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रक्षा विज्ञान पुस्तकालय

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Fri, 09 April 2021

रक्षा तकनीक में देश की ताकत बना DRDO, जानिए कैसा रहा अब तक का इसका सफर

रक्षा अनुसंधान और विकास संगठन का गठन, 1958 में 3 अलग-अलग सरकारी विभागों को मिलाकर किया गया था।

प्रधानमंत्री मोदी का आत्मनिर्भर भारत का आह्वान, देश की अर्थव्यवस्था के एक अहम मोड़ पर आया है। नेटवर्क 18 की पहल और आईटीसी द्वारा प्रस्तुत इस खास पेशकश स्वाभिमान भारत में हम आपके लिए देश भर से ऐसी कहानियां लाते हैं जो आत्मनिर्भरता का बेहतरीन उदाहरण पेश करती हैं। इसमें से कुछ कहानियां उन जानी मानी संस्थाओं के बारे में हैं जो सरकार द्वारा चलाई जा रही हैं और देश को गौर्वांवित कर रही हैं। DRDO यानि Defence Research & Development Organization एक ऐसी ही संस्था है जिसकी 50 से अधिक प्रयोगशालाओं का नेटवर्क रक्षा तकनीकों पर अनुसंधान करके नई तकनीक विकसित कर रहा है।

रक्षा अनुसंधान और विकास संगठन का गठन, 1958 में 3 अलग-अलग सरकारी विभागों को मिलाकर किया गया था। ये केवल 10 प्रयोगशालाओं के साथ एक छोटे संगठन के रूप में शुरू हुआ था।

डीआरडीओ ने हमेशा ही आत्मनिर्भरता का रास्ता अपनाया है और देश को एक अलग पहचान दिलाई है। डीआरडीओ ने सफलतापूर्वक स्वदेशी रुप से बनाए गये स्ट्रैटजिक सिस्टम्स और प्लेटफॉर्मस जैसे अग्नि और पृथ्वि जैसी मिसाइलों की श्रृंखला और तेजस जैसे हल्के लड़ाकू विमानों का उत्पादन किया है।

इसके अलावा COVID-19 महामारी से लड़ने के लिए अपना योगदान देते हुए DRDO ने लगभग 75 उत्पादों का निर्माण किया जो वायरस से निपटने और रोगियों का इलाज करने में मदद करते हैं।

डीआरडीओ का लक्ष्य न केवल एक आत्मनिर्भर राष्ट्र का निर्माण करना है, बल्कि इसे रक्षा उपकरणों का बड़ा निर्यातक बनाना भी है। यकीनन इन्हें स्वाभिमान भारत का शानदार उदाहरण कहा जा सकता है।

https://hindi.moneycontrol.com/news/market-news/drdo-becomes-the-strength-of-the-country-in-defense-technology-know-how-its-journey-so-far_261789.html

The EurAsian Times

Fri, 09 April 2021

Indian Navy better equipped than Army & the Air Force to tackle cyber threats — CDS Rawat

By Ayush Jain

Indian tri-services Chief (CDS) Gen. Bipin Rawat admitted the technological superiority of China in the cyber domain and said that the Indian Navy is better equipped than the Army and the Air Force to thwart cyber threats.

Addressing an event at the Vivekananda International Foundation, a New Delhi-based think tank, on Wednesday, the Chief of Defense Staff also said that the government leadership has shown the 'will' to take a strong stance to uphold vital national interests. He also addressed issues related to the Ladakh standoff with China.

Indian and Chinese soldiers disengaged from a friction point in eastern Ladakh in February, after a 10-month-long border standoff.

Admitting that Chinese technological superiority is indeed challenging for New Delhi to counter, Rawat said, "We know that China is capable of launching cyber attacks on us and that it can disrupt a large number of our systems. What we are trying to do is to create a system which would ensure cyber defense".

Last October, a power outage in India's financial capital, Mumbai, caused a large disruption in the city's normal life and a huge economic loss for the country. While this outage was restored within a few hours, it had hit India's Bombay Stock Exchange and the city's lifeline, the Mumbai local trains.

A New York Times report said that the power outage was investigated and was declared as a cyber attack by China-based operatives. This was confirmed by Maharashtra's Energy Minister Nitin Raut.

The Chinese cybercriminals attempted a similar attack on another power grid in India on March 3 but were successfully thwarted by state government agencies. According to reports, many Western and East Asian countries were hit by Chinese hackers last year.

General Rawat called this a "capability differential" and mentioned that the Indian Navy is "far ahead" of the other two forces in terms of imbibing advanced technologies, and thus being more capable in terms of cyber warfare.

He also revealed that all three services have their dedicated cyber agency to thwart such cyber-attacks and firewalls are being created to deal with the matter "in a serious way".

This trust in the Navy follows Rawat's two-day visit to the Southern Naval Command in Kochi a few days ago, where he reviewed the training establishments and saw the development in trials and construction of India's next aircraft carrier IAC-1 (to be designated as INS Vikrant).

As a "prerequisite for internal stability", the general stressed strong governance saying the security forces and diplomacy could tackle the situation at the international level. "We can't just

return to the way things were before. Therefore, change has become the need of the hour. There is a need to overcome and shed the colonial era syndrome completely," he added.

Rawat also said that time has come for the military to look towards technology in a big way. He said that work is being done to create a national maritime commission under the Navy and the new entity would ensure convergence among users operating in the high seas and coastline.

https://eurasiantimes.com/indian-navy-better-equipped-than-army-and-air-force-to-tackle-cyber-threats-cds-rawat/

Business Standard

Fri, 09 April 2021

IAF Chief flies Su-30MKI fighter jet to witness its 'capability enhancement'

Air Chief Marshal RKS Bhadauria Thursday flew a Su-30MKI fighter jet in Bengaluru to witness its "capability enhancement", the Indian Air Force (IAF) said

New Delhi: Air Chief Marshal RKS Bhadauria Thursday flew a Su-30MKI fighter jet in Bengaluru to witness its "capability enhancement", the Indian Air Force (IAF) said.

Air Chief Marshal RKS Bhadauria | Photo: PTI

"CAS (Chief of Air Staff) visited Bengaluru and interacted with test crew of Aircraft & Systems Testing Establishment (ASTE) & software engineers of Software Development Institute," it said on Twitter.

The ASTE conducts flight testing of aircraft, airborne systems and weapons prior to their induction into the IAF.

Bhadauria reviewed ongoing projects during his visit on Thursday and flew a Su-30MKI aircraft to "witness the capability enhancement on successful completion of one such project", the IAF stated.

(Only the headline and picture of this report may have been reworked by the Business Standard staff; the rest of the content is auto-generated from a syndicated feed.)

https://www.business-standard.com/article/current-affairs/iafchief-flies-su-30mki-fighter-jet-to-witness-its-capability-enhancement-121040801435_1.html

THE TIMES OF INDIA

Fri, 09 April 2021

Army Chief Gen Naravane meets Bangladesh's Navy, Air Force Chiefs; holds defence talks

Dhaka: Indian Army chief Gen MM Naravane on Thursday met Bangladesh's Air Force and Navy chiefs, and discussed issues of mutual interest and matters on bilateral defence cooperation.

