 2022*

India and Africa share a close and historical relationship. The foundation of India–Africa defence relations are based on the two guiding principles namely ‘SAGAR’, Security and Growth for All in the Region’ and ‘Vasudhaiva Kutumbakam’, The World is One Family.

The first-ever India Africa Defence Ministers Conclave (IADMC) was held in Lucknow, Uttar Pradesh in conjunction with DefExpo on February 06, 2020, co-organised by Ministry of Defence and Ministry of External Affairs. This was the first in the series of Pan Africa events at the Ministerial level in the run-up to India Africa Forum Summit IV. A Joint Declaration, ‘Lucknow Declaration’ was adopted after conclusion of IADMC 2020 as an outcome document of the Conclave.

In furtherance of the declaration and in consultation with stakeholders, India proposes to institutionalise the India Africa Defence Dialogue during successive DefExpos to be held once every two years. Institutionalisation of the India Africa Defence Dialogue will help building on the existing partnerships between African countries & India and to explore new areas of convergence for mutual engagements including areas like capacity building, training, cyber security, maritime security and counter terrorism.

It has been decided that Manohar Parrikar Institute for Defence Studies and Analyses shall be the knowledge partner of India Africa Defence Dialogue and will assist in providing necessary support for enhanced defence cooperation between India and Africa.

It has also been decided that Raksha Mantri Shri Rajnath Singh will host the Defence Ministers of African Nations in the next India – Africa Defence Dialogue on the sidelines of the DefExpo that is scheduled to be held at Gandhinagar, Gujarat in March 2022. The broad theme of this India Africa Defence Dialogue will be ‘India – Africa: Adopting Strategy for Synergizing and Strengthening Defence and Security Cooperation’.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754522>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Mon, 13 Sept 2021 3:51PM

भारत-अफ्रीका रक्षा वार्ता प्रत्येक रक्षा प्रदर्शनी के साथ आयोजित की जाएगी

मुख्य विशेषताएं:

- वार्ता से अफ्रीकी देशों और भारत के बीच मौजूदा साझेदारियों को कायम रखने में मदद मिलेगी
- आपसी जुड़ाव के लिए नए क्षेत्रों का पता लगाना
- मनोहर परिकर रक्षा अध्ययन और विश्लेषण संस्थान नॉलेज पार्टनर बनेगा
- रक्षा मंत्री रक्षा प्रदर्शनी 2022 के साथ-साथ आयोजित अगली भारत-अफ्रीका रक्षा वार्ता में अफ्रीकी देशों के रक्षा मंत्रियों की मेजबानी करेंगे

भारत और अफ्रीका के बीच घनिष्ठ और ऐतिहासिक संबंध हैं। भारत-अफ्रीका रक्षा संबंधों की नींव 'सागर' - क्षेत्र में सभी के लिए सुरक्षा और विकास' तथा 'वसुधैव कुटुम्बकम्' - द वर्ल्ड इज वन फैमिली जैसे दो मार्गदर्शक सिद्धांतों पर आधारित है।

रक्षा मंत्रालय और विदेश मंत्रालय द्वारा 06 फरवरी, 2020 को रक्षा प्रदर्शनी के साथ-साथ उत्तर प्रदेश के लखनऊ में पहली बार भारत-अफ्रीका रक्षा मंत्री कॉन्क्लेव (आईएडीएमसी) आयोजित किया गया था। भारत-अफ्रीका फोरम शिखर सम्मेलन IV के क्रम में मंत्रिस्तरीय पैन अफ्रीका कार्यक्रमों की श्रृंखला में यह पहला था। कॉन्क्लेव के परिणाम दस्तावेज़ के रूप में आईएडीएमसी 2020 के समापन के बाद एक संयुक्त घोषणा, 'लखनऊ घोषणा' को लागू की गई थी।

घोषणा को आगे बढ़ाने और हितधारकों के परामर्श से, भारत हर दो साल में एक बार आयोजित होने वाले क्रमिक रक्षा प्रदर्शनी के दौरान भारत-अफ्रीका रक्षा वार्ता को संस्थागत बनाने का प्रस्ताव करता है। भारत-अफ्रीका रक्षा वार्ता के संस्थापन से अफ्रीकी देशों और भारत के बीच मौजूदा साझेदारी के निर्माण में मदद मिलेगी और क्षमता निर्माण, प्रशिक्षण, साइबर सुरक्षा, समुद्री सुरक्षा और आतंकवाद का मुकाबला करने जैसे क्षेत्रों सहित आपसी जुड़ाव के लिए नए क्षेत्रों का पता लगाने में मदद मिलेगी।

यह निर्णय लिया गया है कि मनोहर परिकर रक्षा अध्ययन और विश्लेषण संस्थान भारत अफ्रीका रक्षा वार्ता का नॉलेज पार्टनर होगा और भारत तथा अफ्रीका के बीच रक्षा सहयोग बढ़ाने के लिए आवश्यक सहायता प्रदान करने में मदद करेगा।

यह भी निर्णय लिया गया है कि रक्षा मंत्री श्री राजनाथ सिंह अगले भारत-अफ्रीका रक्षा वार्ता में अफ्रीकी राष्ट्रों के रक्षा मंत्रियों की मेजबानी करेंगे। 'भारत-अफ्रीका: रक्षा और सुरक्षा सहयोग को मजबूत करने और तालमेल के लिए रणनीति अपनाना' इस बार भारत-अफ्रीका रक्षा वार्ता का व्यापक विषय होगा।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754563>

Tue, 14 Sept 2021

Indian Army Chief Gen MM Naravane meets with business heads of Mahindra Defence & others

Chief of Army Staff General MM Naravane on Monday interacted with top officials of Larsen & Turbo, Adani Group, Mahindra Defence, Adani Group and Tata Group

By Kamal Joshi

Chief of Army Staff (CoAS) General MM Naravane on Monday, September 13, interacted with top officials of Adani Group, Larsen & Turbo, Mahindra Defence, Adani Group and Tata Group. During the meet, the Army chief praised the business entities for their contribution to self-reliant India and the Indian Army.