Naravane also paid tributes to the fallen heroes of Bangladesh's 1971 Liberation War after arriving in the country on a five-day visit to further strengthen the close and fraternal ties existing between the Armed Forces of the two nations.

The visit of Naravane, who is here at the invitation of his Bangladeshi counterpart Gen Aziz Ahmed, comes less than two weeks after Prime Minister Narendra Modi travelled to the neighbouring country.

The Indian Army's Additional Directorate General of Public Information (ADG PI) said on Twitter that Gen Naravane called on Admiral M Shaheen Iqbal, Chief of Naval Staff, Bangladesh Navy and discussed issues of mutual interest.

After his interaction with Admiral Iqbal, the Indian Army chief met the country's acting Chief of Air Staff of Bangladesh Air Force.

“General MM Naravane COAS interacted with Air Vice Marshal M Abul Bashar, Acting Chief of Air Staff of Bangladesh Air Force and discussed matters on bilateral defence cooperation,” the ADG PI said in another tweet.

Soon after his arrival here, Gen Narawane paid tribute to the fallen heroes of the 1971 Liberation War by laying a wreath at the altar of Shikha Anirban in Dhaka Cantonment.

"Gen Narawane on 1st day of his 5-day visit to #Bangladesh paid tributes to the martyrs of the Liberation War at the #ShikhaAnirban today," the ADG PI said.

He was welcomed with a guard of honour at Senakunj.

He will also be visiting various military stations in Bangladesh.

The Indian Army chief will share his experience during the seminar on United Nations Peace Support Operations. He will also witness the culmination exercise, hardware display and closing ceremony of the joint military exercise 'Shantir Ogroshena', a multilateral UN-mandated counter-terrorism exercise from April 4 to 12. Besides armies of Bangladesh and India, the exercise is being participated by Bhutan and Sri Lanka along with observers from the US, the UK, Turkey and Saudi Arabia.

The visit of the Indian Army chief will further strengthen the close and fraternal ties existing between the Armed Forces of the two countries, the Indian High Commission here said.

The year 2021 marks the 50th anniversary of diplomatic relations between India and Bangladesh, the liberation of Bangladesh and the birth centenary of 'Bangabandhu' Sheikh Mujibur Rahman.

In reflection of close ties, India is also hosting a number of events to mark the 50th anniversary of the 1971 war that led to the liberation of Bangladesh.

Around 93,000 Pakistani troops had surrendered before the joint forces of the Indian Army and the "Mukti Bahini" on December 16, 1971 that paved the way for the birth of Bangladesh.

The Army chief is also scheduled to visit the Mujibur Rahman memorial museum in Dhanmondi where he will pay tributes to the founding father of that country.

https://timesofindia.indiatimes.com/india/army-chief-gen-naravane-meets-bangladeshs-navy-air-force-chiefs-holds-defence-talks/articleshow/81970516.cms

Hindustan Times

Fri, 09 April 2021

6 Rafale fighters to land in India on April 28, 4 more in May: Official

The IAF is trying to see if the 6 Rafale fighters can be flagged off by IAF chief Air Chief Marshal RKS Bhadauria during his visit to Paris later this month but it may not be possible

By Shishir Gupta

Six Rafale warplanes will land in India on April 28, enabling the Indian Air Force (IAF) to take the first steps to raise its second squadron of the fourth-generation-plus fighter jets at West Bengal's Hasimara airbase, people familiar with the matter said on Thursday. Four more fighters are scheduled to reach next month.

The arrival of 6 more Rafale fighters will allow the Indian Air Force to complete the Golden Arrows Sqaudron in Ambala, and start the Rafale squadron at West Bengal's Hasimara airbase with 2 fighters (Twitter/@IAF_MCC)

The 6 planes will allow the IAF to fully raise the No. 17 Squadron, also known as the Golden Arrows. The squadron, disbanded in 2016 after the IAF started phasing out of Russian-origin MiG 21 jets, was revived in September last year after the induction of the first batch of the French-origin warplanes. The squadron is based out of Ambala Air Force Station, India's oldest airbase that is strategically located near India's border with Pakistan and China.

A senior IAF official said induction of the 6 fighters will complete the Golden Arrows squadron - it currently has 14 fighters against a standard squadron strength of 18 - and enable the air force to induct 2 remaining planes from this batch in the second Rafale squadron to be raised at the Hasimara airbase in Bengal's Siliguri corridor. The four planes expected in May will also be sent to the squadron in Hasimara which will cover central and eastern Tibet.

A second IAF official said the IAF was trying to see if the six Rafale fighters could be flagged off by IAF chief Air Chief Marshal RKS Bhadauria during his visit to Paris later this month. "But it looks difficult," he said.

The arrival of 10 fighters in two batches by next month will raise the strength of the Rafales in the air force to 24. French ambassador Emmanuel Lenain told reporters last week that the delivery of all 36 Rafale jets will be completed by 2022 as per the contract.

India had inked a ₹59,000 crore ($8.7 billion) agreement with the French government to buy 36 Rafale fighter jets, replacing the previous United Progressive Alliance (UPA) regime's decision to buy 126 Rafale aircraft, 108 of which were to be made in India by the state-owned Hindustan Aeronautics Ltd (HAL).

The deal was dragged into a controversy after the opposition led by the Congress claimed that the NDA government was buying the planes at an inflated price. The Supreme Court and the government's top auditor, Comptroller and Auditor General, did not find any indication of malfeasance. But the controversy was reignited over the last week after a French online journal, Mediapart, claimed that Dassault Aviation, which manufactures the Rafale jet, paid €1 million to a Sushen Gupta, described as a "middleman", in connection with the deal for 36 jets.

A French diplomat in Delhi said the French aviation giant, Dassault Aviation, and the government would issue an appropriate rebuttal to the 'so-called expose' by the online portal.

The diplomat cited a $3.7 billion deal between France and Greece for the sale of 18 Rafale jets including 12 used fighters to assert that this agreement sealed in Athens suggested that New Delhi had negotiated better terms.

The warplanes received by the IAF are equipped with India-specific enhancements including the Meteor beyond visual range air-to-air missiles, Mica multi-mission air-to-air missiles, Scalp deep-strike cruise missiles and the Hammer smart weapon.

https://www.hindustantimes.com/india-news/6-rafale-fighters-to-land-in-india-on-april-28-4-more-in-may-official-101617882396017.html

Hindustan Times

Fri, 09 April 2021

India hands over ₹100 cr patrol boat to boost Seychelles' maritime security

India has been working closely with countries in the Indian Ocean, especially the Maldives and Seychelles, to bolster maritime security through the supply of aircraft and patrol vessels. The PS Zoroaster is the fourth made-in-India patrol boat to be gifted to Seychelles since 2005

By Rezaul H Lashkar

India on Thursday formally handed over a ₹100-crore patrol vessel to Seychelles, with Prime Minister Narendra Modi saying the Indian Ocean archipelago is central to New Delhi's vision for security and development in the region.