In a tweet, ADG PI - Indian Army informed: "General MM Naravane #COAS interacted with business heads of Mahindra Defence, Adani Group, Larsen & Toubro and Tata Group. #COAS complimented the business houses for stellar contributions towards Aatmanirbhar Bharat & capability enhancement of #IndianArmy."

Private companies have got a boost under Prime Minister Narendra Modi's Aatmanirbhar Bharat initiative. In January 2021, Defence Minister Rajnath Singh had approved a ban on the import of 108 military systems and weapons such as hi-tech corvettes, tank engines, airborne early warning systems and radars. These military essentials will be made in India, he had informed.

Last month, Mahindra Defence Systems bagged a Rs 1,349.95 Crore contract to manufacture an integrated Anti-Submarine Warfare Defence Suite (IADS) for the next-generation warships of the Indian Navy. The Mahindra & Mahindra's company would be supplying 14 IADS for the Indian Navy.

"It is the first major contract with the private sector meant for underwater detection and protection from threats. This contract once again epitomises the success of the Atmanirbhar Bharat initiative," Mahindra Defence Systems' Chairman SP Shukla had said.

Reportedly, Adani's Alpha Design is given a contract to manufacture Skystriker drones in collaboration with Israel's Elbit System. Last year, Larsen & Turbo was awarded a contract to set up an advanced IT-enabled system to operate the Armed Forces Network under the Network of Spectrum (NFS).

<https://www.republicworld.com/business-news/india-business/indian-army-chief-gen-mm-naravane-meets-with-business-heads-of-mahindra-defence-and-others.html>



Image: @ADGPI-Twitter

Tue, 14 Sept 2021

India Australia 2+2 dialogue: A boost to the comprehensive strategic partnership

Australian Minister for Foreign Affairs and Women Senator the Hon Marise Payne and Defence Minister the Hon Peter Dutton MP, travelled to New Delhi on 10-11 September for in person meetings with their counterparts from India, External Affairs Minister S. Jaishankar and Defence Minister Rajnath Singh

By Anil Wadhaa

The Comprehensive Strategic Partnership between India and Australia- two democratic countries, pluralistic societies and market economies who see eye to eye on diverse issues across the board in recent times – has just received another shot in the arm through their first ever 2+2 ministerial dialogue. Australian Minister for Foreign Affairs and Women Senator the Hon Marise Payne and Defence Minister the Hon Peter Dutton MP, travelled to New Delhi on 10-11 September for in person meetings with their counterparts from India, External Affairs Minister S. Jaishankar and Defence Minister Rajnath Singh. At the heart of this interaction, which arose out of a decision taken at the virtual Summit between the two Prime Ministers in June 2020, was the objective of advancing their shared vision of an open, free, prosperous and rules-based Indo – Pacific region. They have decided to meet at least once every two years in this format to keep up the momentum. Over the past few years, there has been unprecedented engagement, development of new mechanisms and synergies as well as burgeoning people to people contacts between the two countries.



Agreement was reached to deepen cooperation in vaccine manufacturing, including under the Quad framework, and to deliver high quality vaccines to their Indo – Pacific partners. (Photo source: PTI)

Agreement was reached to deepen cooperation in vaccine manufacturing, including under the Quad framework, and to deliver high quality vaccines to their Indo – Pacific partners. Researchers of both countries are working together to advance Covid 19 screening and study the future health effects of the virus through projects funded by the Australia – India Strategic Research Fund. Building upon the Resilient Supply Chains Initiative launched by their Trade Ministers, they agreed to work together through multilateral, regional and plurilateral mechanisms to diversify supply chains between trusted and reliable trading partners for critical health, technology and other goods and services.

The Ministers agreed to continue to bolster their maritime cooperation, working together to support the health and sustainability of oceans and water resources, and support India's Indo Pacific Oceans Initiative. Their reiteration of commitment to maintain a free, open, inclusive and rules-based Indo- Pacific region to support freedom of navigation, over flight and peaceful and unimpeded commerce by adherence of all nations to international law including UNCLOS, the peaceful resolution of disputes; and their emphasis on a Code of Conduct in the South China Sea which is fully consistent with International law, particularly UNCLOS, and does not prejudice the legitimate rights and interests of any nation in accordance with international law point to their concerns about aggressive Chinese activities in the South China Sea. Over the past few years, China's actions– including extensive island building at sites it occupies illegally in the Spratly islands and Scarborough shoal, denial of fishing rights and assertion of claims against neighbours

like Philippines and Vietnam in disputed seas, and naval incursions around the Japanese Senkaku islands in the East China Sea has heightened concerns in a number of countries around the world.

In this context, Asean would note the joint commitment of both countries to its centrality and to a strong, resilient and inclusive regional architecture that they will try to achieve through plurilateral and trilateral mechanisms. Also notable was the commitment of both countries to the Quad mechanism and its “positive” agenda aimed at practical cooperation in Covid 19 vaccines, maritime security, climate change, humanitarian assistance and disaster relief, connectivity and infrastructure, counter terrorism, and critical and emerging technologies. This is significant, coming as it does before the first in person Summit of the Quad leaders which is expected later this month in Washington.

While reaffirming support for the Indian candidacy for permanent membership of the UNSC, grants of Australian \$ 1 million to the International Solar Alliance, and Australian \$10 million to the Coalition for Disaster Resilient infrastructure – both India led initiatives were announced and joint research and investments pledged by Australia in low emissions technologies. Interestingly, after detailed discussion on a joint approach, India and Australia have called upon ‘those in positions of power and authority across Afghanistan’ to adhere to counter terrorism commitments and human rights, in accordance with UNSCR 2593 and the cessation of violence, restoration of democracy, release of political detainees and dialogue in Myanmar. Australia was briefed on the ongoing disengagement talks with China on the India China LAC. Both countries, especially India, are concerned that the Pakistani influenced Taliban government should not start supporting the Pakistani agenda of outsourced terror activities from its soil and harm the security interests of India and other regional countries.

The Defence relationship promises a lot, the synergies between the armed forces of the two countries have been enhanced considerably in recent years, and Australia’s continued presence in Malabar exercises, ramping up the air force cooperation, as well as Indian participation in future in Talisman Sabre exercises will raise interoperability while both sides explore longer term reciprocal arrangements in logistics support. The last version of the Malabar exercises was held off the coast of Guam last month, while the next phase will be held in the Bay of Bengal from October 11-14. The maritime forces of the two countries are currently participating in the AUSINDEX exercises off the northern Coast of Australia. Both sides endeavor to increase cooperation in various defence technologies and the dialogue between the Defence Research & Development organization of India and the Defence Science and Technology Group of Australia as well as ISRO and Australian Space Agency continues, but cooperation in defence industries including unmanned vehicles, Artificial Intelligence and other niche technologies were specifically singled out. Defence Minister of India Rajnath Singh invited Australia to invest in India in defence manufacturing, and to take advantage of the recently announced liberalized policies related to the co-development and co-production of weapons systems.

Both sides emphasized cooperation in cyber security, innovation, digital economy, cyber and critical technologies and pledged to work together in secure telecommunications networks including 5G. Foreign Minister Marise Payne conveyed that India wants to work with India in setting standards and rules for secure and resilient technologies. Notably, there was agreement to reinforce maritime domain awareness through information sharing and practical cooperation. A liaison officer has been posted from Australia at the Information fusion center – Indian Ocean Region in Gurugram and Australia will further strengthen its defence related diplomatic presence at the Embassy in New Delhi. The two sides can be expected to do more to maximize resources to ensure free and open critical maritime corridors in the Indo – Pacific. There was commitment to keep the seas, space and airways free and open; to keep nations secure from terrorism and piracy, to ensure that global cyberspace is free from disruption, and to ensure access to and responsible use of global commons. They also pledged to strengthen cooperation in critical minerals where a working group has made progress, reports have been released and their scientific organizations are working together. They agreed to continue to work together on counter terrorism; countering of radicalization and on the proposed UN Comprehensive Convention on International Terrorism.

There was renewed support expressed for an early harvest announcement by December 2021 on an interim agreement to liberalize and deepen bilateral trade in goods and services, and pave the way for a bilateral Comprehensive Economic Cooperation Agreement, as well as an early resolution of the issue of taxation of offshore income of Indian firms under the India Australia Double Taxation Avoidance Agreement. An early conclusion of the Migration and Mobility Partnership Agreement was also flagged. India's national Education Policy 2020 has paved the way for boosting collaboration between the academic institutions of both countries further, but the burning topic of the day is the travel facilitation of Indian students enrolled in Australian Universities – Foreign Minister Marise Payne spent considerable time on the issue, assuring of best efforts in this regard. The two natural partners can look back with satisfaction on their productive discussions.

(The author is a former Secretary (East) in the Indian Ministry of External Affairs, and has served as the Indian Ambassador to Poland, Oman, Thailand and Italy. Currently, he is a Distinguished Fellow with the Vivekananda International Foundation in New Delhi. Views expressed are personal and do not reflect the official position or policy of Financial Express Online.)

<https://www.financialexpress.com/defence/india-australia-22-dialogue-a-boost-to-the-comprehensive-strategic-partnership/2329102/>

R. REPUBLICWORLD.COM

Tue, 14 Sept 2021

Vision Sagar | India hands over Dornier Aircraft to Mauritius as part of maritime security initiative

The deal was part of the Indian Navy's Security and Growth for All in the Region (SAGAR) programme set up for enhanced maritime security of the Indian Ocean

By Vishnu V V

The Indian High Commission in Mauritius on Monday informed the handover of a Dornier aircraft from India to Mauritius. India, as part of Vision SAGAR, has supplied the aircraft on lease. The deal was part of the Indian Navy's Security and Growth for All in the Region (SAGAR) programme announced for enhanced maritime security of the Indian Ocean Region (IOR).

India on Monday handed over Dornier aircraft to Mauritius to assist the island nation with its security. "Implementing Vision SAGAR, HC handed over a Dornier aircraft on lease from @indiannavy to Mauritius and exchanged the contract for the purchase of a new Dornier aircraft under Line of Credit (LOC). India-Mauritius for enhanced maritime security of our common IOR," tweeted the Indian High Commission in Mauritius.



Image: Twitter/ @HCI_PortLouis

Further adding to the deal, the High Commission also informed that the deal marked 47 years of maritime cooperation between India and Mauritius. "Another milestone in 47 years of maritime cooperation between India and Mauritius. Looking forward to many more years of India-Mauritius cooperation under Vision SAGAR," the HC added. The spokesperson for Indian Navy shared the series and wrote "bridges of friendship".

India's 'Mission SAGAR'

It is to mention that 'Mission SAGAR' was launched by the Indian government on 10 May, 2020, aiming to deliver COVID-19 related assistance to the countries in the Indian Ocean region. It is also being seen as a major milestone in engagement with the countries in the region to fight the

menace of COVID-19. INS Airavat is on a deployment to South East Asia for trans-shipment of relief materials.