Besides the donation of the PS Zoroaster to the Seychelles Coast Guard, Modi and President Wavel Ramkalawan inaugurated the new magistrates' court building in Mahé constructed with a $3.5-million grant, a 1 MW solar power plant built at a cost of $3.4 million, and 10 community development projects during a virtual event.

The 48.9-metre patrol boat was built by Garden Reach Shipbuilders and Engineering at a cost of ₹100 crore and has a top speed of 35 knots and an endurance of 1,500 nautical miles. The vessel will be used for multi-purpose operations, such as patrolling, anti-smuggling and anti-poaching operations, and search and rescue. (TWITTER/@MEAIndia.)

India has been working closely with countries in the Indian Ocean, especially the Maldives and Seychelles, to bolster maritime security through the supply of aircraft and patrol vessels. The PS Zoroaster is the fourth made-in-India patrol boat to be gifted to Seychelles since 2005, and more than 50% of Seychelles' maritime and air assets have been provided by India.

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"India is committed to strengthening the maritime security of Seychelles...This vessel will help Seychelles to protect its maritime resources," Modi said at the virtual event.

Seychelles, he added, is central to India's vision of "SAGAR" or "Security and Growth for All in the Region", and India will help develop the archipelago's security capabilities and meet its infrastructural and developmental needs.

Ramkalawan, who has his roots in Gopalganj district of Bihar, said the vessel will play a key role in counter-narcotics operations within Seychelles' vast maritime zone and contribute to regional stability and security.

"In India, we have a reliable and trusted partner. India has never failed us, India stands by us and Seychelles stands by India," Ramkalawan said, adding that India's "precious donation" of 50,000

doses of Covid-19 vaccines had helped his country in moving towards the goals of achieving 70% herd immunity by the end of April and opening up the economy.

The magistrates' court building brings together several courts that were spread over Mahé and is located next to the Supreme Court of Seychelles, built with Chinese assistance in 2013. This is the first India-backed construction project in the archipelago and was completed amid the pandemic.

The building has eight courtrooms, separate holding cells for men, women and children, and multi-functional conference rooms and video rooms.

India has so far taken up 29 small people-oriented development projects in Seychelles, while the 1MW solar project was built in addition to installing solar systems at 146 government buildings and domestic households. The solar plant will meet the electricity needs of around 400 houses round the year.

The virtual event was the first interaction between Modi and Ramkalawan, who came to power in the October 2020 elections. Seychelles was the first destination in Modi's tour of Indian Ocean countries in 2015. It was during this tour that Modi had unveiled the "SAGAR" vision.

https://www.hindustantimes.com/world-news/india-hands-over-rs-100-cr-patrol-boat-to-boost-seychelles-maritime-security-101617893626722.html

FINANCIAL EXPRESS
Read to Lead

Fri, 09 April 2021

India-China LAC issue: Stage set for next round of Corps Commander level talks; Disengagement from the friction points to be addressed

According to reports there seems to be a movement of the Chinese PLA ground forces into the plains of Aksai Chin, which according to sources appears to be preparation of their annual summer drills

By Huma Siddiqui

One year over, the Indian and Chinese sides are set to meet for the next round of Corps Commander-level talks. Though the dates have not been formally announced, sources based reports indicate the talks are set to take place on Friday (April 8, 2021) between the two sides. According to sources in the Indian Army, the talks will be focused on resolving the pending issues including the friction points at the Depsang Plains, Demchok, Gogra and Hot Springs. The talks between the two sides are taking place when the winters are over and the second phase of disengagement should start, and the Chinese PLA continues to be present on the Indian perception of the LAC.

According to reports there seems to be a movement of the Chinese PLA ground forces into the plains of Aksai Chin, which according to sources appears to be preparation of their annual summer drills.

The stand-off lasted nine long months along the LAC in eastern Ladakh.

In April 2020, under the pretence of summer drills, the Chinese PLA had moved in towards the Line of Actual Control. And as reported earlier by Financial Express Online, this led to a major stand-off between the Indian and Chinese forces. The stand-off lasted nine long months along the LAC in eastern Ladakh.

At the end of several rounds of marathon talks at the military and diplomatic levels, both India and China had agreed to the withdrawal of troops and weapons from the South and North banks of

Pangong Lake. This was in line with an agreement on disengagement between the two sides. Earlier this year in February, once the two sides completed the first phase of disengagement military commanders had another round of talks and focused on taking forward the process of disengagement at other friction points.

Recap

Last summer, intelligence reports which were generated by multiple agencies; the ITBP, IA, R&AW, IB, State Intelligence and others had indicated that the Chinese troops had come inside around 12.5 km on the Indian side of the LAC. Thereafter, the intelligence gathering has been further strengthened and that is how the Indian Army was able to take action in August 2020, which ensured that the Chinese troops were taken by surprise.

The Indian Army and other agencies are maintaining a 24×7 ISR and watching any movement by the Chinese troops. Though in the first Phase of disengagement, the troops had moved back about 100-150 km from the LAC, they remained in bases around the G-219 highway. And this highway cuts through Aksai Chin.

What happened in August 2020?

Last August the Chinese PLA had successfully fortified gun positions on the ridgelines of Finger 4.

These positions according to the army were overlooking the Indian positions and it was in response to this last August the Indian troops had achieved the most critical tactical advantage on the South bank of Pangong Tso. They set up positions around the Finger 4.

Phase I of disengagement

Financial Express Online has reported earlier, that in the first round of disengagement, the Chinese PLA troops had cleared the Finger 4 area on the North Bank of the Pangong Tso Lake. Also, the huge map of China which was engraved near Finger 5 has already been cleared as well the big heavy structures and defences which were raised by the Chinese between Finger 8 to Finger 4 were cleared out. There were reports that indicated the disengagement process at the Patrolling Points (PP) 15 and 17A, being completed.

Will the Corps Commanders talk about Depsang Plains?

According to sources, it will be on the agenda of talks, as this is a critical area and the Chinese PLA troops are not letting the Indian soldiers carry out patrolling up to PPs 10-13 located in the Depsang plains.

Present position of the forces

The number of Indian troops which had been deployed along the LAC remains there and the Indian Air Force (IAF) too has not scaled down its presence in Ladakh and close by areas. And the Chinese troops are also maintaining their troops deployment around the region and have their air force deployed in Tibet.

https://www.financialexpress.com/defence/india-china-lac-issue-stage-set-for-next-round-of-corps-commander-level-talks-disengagement-from-the-friction-points-to-be-addressed/2229368/

The Washington Post

Fri, 09 April 2021

China builds advanced weapons systems using American chip technology

By Ellen Nakashima and Gerry Shih

In a secretive military facility in southwest China, a supercomputer whirs away, simulating the heat and drag on hypersonic vehicles speeding through the atmosphere — missiles that could one day be aimed at a U.S. aircraft carrier or Taiwan, according to former U.S. officials and Western analysts.

The computer is powered by tiny chips designed by a Chinese firm called Phytium Technology using American software and built in the world's most advanced chip factory in Taiwan, which hums with American precision machinery, say the analysts.

China's hypersonic glide vehicle DF-17 is seen on Oct. 1, 2019 during a military parade in Beijing to celebrate the 70th Anniversary of the founding of the People's Republic. (The Asahi Shimbun/Getty Images)

Phytium portrays itself as a commercial company aspiring to become a global chip giant like Intel. It does not publicize its connections to the research arms of the People's Liberation Army.

The hypersonic test facility is located at the China Aerodynamics Research and Development Center (CARDC), which also obscures its military connections though it is run by a PLA major general, according to public documents, and the former officials and analysts, many of whom spoke on the condition of anonymity to discuss a sensitive matter.

Phytium's partnership with CARDC offers a prime example of how China is quietly harnessing civilian technologies for strategic military purposes — with the help of American technology. The trade is not illegal but is a vital link in a global high-tech supply chain that is difficult to regulate because the same computer chips that could be used for a commercial data center can power a military supercomputer.

Hypersonics refers to a range of emerging technologies that can propel missiles at greater than five times the speed of sound and potentially evade current defenses.

:On Thursday the Biden administration placed Phytium and six other Chinese firms and labs involved in high-performance computing on an export blacklist, blocking technology of American origin from flowing to those entities. The aim, Commerce Department officials said, is to prevent U.S. goods and know-how from aiding China's military modernization, in particular its development of advanced weapons, including nuclear and hypersonics.

Phytium did not respond to repeated requests for comment.

American firms generally argue that export controls hurt their profits while encouraging China to send its business elsewhere and develop its own industries. But they say they obey U.S. rules and laws.

Analysts say that curtailing future progress by the PLA is worth the cost in lost business. And, they warn, though the administration's new export controls are a welcome step, China will find ways around them unless the Biden administration restricts access to foreign chip foundries that use American tools.

The Phytium case also spotlights the dilemma for Taiwan, a self-ruled liberal democracy perched strategically between the United States and China. Taiwan relies on Washington for defense against invasion by Beijing, which U.S. officials say is a growing risk. But Taiwan's companies rely on the Chinese market, which accounts for 35 percent of Taiwan's trade.

As tensions between China and the United States deepen, so too have questions over the proper limits for American and Taiwanese firms doing business with China.

Reaching the target in minutes

Semiconductors are the brains of modern electronics, enabling advances in everything from clean energy to quantum computing. They are now China's top import, valued at more than $300 billion a year, and a major priority in China's latest Five-Year Plan for national development.

In January 2019, Chinese President Xi Jinping visited Tianjin, 70 miles from Beijing and home to Phytium, and touted the company's importance to the country's "indigenous innovation" effort. Today, Phytium boasts it is "a leading independent core chip provider in China." The company markets microprocessors for servers and video games, but its shareholders and main clients are the Chinese state and military, according to government records.

Phytium was founded in August 2014, according to business registration records in a public government database. It was created as a joint venture of the state-owned conglomerate China Electronic Corp. (CEC), the National Supercomputing Center in Tianjin, and the Tianjin municipal government, according to the records.

The national supercomputing center is a lab run by the National University of Defense Technology (NUDT), a premier military research institution whose current president and immediate past president were PLA generals.

In 2015, the Commerce Department placed both organizations on its trade blacklist list, for involvement in nuclear weapons activity, a designation that bars U.S. exports to the firms unless a waiver is obtained.

Phytium's ownership has changed hands over the years, but its shareholders often have links to the PLA, records show.

"Phytium acts like an independent commercial company," said Eric Lee, a research associate at the Project 2049 Institute, a Northern Virginia think tank focused on strategic Indo-Pacific issues. "Its executives wear civilian clothes, but they are mostly former military officers from NUDT.''

In China's rugged hinterland lies Mianyang, a city in southwest Sichuan province that is a center for research in nuclear weapons. It is also home to the country's largest aerodynamics research complex: CARDC.

CARDC, which says it has 18 wind tunnels, is heavily involved in research on hypersonic weapons, according to former U.S. officials and U.S. and Australian researchers. Its director, Fan Zhaolin, is a major general, but he is pictured in civilian clothes on the center's website.

The center has been on the U.S. trade blacklist — called the "entity list"— since 1999 for contributing to "the proliferation of missiles." In 2016 Commerce further tightened restrictions on the facility.

CARDC, said Tai Ming Cheung, director of the University of California San Diego's Institute on Global Conflict and Cooperation, is "a beating heart of Chinese hypersonic research and development."

The research center and Fan did not respond to emails seeking comment.

China's major investments in hypersonics is a major concern at the Pentagon.

"The only way to reliably see a hypersonic vehicle is from space, which makes it a challenge," said Mark J. Lewis, until recently the Pentagon's director of defense research and technology. If it is traveling at hypersonic speeds — going at least a mile per second — it gives a missile defense system very little time to figure out what it is and how to stop it, he said.

Hypersonics is a critical, emerging military technology, said Lewis, the executive director of the National Defense Industrial Association's Emerging Technologies Institute. China could target Navy ships and air bases in the Pacific, he said, adding that a conventional cruise missile would take an hour or two to reach its target while a hypersonic missile could do so in minutes.

"It is a huge concern," he said.

A million trillion calculations

In 2014, the U.S. Air Force released an unclassified report on the technology of air warfare that included hypersonics. "Anyone could pick up this document," Lewis said. "Then we basically took our foot off the gas. There was no sense of hurry, of alacrity."

Meanwhile, the Chinese read the American research. Their scientists began showing up at U.S. conferences. They started investing. "They saw that hypersonics could give them a military advantage," Lewis said. "And they acted."

China, unlike the United States, has fielded a hypersonic weapon: a medium-range hypersonic glide vehicle.

Hundreds to thousands of different configurations of heat, vehicle lift and atmospheric drag need to be analyzed to make a hypersonic missile work, which would be too expensive and time-consuming through physical testing alone, said Iain Boyd, Director of the Center for National Security Initiatives at the University of Colorado, Boulder. "If you didn't have supercomputers it could take a decade,'' he said.

In May 2016, CARDC unveiled a "petascale" supercomputer that would aid the aerodynamic design of hypersonic missiles and other aircraft. A petascale computer can handle one trillion calculations per second.

In 2018 and 2019, CARDC scientists published papers showcasing their supercomputer and noting their calculations were done with Phytium's 1500 and 2000 series chips, though the papers do not discuss research on hypersonic weapons.

CARDC, Phytium, the military university and the Tianjin supercomputing lab are currently developing an even faster computer — able to handle "exascale" speeds of a million trillion calculations per second. The supercomputer, dubbed Tianhe-3, is powered by Phytium's 2000 series chips, according to Chinese state media.

To produce such chips, Phytium requires the newest design tools.