According to the continuing programme, the Indian Navy has been carrying out numerous philanthropic missions to help nations in their battle against the lethal pandemic. The Navy's missions span the entire extent of the Indian Ocean, including South East Asia and East Africa. Under the programme, the Navy has carried out multiple missions apart from COVID relief initiatives. With the help of the programme, the Central government is trying to strengthen ties between countries and to improve maritime cooperation and engagement between various countries. Numerous joint missions and training sessions have been done as part of the Naval outreach initiative in the past year.

<https://www.republicworld.com/india-news/general-news/india-hands-over-dornier-aircraft-to-mauritius-as-part-of-maritime-security-initiative.html>



Tue, 14 Sept 2021

Indian Army display firepower, air stunts at Zapad 2021; China & Pakistan watch

The 200-personnel contingent of the Indian Army is participating at the multi-nation military exercise, being reviewed by Russian President Vladimir Putin, with nine other countries

By Avik Roy

New Delhi: The Indian Army contingent of personnel from the Naga Regiment and Mechanised Infantry and commandos of the Indian Air Force on Monday participated at the multi-nation strategic drills, Zapad 2021, at Nizhny in Russia.

The Indian Army posted on its official Twitter handle that the contingent carried out a joint rehearsal of the Special Heliborne Operation (SHBO) on Sunday for the final validation of the Zapad 2021 exercise, which will continue till September 16.

Russian President Vladimir Putin attended the main stage of the Zapad 2021 Russian-Belarusian joint strategic drills at the Mulino testing ground at Nizhny Novgorod earlier in the day, according to Russian news agency TASS.

During the main stage of the exercises, Russian army units, jointly with military contingents from military contingents of the armed forces of Armenia, Belarus, India, Kazakhstan, Kyrgyzstan, and Mongolia are taking part in practical actions as part of the coalition group of troops, to conduct flexible defense, to deliver targeted fire attack and crush the enemy.

Interestingly, while India showcased its military prowess at the war game, Pakistan and China were among the 'observer' nations along with Vietnam, Malaysia, Bangladesh, Myanmar, Uzbekistan and Sri Lanka.

The joint strategic exercise of the armed forces of the Russian Federation and the Republic of Belarus takes place every two years in accordance with the decision taken by the heads of the two states.

The Zapad 2021 exercise is the final stage of joint training of the armed forces of the Republic of Belarus and the Russian Federation in 2021.

A release by the ministry of defence of the Russian Federation said on Monday elaborated on the methodology of performing combat training tasks. It said that the methodology is based on the



The main stage of the joint strategic exercise Zapad-2021 is being held at the Mulino training ground in the Nizhny Novgorod region of Russia. (Twitter/Indian Army)

experience of recent armed conflicts, as well as new methods of action of troops and forces that have proven themselves during combat training events.

“The draw will use the method of a through attack, which is the most difficult type of training of troops (forces) and requires precise and coordinated actions from the opposing sides. For the first time, reconnaissance and fire support robots Uran-9 multifunctional robotic complexes, prototypes of BMP B-19 infantry fighting vehicles with the Epokha combat module, mixed mobile air defense groups to combat unmanned aerial vehicles will be used,” the Russian military said in the statement.

“In the fire defeat of a mock enemy, all types of aviation equipment in service with the Russian Aerospace Forces will be involved, attack UAVs, artillery, rocket and multiple launch rocket systems as part of reconnaissance, shock and fire complexes, high-precision ammunition, heavy flamethrower systems TOS-1, an engineering reconnaissance and fire complex of engineering systems for remote mining,” it added.

Zapad 2021 will focus primarily on operations against terrorists, the Indian Army said in a recent statement. “The Naga battalion group participating in the exercise will feature an all arms combined task force. The exercise aims to enhance military and strategic ties amongst the participating nations while they plan and execute this exercise,” it further said.

<https://www.hindustantimes.com/india-news/indian-army-display-firepower-air-stunts-at-zapad-2021-china-pakistan-watch-101631546972208.html>

ISRO के गगनयान मिशन को सपोर्ट करेगा ऑस्ट्रेलिया, कोकोस कीलिंग द्वीप से होगी ट्रैकिंग

By Ashutosh Tiwari

नई दिल्ली: भारतीय अंतरिक्ष एजेंसी इसरो अपने पहले मानवयुक्त अंतरिक्ष मिशन पर तेजी से काम कर रही है। इस प्रोजेक्ट का नाम 'गगनयान मिशन' रखा गया है। अब इसको लेकर एक अच्छी खबर सामने आई है। आस्ट्रेलियाई अंतरिक्ष एजेंसी के उप प्रमुख एंथनी मर्फेट ने सोमवार को दावा किया कि उनका देश गगनयान मिशन को पूरी तरह से सपोर्ट करेगा। इसके अलावा वो कोकोस कीलिंग द्वीप से पूरे मिशन को ट्रैक करेंगे।



मर्फेट ने भारतीय उद्योग परिसंघ (सीआईआई) द्वारा आयोजित अंतरराष्ट्रीय अंतरिक्ष सम्मेलन में सोमवार को हिस्सा लिया। इसी कार्यक्रम में लोगों को संबोधित करते हुए उन्होंने कहा कि भारत और ऑस्ट्रेलिया के बीच अंतरिक्ष सहयोग बढ़ रहा है। हाल ही में दोनों देशों की अंतरिक्ष एजेंसियों ने कुछ अहम MoU को अपडेट किया था। ऐसे में जब भारत गगनयान मिशन लॉन्च करेगा, तो वो कोकोस कीलिंग द्वीप समूह से उसकी पूरी निगरानी करेंगे।

इस साल की शुरुआत में ही इसरो प्रमुख सिवन ने कहा था कि भारतीय एजेंसी ऑस्ट्रेलिया के साथ मिलकर कोकोस कीलिंग द्वीप समूह में एक ग्राउंड स्टेशन बनाने की कोशिश कर रही है। विशेषज्ञों के मुताबिक अगर ग्राउंड स्टेशन पर उपग्रह को क्लियर व्यू नहीं मिलता, तो वो सही से डेटा ट्रांसफर नहीं कर सकता है। कई बार ब्लाइंड स्पॉट की वजह से भी उपग्रह से डेटा मिलने में दिक्कत आती है। ऐसे में कोकोस कीलिंग द्वीप के डेटा रिले उपग्रह ट्रैकिंग से इस मुद्दे को हल किया जा सकेगा।

कितनी आएगी लागत?