Although CARDC and other PLA entities are under U.S. export controls, the Chinese military is still able to access U.S. semiconductor technology through companies like Phytium.

One Silicon Valley company that counts Phytium as a customer is Cadence Design Systems Inc., which gave an award to Phytium at a 2018 conference for presenting the "best paper" on how to use its software for high-performance chip applications. Another is Synopsys, headquartered eight miles from Cadence in San Jose, Calif.

"I have not in my decade in China met a chip design company that isn't using either Synopsys or Cadence," said Stewart Randall, a consultant in Shanghai who sells electronic design automation software to top Chinese chipmakers.

Cadence did not respond to repeated requests for comment. In an emailed statement Thursday, Synopsys said, "we continue to abide by the U.S. government entity list restrictions."

More loopholes

Phytium's microprocessors are produced at gleaming factories outside Taipei by the Taiwan Semiconductor Manufacturing Company, which now makes the world's most advanced chips, having surpassed the United States.

TSMC, the largest of several Taiwanese chipmakers, is in the unusual position of manufacturing chips "that end up being used for military purposes by both the United States and China," said Si-fu Ou, a fellow at the Institute for National Defense and Security Research, a think tank co-founded by Taiwan's defense ministry.

The company, for instance, makes chips used in advanced American weapons, including Lockheed-Martin's F-35 fighter jet. TSMC announced last year it would build a $12 billion factory in Arizona in response to Trump administration concerns about the security of the semiconductor supply chain.

"These private companies do business and don't consider factors like national security," Ou said, adding that Taiwan, as a small country, lacks the leverage and will to enact export bans. "The

United States has a relatively complete set of export control measures and regulations, while Taiwan is relatively loose and has more loopholes," Ou said.

TSMC said in an email to The Washington Post it obeys all laws and export controls. Earlier this week, company spokeswoman Nina Kao said, "We are not aware of a product manufactured by TSMC that was destined for military end-use as alleged in your email."

On Thursday, Kao said the company had no comment on the Commerce Department action.

The final stage of Phytium chip design is handled by another Taiwanese company, Alchip, which deals directly with TSMC's factories on Phytium's behalf.

Alchip chief financial officer Daniel Wang said Phytium signed an agreement stipulating its chips are not for military use. Phytium has told Alchip its clients are civilians, and that the 1500 and 2000 series chips are made specifically for commercial servers and personal computers, Wang said.

However, a 2018 Alchip news release notes the firm has worked with "China's National Supercomputing Center," which had been on Commerce's blacklist for three years at that point for involvement in "nuclear explosive activities."

Alchip on Thursday said it had not yet reviewed the Commerce listing and so could not immediately comment.

Mark Li, an analyst at Sanford Bernstein, said unless Phytium is placed under sanctions, TSMC is in no position to cut it off. "It's not TSMC's job to be a policeman for the United States," he said. "That's for politicians to decide. China is the biggest semiconductor market. If you give that up when the business is legally allowed, you can't explain that to shareholders."

(Shih reported from Taipei, Taiwan. Pei Lin Wu in Taipei contributed to this report.)

https://www.washingtonpost.com/national-security/china-hypersonic-missiles-american-technology/2021/04/07/37a6b9be-96fd-11eb-b28d-bfa7bb5cb2a5_story.html

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Ministry of Science & Technology

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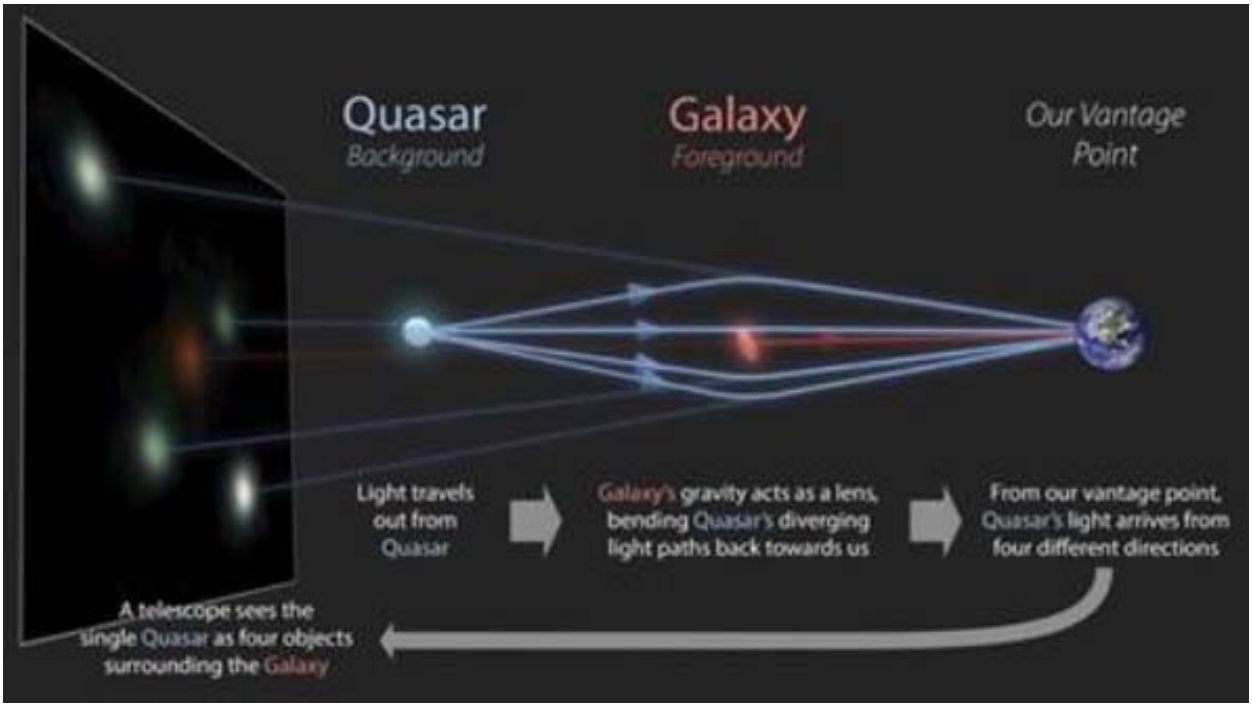
Dozen rare quadruply imaged quasars discovered can help determine expansion rate of the universe

A group of astronomers have discovered a dozen quasars that have been warped by a naturally occurring cosmic "lens" and split into four similar images. This rare discovery increases the number of known quasars or quads by about 25 percent and can help determine the expansion rate of the universe and help address other mysteries.



Caption: This diagram illustrates how quadruply imaged quasars, or quads for short, are produced on the sky. The light of a distant quasar, lying billions of light-years away, is bent by the gravity of a massive galaxy that happens to sit in front of it,

Quasars are extremely luminous cores of distant galaxies that are powered by supermassive black holes. Quadruply imaged quasars are rare, and the first quadruple image was discovered in 1985. Over the past four decades, astronomers had found about fifty of these “quadruply imaged quasars” or quads for short, which occur when the gravity of a massive galaxy that happens to sit in front of a quasar splits its single image into four.