गगनयान मिशन को पीएम मोदी का ड्रीम प्रोजेक्ट कहा जाता है। इसके लिए फंड की कमी ना हो, सरकार इसका भी पूरा ध्यान रख रही है। एक अनुमान के मुताबिक गगनयान प्रोजेक्ट पर 10,000 करोड़ रुपये से ज्यादा का खर्च आएगा।

<https://hindi.oneindia.com/news/india/australia-to-support-isro-gaganyaan-mission-638730.html?story=2>

Enormous scope of tie-up with foreign companies in space sector: ISRO Chief

After initiating reforms in the space sector, the Department of Space has received 40 applications, mostly from start-ups, for utilising ISRO's facilities and each proposal is being looked into

New Delhi: The reforms initiated by the government in the space sector and the liberalisation of FDI norms will ensure a sustained engagement between Indian and overseas companies which will greatly benefit both, ISRO chairman K Sivan said on Monday.

After initiating reforms in the space sector, the Department of Space has received 40 applications, mostly from start-ups, for utilising ISRO's facilities and each proposal is being looked into. The DoS is assessing the requirements of each of the applications, he said.

"Our space FDI policy is getting revised and this will open up huge avenues of opportunities for foreign space companies to invest in India. This will ensure a sustained engagement between Indian and overseas companies which will greatly benefit both," Mr Sivan said.

He was speaking at the International Space Conference organised by the Confederation of Indian Industry (CII).

Mr Sivan, who is also the Secretary of the Department of Space, said there is an enormous scope for foreign companies to tie up with Indian companies in the space sector.

"This is something we have to take up very very strongly. We have seen a lot of interest (in the Indian space sector) from the foreign companies," he stressed.

He said ISRO will be concentrating more on research and development and strive to overcome the challenges and the technological gap in a timely and more responsive manner in the changing scenario.

ISRO facilities' expertise will be leveraged so that opportunities will be there for private industry to generate more cash flow and investment.

Last week, the DoS has signed a framework MoU with Skyroot Aerospace Pvt Ltd. that will enable the company to undertake multiple tests and access facilities at various ISRO centers and avail technical expertise of ISRO for testing and qualifying their space launch vehicle systems and subsystems.

Mr Sivan said many such MoUs with other start-ups will be signed soon.

In a major reform in India's space arena announced by the government last year, the private sector was allowed to carry out space activities like building of rockets, satellites and providing launch services.

The government also formed the Indian National Space Promotion and Authorisation Centre (In-Space) under the Department of Space as a separate vertical for taking independent decisions with respect to permitting and regulating space activities of the private sector.

Mr Sivan said In-Space will act as a link between ISRO and the private sector industry assessing how to best utilise India's space resources and increase the space-based activities.

"The department sees start-ups as new-age industry partners and the potential future partners who can contribute to space economy and we will be able to enable them to become competitive with other big global players," he said.



ISRO Chief K Sivan said many such MoUs with other start-ups will be signed soon. (File)

R Umamaheshwaran, Scientific Secretary, ISRO and incharge (IN-Space Activities), said the DoS is now in the process of finalising policies related to SATCOM (Satellite Communications) and remote sensing with a view to enable the Indian industry to penetrate more into the space applications demand.

The DoS has also released draft policies for space transportation, satellite navigation, human space technology transfer, all of which shall incorporate the public feedback, go through the various stages of internal reviews before being formally approved.

The Space Activities Bill is going through various departmental reviews, inter-ministerial consultations before being finally tabled in Parliament, Mr Umamaheshwaran added.

<https://www.ndtv.com/india-news/enormous-scope-of-tie-up-with-foreign-companies-in-space-sector-isro-chief-k-sivan-2539811>



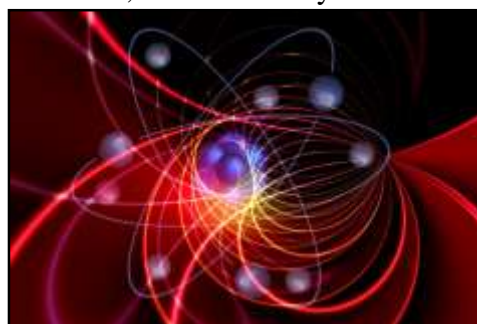
Tue, 14 Sept 2021

By confining the transport of electrons and ions, scientists show they can alter material properties

By Joan Koka

Like ripples in a pond, electrons travel like waves through materials, and when they collide and interact, they can give rise to new and interesting patterns.

Scientists at the U.S. Department of Energy's (DOE) Argonne National Laboratory have seen a new kind of wave pattern emerge in a thin film of metal oxide known as titania when its shape is confined. Confinement, the act of restricting materials within a boundary, can alter the properties of a material and the movement of molecules through it.



Credit: Pixabay/CC0 Public Domain

In the case of titania, it caused electrons to interfere with each other in a unique pattern, which increased the oxide's conductivity, or the degree to which it conducts electricity. This all happened at the mesoscale, a scale where scientists can see both quantum effects and the movement of electrons and molecules.