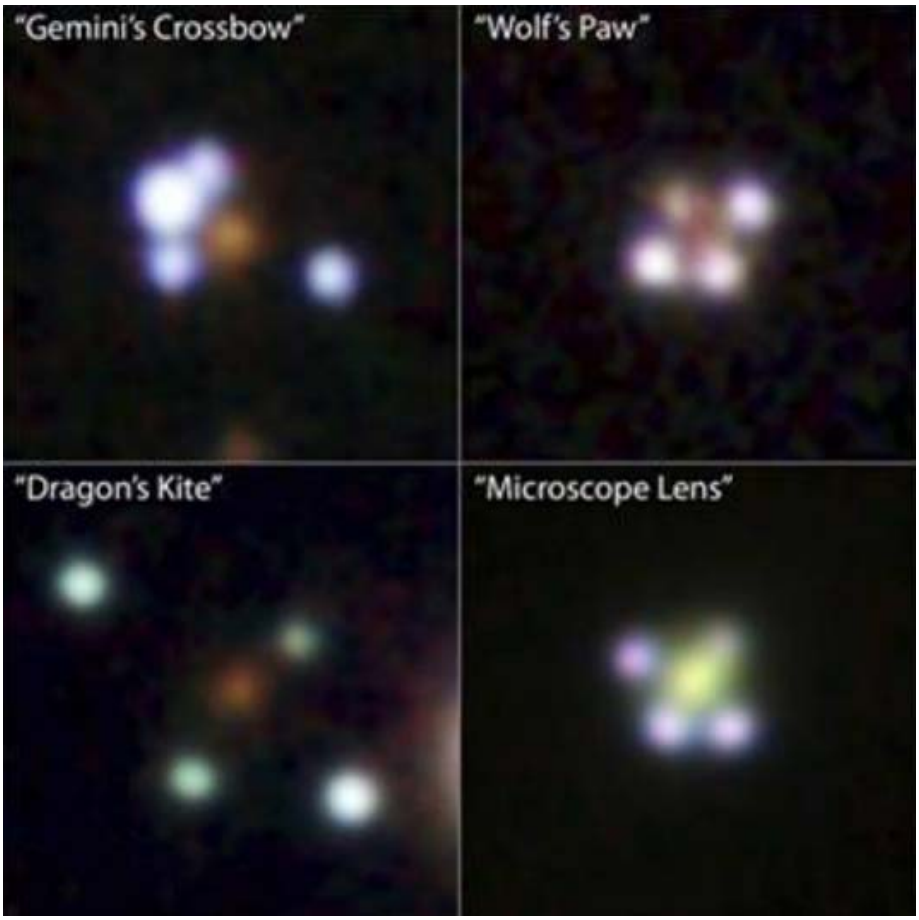
The study by Gaia Gravitational Lenses Working Group (GraL) of astronomers, which included scientists from Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, an autonomous institute of Department of Science and Technology, spanning only a year and a half, demonstrates the power of machine-learning to assist astronomers in their search for these cosmic jewels. It has been accepted for publication in ‘The Astrophysical Journal’.

"The quads are gold mines for all sorts of questions. They can help determine the expansion rate of the universe and help address other mysteries, such as dark matter and quasar 'central engines',"

says Daniel Stern, lead author of the new study and a research scientist at the Jet Propulsion Laboratory USA.

Cosmological Dilemma

In recent years, a discrepancy has emerged over the precise value of the universe's expansion rate, also known as Hubble-Lemaître's constant. Two primary means can be used to determine this number: one relies on measurements of the distance and speed of objects in our local universe, and the other extrapolates the rate from models based on distant radiation left over from the birth of our universe called the cosmic microwave background. The problem is that the numbers do not match. The quasars lie in between the local and distant targets used for the previous calculations. The new quasar quads, which the team gave nicknames such as "Wolf's Paw" and "Dragon Kite," will help in future calculations of Hubble-Lemaître's constant and may illuminate why the two primary measurements are not in alignment.



Caption: Four of the newfound quadruply imaged quasars are shown here: From top left and moving clockwise, the objects are: GraL J1537- 3010 or "Wolf's Paw;" GraL J0659+1629 or "Gemini's Crossbow;" GraL J1651-0417 or "Dragon's Kite;" GraL J2038-4008 or "

Humans and Machines Working Together

"Machine learning along with Augmented Intelligence (AI) tools was key to our study, but it is not meant to replace human decisions," explains Krone-Martins, Lecture at University of California. "We continuously train and update the models in an ongoing learning loop, such that humans and the human expertise are an essential part of the loop," said Krone-Martins, one of the authors of the study.

In the new study, the researchers used data from Wide-field Infrared Survey Explorer (WISE) to find likely quasars and then used the sharp resolution of Gaia to identify which of the WISE quasars were associated with possible quadruply imaged quasars. The researchers then applied machine-learning tools to pick out which candidates were most likely to multiply imaged sources and not just different stars sitting close to each other in the sky. Follow-up observations by Keck

Observatory at U.S. state of Hawaii; Palomar Observatory at California, United States, the New Technology Telescope operated by the European Southern Observatory, and Gemini-South Observatory at Hawaii confirmed which of the objects were indeed quadruply imaged quasars lying billions of light-years away.

Confirming candidates with spectral data

Priyanka Jalan, a Ph.D. student at Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, India, and Jean Surdej, Visiting astronomer at ARIES, have been very actively involved in the reduction and analysis of spectra of quasar components obtained from large ground-based telescopes.

"Many two lensed images of a single quasar have been found in the past, however, finding four lensed images is like searching for a cloverleaf in a large green field. It is thus appropriate to name those mirages "cosmic clover-leaves," says Jean Surdej, member of GraL and Professor at the University of Liege, Belgium.

Further astrophysical studies of these new cosmic clover-leaves and other multiply imaged quasars with the 3.6m Devasthal Optical Telescope (DOT) and the upcoming 4m International Liquid Mirror Telescope (ILMT) facilities operated by ARIES should lead to an independent determination of the age of the Universe and its expansion rate.

"Considering the excellent seeing conditions at Devasthal and frontline back-end instruments, candidate multiply quasar sources can be most suitably observed with the 3.6m DOT," said Brijesh Kumar, Astronomer-in-charge of 3.6m DOT Facility.

https://www.pib.gov.in/PressReleasePage.aspx?PRID=1710415

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विज्ञान एवं प्रौद्योगिकी मंत्रालय

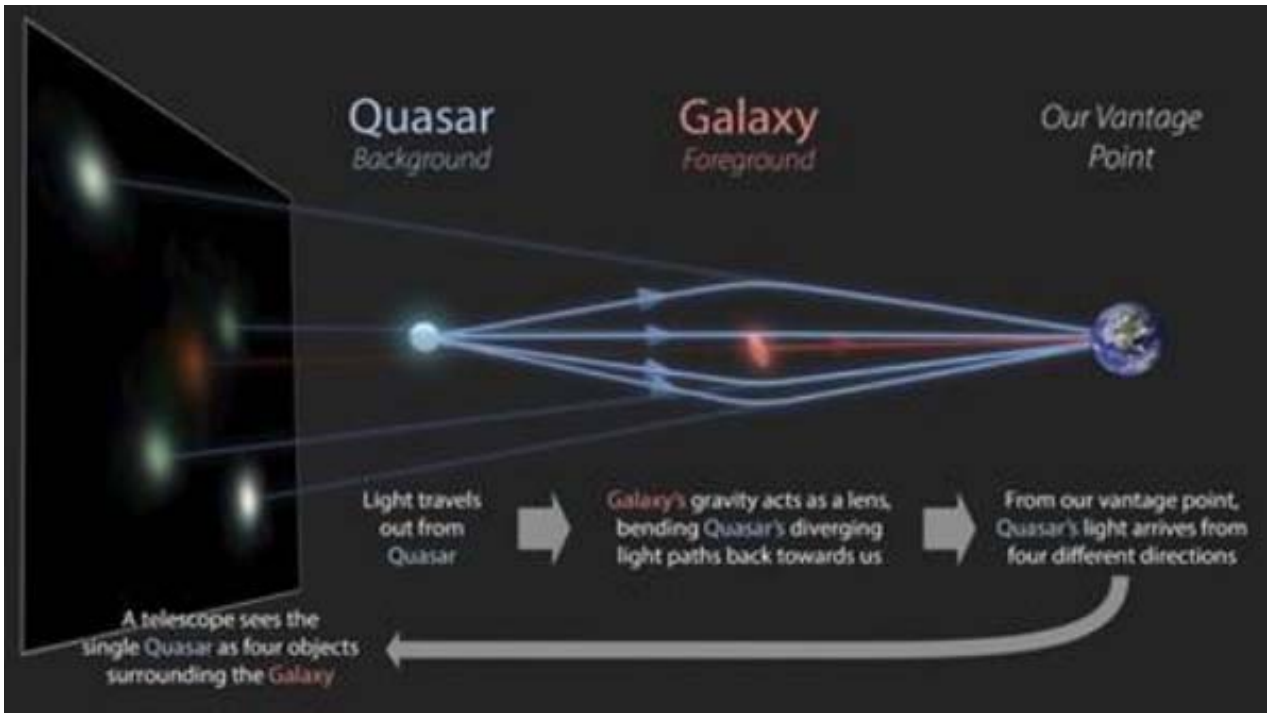
Wed, 08 April 2021 3:47PM

दर्जन भर दुर्लभ चौकोर छवि के आकाशीय पिंड क्वाजर की खोज से ब्रह्मांड की विस्तार दर निर्धारित करने में मदद मिल सकती है

खगोल विज्ञानियों के एक समूह ने एक दर्जन आकाशीय पिंड की खोज की है जो प्राकृतिक कॉस्मिक लेंस से ढके हुए हैं और एक तरह की चार छवियों में बंटे हैं। इस दुर्लभ खोज से ज्ञात क्वाजर की संख्या लगभग 25 प्रतिशत बढ़ी है और इससे ब्रह्मांड की विस्तार दर निर्धारित करने तथा अन्य रहस्यों के समाधान में मदद मिलेगी।

क्वाजर दूर आकाश गंगा की अत्यधिक चमकीला पिंड है जिसे सुपरमैसिव ब्लैकहोल से ऊर्जा मिलती है। चौकोर छवि के क्वाजर दुर्लभ हैं और पहली चौकोर छवि 1985 में खोजी गई। पिछले चार दशकों में खगोल विज्ञानियों को चौकोर छवि के 50 क्वाजर मिले। यह तब मिले जब विशाल आकाशगंगा का गुरुत्वाकर्षण क्वाजर के सामने होता है और यह एकल छवि को चार छवियों में विभाजित कर देता है।

यह अध्ययन खगोल विज्ञानियों के समूह गाइया ग्रैविटेशनल लेंसेज वर्किंग ग्रुप (जीआरएए) द्वारा किया गया है। इसमें आर्यभट्ट रिसर्च इंस्टीट्यूट ऑफ ऑब्जर्वेशनल साइंसेज (एआरआईईएस), नैनीताल के वैज्ञानिक हैं। डेढ़ वर्ष के इस अध्ययन में ऐसे ब्रह्मांडीय तारों के समूहों की खोज में खगोल विज्ञानियों की मदद के लिए मशीन लर्निंग की शक्ति दिखाती है 'द एस्ट्रोफिजिकल जर्नल' में प्रकाशन के लिए इसे स्वीकृत किया गया है। नए अध्ययन के लीड ऑथर तथा जेट प्रोपल्सन लेबोरेटरी अमेरिका के शोध विज्ञानी डैनियल स्टर्न ने कहा कि क्वाड सभी प्रकार के सवालों के लिए सोने की खान हैं।



यह रेखा चित्र दिखाता है कि आसमान में किस तरहचौकोर छवि के क्वाजर उत्पन्न होते हैं। दूर के क्वाजर की रोशनी आकाशगंगा के गुरुत्वाकर्षण से झुकी है जो इसके समक्ष होती है। प्रकाश के झुकने से यह इल्युजन होता है कि क्वाजर समान प्रकार के चार भागों में बंट गए हैं।
छविः **R. Hurt (IPAC/Caltech) / The GraL Collaboration.**

वे ब्रह्मांड की विस्तार दर निर्धारित करने में मदद कर सकते हैं और डार्क मैटर तथा क्वाजर सेंट्रल इंजन जैसे रहस्यों का समाधान कर सकते हैं।