This work offers scientists more insight about how atoms, electrons and other particles behave at the quantum level. Such information could aid in designing new materials that can process information and be useful in other electronic applications.

"What really set this work apart was the size of the scale we investigated," said lead author Frank Barrows, a Northwestern University graduate student in Argonne's Materials Science Division (MSD). "Investigating at this unique length scale enabled us to see really interesting phenomena that indicate there is interference happening at the quantum level, and at the same time gain new information about how electrons and ions interact."

Altering geometry to change material properties

Normally, when an electric current is applied to an oxide like titania, electrons flow through the material in a simple wave form. At the same time, ions—or charged particles—also move around. These processes give rise to the material's electronic transport properties, such as conductivity and resistance, which are exploited in the design of next-generation electronics.

"What we did in our study was try to understand how we can change material properties by confining the geometry or shape of the film," said co-author Charudatta Phatak, a materials scientist and group leader in Argonne's MSD.

To start, researchers created films of titania, then engineered a pattern on them. In the pattern were holes that were a mere 10 to 20 nanometers apart. Adding the geometric pattern altered the movement of electrons the same way that throwing rocks into a body of water alters the waves that ripple through it. In the case of titania, the pattern caused electron waves to interfere with each other, which led the oxide to conduct more electricity.

"The interference pattern basically held in place the oxygen or ions that normally would be moving in materials like titania. And we found that holding those in place was important or necessary to get constructive interference of those waves," Phatak said.

The researchers investigated conductivity and other properties using two techniques: Electron holography and electron energy loss spectroscopy. To that end, they leveraged resources at Argonne's Center for Nanoscale Materials (CNM), a DOE Office of Science User Facility, to fabricate their samples and make some of the measurements.

"We wouldn't have been able to see this unique pattern of interference if we weren't able to produce enough of these holes in a pattern, which is very hard to do," said Barrows. "Expertise and resources at the CNM and Argonne's Materials Science Division proved critical to helping us observe this emergent behavior."

Future applications

In the future, if researchers can better understand what gave rise to the increase in conductivity, they could potentially find ways to control electrical or optical properties and harness this information for quantum information processing. Insights could also be used to expand our understanding of materials that can switch resistance. Resistance measures how much a material resists the flow of electrons in an electrical current.

"Resistance-switching materials are of interest because they can be information carriers—one resistance state can be 0 and the other can be 1," said Phatak. "What we've done can give us a bit more insight into how we can control these properties by using geometric confinements."

More information: Frank Barrows et al, Mesoscale Confinement Effects and Emergent Quantum Interference in Titania Antidot Thin Films, *ACS Nano* (2021). DOI: [10.1021/acsnano.1c01340](https://doi.org/10.1021/acsnano.1c01340)

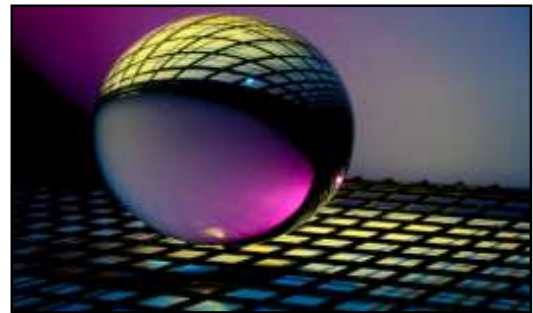
Journal information: [ACS Nano](https://doi.org/10.1021/acsnano.1c01340)

<https://phys.org/news/2021-09-confining-electrons-ions-scientists-material.html>

Researchers develop new tool for analyzing large superconducting circuits

The next generation of computing and information processing lies in the intriguing world of quantum mechanics. Quantum computers are expected to be capable of solving large, extremely complex problems that are beyond the capacity of today's most powerful supercomputers.

New research tools are needed to advance the field and fully develop quantum computers. Now Northwestern University researchers have developed and tested a theoretical tool for analyzing large superconducting circuits. These circuits use superconducting quantum bits, or qubits, the smallest units of a quantum computer, to store information.



Credit: Unsplash/CC0 Public Domain

Circuit size is important since protection from detrimental noise tends to come at the cost of increased circuit complexity. Currently there are few tools that tackle the modeling of large circuits, making the Northwestern method an important contribution to the research community.

"Our framework is inspired by methods originally developed for the study of electrons in crystals and allows us to obtain quantitative predictions for circuits that were previously hard or impossible to access," said Daniel Weiss, corresponding and first author of the paper. He is a fourth-year graduate student in the research group of Jens Koch, an expert in superconducting qubits. Koch, an associate professor of physics and astronomy in Weinberg College of Arts and Sciences, is a member of the Superconducting Quantum Materials and Systems Center (SQMS) and the Co-design Center for Quantum Advantage (C²QA). Both national centers were established last year by the U.S. Department of Energy (DOE). SQMS is focused on building and deploying a beyond-state-of-the-art quantum computer based on superconducting technologies. C²QA is building the fundamental tools necessary to create scalable, distributed and fault-tolerant quantum computer systems.

"We are excited to contribute to the missions pursued by these two DOE centers and to add to Northwestern's visibility in the field of quantum information science," Koch said.

In their study, the Northwestern researchers illustrate the use of their theoretical tool by extracting from a protected circuit quantitative information that was unobtainable using standard techniques. Details were published today (Sept. 13) in the open access journal *Physical Review Research*. The researchers specifically studied protected qubits. These qubits are protected from detrimental noise by design and could yield coherence times (how long quantum information is retained) that are much longer than current state-of-the-art qubits.

These superconducting circuits are necessarily large, and the Northwestern tool is a means for quantifying the behavior of these circuits. There are some existing tools that can analyze large superconducting circuits, but each works well only when certain conditions are met. The Northwestern method is complementary and works well when these other tools may give suboptimal results.

The title of the paper is "Variational tight-binding method for simulating large superconducting circuits."

More information: D. K. Weiss et al, Variational tight-binding method for simulating large superconducting circuits, *Physical Review Research* (2021). DOI: [10.1103/PhysRevResearch.3.033244](https://doi.org/10.1103/PhysRevResearch.3.033244)
<https://phys.org/news/2021-09-tool-large-superconducting-circuits.html>

New method designs nanomaterials with less than 10-nanometer precision

A new method designs nanomaterials with less than 10-nanometer precision. It could pave the way for faster, more energy-efficient electronics.

DTU and Graphene Flagship researchers have taken the art of patterning nanomaterials to the next level. Precise patterning of 2D materials is a route to computation and storage using 2D materials, which can deliver better performance and much lower power consumption than today's technology.

One of the most significant recent discoveries within physics and material technology is two-dimensional materials such as graphene. Graphene is stronger, smoother, lighter, and better at conducting heat and electricity than any other known material.

Their most unique feature is perhaps their programmability. By creating delicate patterns in these materials, we can change their properties dramatically and possibly make precisely what we need.

At DTU, scientists have worked on improving state of the art for more than a decade in patterning 2D materials, using sophisticated lithography machines in the 1500 m² cleanroom facility. Their work is based in DTU's Center for Nanostructured Graphene, supported by the Danish National Research Foundation and a part of The Graphene Flagship.

The electron beam lithography system in DTU Nanolab can write details down to 10 nanometers. Computer calculations can predict exactly the shape and size of patterns in the graphene to create new types of electronics. They can exploit the charge of the electron and quantum properties such as spin or valley degrees of freedom, leading to high-speed calculations with far less power consumption. These calculations, however, ask for higher resolution than even the best lithography systems can deliver: atomic resolution.

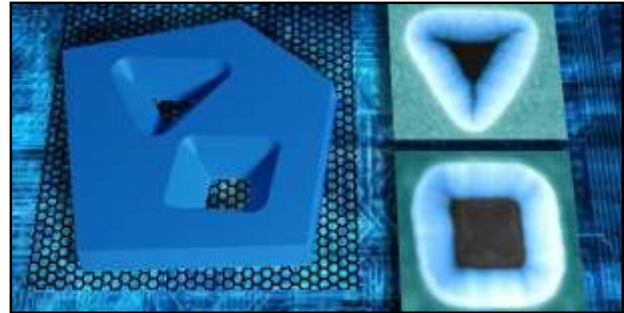
"If we really want to unlock the treasure chest for future quantum electronics, we need to go below 10 nanometers and approach the atomic scale," says professor and group leader at DTU Physics, Peter Bøggild.

And that is exactly what the researchers have succeeded in doing.

"We showed in 2019 that circular holes placed with just 12-nanometer spacing turn the semimetallic graphene into a semiconductor. Now we know how to create circular holes and other shapes such as triangles, with nanometer sharp corners. Such patterns can sort electrons based on their spin and create essential components for spintronics or valleytronics. The technique also works on other 2D materials. With these supersmall structures, we may create very compact and electrically tunable metalenses to be used in high-speed communication and biotechnology," explains Peter Bøggild.

Razor-sharp triangle

The research was led by postdoc Lene Gammelgaard, an engineering graduate of DTU in 2013 who has since played a vital role in the experimental exploration of 2D materials at DTU:



Crystals of the material hexagonal boron nitride can be etched so that the pattern you draw at the top transforms into a smaller and razor-sharp version at the bottom. These perforations can be used as a shadow mask to draw components and circuits in graphene. This process enables a precision that is impossible with even the best lithographic techniques today. To the right are images of triangular and square holes taken with an electron microscope. Credit: Peter Bøggild, Lene Gammelgaard, Dorte Danielsen

"The trick is to place the nanomaterial hexagonal boron-nitride on top of the material you want to pattern. Then you drill holes with a particular etching recipe," says Lene Gammelgaard, and continues:

"The etching process we developed over the past years down-size patterns below our electron beam lithography systems' otherwise unbreakable limit of approximately 10 nanometers. Suppose we make a circular hole with a diameter of 20 nanometers; the hole in the graphene can then be downsized to 10 nanometers. While if we make a triangular hole, with the round holes coming from the lithography system, the downsizing will make a smaller triangle with self-sharpened corners. Usually, patterns get more imperfect when you make them smaller. This is the opposite, and this allows us to recreate the structures the theoretical predictions tell us are optimal."

One can, e.g., produce flat electronic meta-lenses—a kind of super-compact optical lens that can be controlled electrically at very high frequencies, and which according to Lene Gammelgaard can become essential components for the communication technology and biotechnology of the future.

Pushing the limits

The other key person is a young student, Dorte Danielsen. She got interested in nanophysics after a 9th-grade internship in 2012, won a spot in the final of a national science competition for high school students in 2014, and pursued studies in Physics and Nanotechnology under DTU's honors program for elite students.

She explains that the mechanism behind the "super-resolution" structures is still not well understood:

"We have several possible explanations for this unexpected etching behavior, but there is still much we don't understand. Still, it is an exciting and highly useful technique for us. At the same time, it is good news for the thousands of researchers around the world pushing the limits for 2D nanoelectronics and nanophotonics."

Supported by the Independent Research Fund Denmark, within the METATUNE project, Dorte Danielsen will continue her work on extremely sharp nanostructures. Here, the technology she helped develop, will be used to create and explore optical metalenses that can be tuned electrically.

More information: Dorte R. Danielsen et al, Super-Resolution Nanolithography of Two-Dimensional Materials by Anisotropic Etching, *ACS Applied Materials & Interfaces* (2021). DOI: 10.1021/acsami.1c09923 , [dx.doi.org/https://doi.org/10.1021/acsami.1c09923](https://doi.org/10.1021/acsami.1c09923)
<https://phys.org/news/2021-09-method-nanomaterials-nanometer-precision.html>

COVID-19 and young people: Impact on lung function

- *Scientists recently explored COVID-19's impact on lung health in young people.*
- *According to a small-scale study, SARS-CoV-2 does not appear to impact lung function in young adults.*
- *Another study showed that lung function in children and adolescents was unimpaired after a SARS-CoV-2 infection, apart from in those whose infection was severe.*
- *Although the findings are reassuring, experts urge continued research and vigilance in the fight against SARS-CoV-2.*

Infants and children generally have a higher susceptibility to viral respiratory tract infections than older individuals.

However, younger people with SARS-CoV-2, the virus responsible for COVID-19, tend to fare better than adults. When children and teens do contract the virus, they often experience milder symptoms.

A systematic review Trusted Source covering 1,124 cases notes that only a small proportion of children with a SARS-CoV-2 infection “became severely or critically ill.”

Recently, researchers have investigated the possibility of lung impairment after a SARS-CoV-2 infection in children, adolescents, and young adults.

Dr. Ida Mogensen and Dr. Anne Schlegtehdal presented their findings at the virtual European Respiratory Society International Congress.

Dr. Mogensen is a postdoctoral fellow at the Karolinska Institute in Stockholm, Sweden.

Dr. Schlegtehdal is a specialist in pediatric and adolescent medicine and pediatric pulmonology at University Children's Hospital, Ruhr University Bochum in Germany.

Dr. Mogensen's study

To Dr. Mogensen's knowledge, hers was the first study to explore how a SARS-CoV-2 infection affects lung function.

According to the abstract, Dr. Mogensen's study set out to determine whether “[SARS-CoV-2] infection (presence of antibodies against SARS-CoV-2) has a negative impact on lung function and whether asthma, type 2 inflammation, or inhaled corticosteroids (ICS) modify this relationship.”

Type 2 inflammation Trusted Source is a type of immune response. In its dysregulated form, type 2 inflammation has been implicated in a number of conditions, including asthma.

Study methods

Dr. Mogensen and her team collected data from 661 individuals whose average age was 22 years. These young people participated in the BAMSE Project, which follows Swedish children born between 1994 and 1996.

Of this group, 27% had antibodies indicating a SARS-CoV-2 infection.

The researchers analyzed lung function measurements and inflammation markers. They included counts of eosinophils, which are a type of white blood cell associated with a decline in lung function.

What they found

Dr. Mogenson reported, “We found no difference in lung function change with respect to blood eosinophils, fractional exhaled nitric oxide [a measure of airway inflammation], allergic sensitization, or ICS use.” The participants with asthma did not show a significant decline in lung function. However, they had slightly lower measurements of forced expiratory air volume in 1 second, which is a measure of lung function.

Dr. Schlegtendal’s study

Dr. Schlegtendal presented a study on pulmonary function in young people following a SARS-CoV-2 infection between August 2020 and March 2021.

In their abstract, the scientists explain that “[p]ulmonary function in adults after COVID-19 can show long-term impairment: 10% of hospitalized adults had reduced spirometry values, and 24% had decreased diffusion capacity.”

However, evidence of the effect of COVID-19 on the lungs in children and teens was sparse. The recent study sets out to help fill in this gap.

Study methods

Dr. Schlegtendal and her team collected data from 73 individuals aged 5–18 years between 2 weeks and 6 months after a positive SARS-CoV-2 test.

The researchers performed various analyses, including multiple-breath washout Trusted Source, diffusion capacity testing, and body plethysmography.

They compared the cases with the control group consisting of 45 people who had not had the coronavirus infection but who may have had other types of infection.

Dr. Schlegtendal’s findings

Nineteen participants (27.1%) reported emerging or persistent symptoms following their COVID-19 diagnosis, and eight (11.4%) of these people reported respiratory symptoms.

Compared with the children in the control group, “no significant differences were detected in frequency of abnormal pulmonary function.”

Dr. Schlegtendal concludes that COVID-19 seldom diminishes pulmonary function in children and adolescents.

The studies’ limitations

Both studies used small samples and short time frames. Dr. Mogensen explains that the number of the participants with asthma in her study was especially low.

Dr. Mogensen also wonders how the length of time after infection, symptoms, and severity of disease factor into lung function postinfection.

Medical News Today spoke with Dr. Robert Darzynkiewicz, chief medical officer at Hazel Health and an emergency medicine physician. He felt that these studies are “promising in looking to the long-term problems of lung function with children.”

Speaking about the strengths of the studies, Dr. Darzynkiewicz praised the use of multiple tests of lung function. However, he also agreed that because the studies were small, it is necessary to amass more data before a clearer picture of the long-term impact on young people’s lungs can emerge. According to Dr. Darzynkiewicz, there are still a range of questions to answer, and he hopes that these studies spur more research.

Stay on guard

In the interview with *MNT*, Dr. Darzynkiewicz stated that children are less likely to be hospitalized for COVID-19. However, because there are so many new cases in the United States due to the spread of the Delta variant, cases in children, as with other age groups, are increasing.

He explained that although 0.1–1.9% of children with a SARS-CoV-2 infection require hospitalization, because there are currently more than 200,000 infections in children each week in the U.S., that is still potentially hundreds to thousands of hospitalizations.

<https://www.medicalnewstoday.com/articles/covid-19-and-young-people-impact-on-lung-function>