ब्रह्मांडीय दुविधा

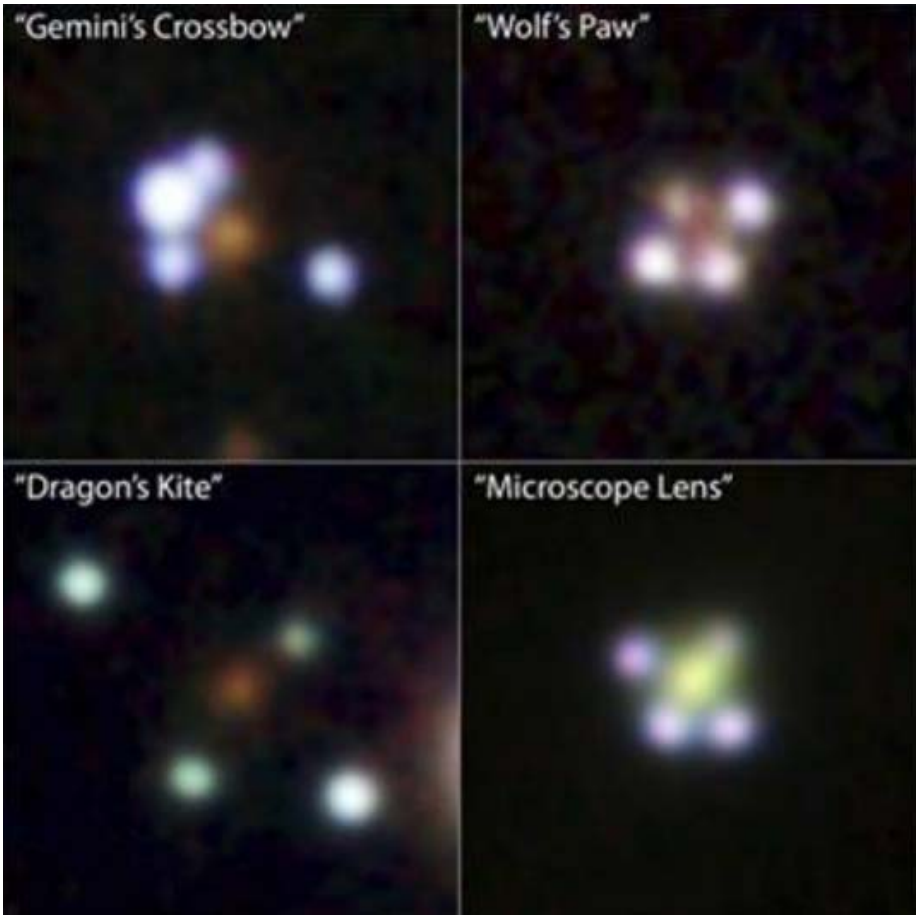
हाल के वर्षों में ब्रह्मांड की विस्तार दर के सटीक मूल्य को लेकर असंगति उभर है। इसे हबबल-लिमेत्रे कॉस्टेंट कहा जाता है। इस संख्या को निर्धारित करने के लिए दो प्राथमिक साधनों का उपयोग किया जा सकता है। पहला साधन दूरी और हमारे स्थानीय ब्रह्मांड में वस्तु की गति मापन पर निर्भर करता है जबकि दूसरा साधन ब्रह्मांड के जन्म के समय बचे दूर के रेडिएशन पर आधारित मॉडलों से दर को बढ़ाता है जिसे कॉस्मिक माइक्रोवेब बैकग्राउंड कहते हैं। समस्या संख्याओं के नहीं मिलने को लेकर है। स्थानीय तथा पहले की गणनाओं में प्रयुक्त दूर के लक्ष्यों के बीच क्वाजर रहते हैं। अध्ययन दल ने नए क्वाजर क्वाडों को 'ओल्फॉपा' तथा 'ड्रेगनकाइट' नाम दिए हैं। इनसे हबबल-लिमेत्रे कॉस्टेंटकी भविष्य में गणना में मदद मिलेगी और यह स्पष्ट होगाकि दो प्राथमिक मापन एक सीध में नहीं हैं।

मानव तथा मशीन का एक साथ काम करना

कैलीफोर्नियां विश्वविद्यालय के ग्रोन-मार्टिस बताते हैं कि हमारे अध्ययन का प्रमुख टूल अगुमेंटेल इंटेलीजेंस के साथ मशीन लर्निंग था। लेकिन यह मानवीय निर्णय को बदलने के लिए नहीं था। हम जारी लर्निंग लूप में मॉडलों को प्रशिक्षित और अपडेट करते हैं जैसे मानव और मानव विशेषज्ञता लूप के आवश्यक भाग हो।

नए अध्ययन में अनुसंधानकर्ताओं ने वाइल्ड फील्ड इन्फ्रारेड सर्वे इक्स्प्लोरर (डब्ल्यूआईएसई) से डेटा का इस्तेमाल संभावित क्वाजर का पता लगाने के लिए किया और फिर गाइया केशार्प रिसॉल्यूशन के इस्तेमाल से यह चिन्हित किया गया है कि कौन सा डब्ल्यूआईएसई क्वाजर संभावित चौकोर छवि के क्वाजरों से जुड़े हैं। शोधकर्ताओं ने फिर मशीन लर्निंग उपाय का इस्तेमाल किया, यह देखने के लिए कि कौन सा कैंडिडेट चित्रित स्रोत को बढ़ा सकता है और केवल इतना नहीं कि आसमान में एक दूसरे के निकट बैठे विभिन्न तारों को दिखाते। अमेरिका के हवाई स्थित केक ऑब्जर्वेटरी, कैलीफोर्निया की पालोमर ऑब्जर्वेटरी, यूरोपीय सदरन ऑब्जर्वेटरी द्वारा संचालित न्यू टेक्नोलॉजी

टेलीस्कोप तथा जेमिनि-साउथ ऑब्जर्वेटरी, हवाई के फॉलोअप ऑब्जर्वेशन में यह पुष्टि हुई कि अरबों खरब प्रकाश वर्ष पीछे पड़े चौकोर छवि के क्वाजर असल हैं।



अध्ययन में पाए गए चौकोर छवि के क्वाजर: ऊपर बायें से नीचे, पिंड हैं GraL J1537- 3010 or "Wolf's Paw;" GraL J0659+1629 or "Gemini's Crossbow;" GraL J1651-0417 or "Dragon's Kite;" GraL J2038-4008 or "Microscope Lens." चित्रों के मध्य में धुंधली बिंदु ***लेंसिंग गैलक्सी है। इसका गुरुत्वाकर्षण क्वाजर से प्रकाश को इस तरह बांट रहा है ताकि क्वाजर के चार चित्र मिले। समय के अनुसार चित्रोंकीचमक कैसे बदलती है इसकी मॉडलिंग और निगरानी करके खगोल विज्ञानी ब्रह्मांड की विस्तार दर निर्धारित कर सकते हैं और ब्रह्मांडीय समस्याओं के समाधान में मदद दे सकते हैं। छवि: The GraL Collaboration.***

स्पेशल डेटा के साथ कनफर्मिंग कैंडिटेड

आर्यभट्ट रिसर्च इंस्टीट्यूट ऑफ ऑब्जर्वेशन साइंसेस (एआरआईईएस), नैनीताल की पीएचडी की छात्रा प्रियंका जालान तथा एआरआईईएस में विजिटिंग खगोल विज्ञानी ज्यां सर्देज बड़े जमीनी टेलीस्कोपों से प्राप्त क्वाजर घटकों के इस्पेक्ट्रा के विश्लेषण में सक्रिय रूप से शमिल हैं। जीआरएएल के सदस्य तथा बेल्जियम के लीज विश्वविद्यालय के प्रोफेसर ज्यां सर्देज ने कहा कि पहले एकल क्वाजर के दो लेंस वाले चित्र तो मिले हैं यद्यपि चार लेंस वाले चित्रों को खोजना विशाल हरित क्षेत्र में तीन पत्तियां वाली घास को खोजना है। उन्होंने कहा कि इसमरीचिका को लॉकिक तीन पत्तियां घास का नाम देना सही है। इस नए ब्रह्मांडीय क्लोवरलीफ का आगे खगोल भौतकीय अध्ययन तथा 3.6एम देवस्थल ऑप्टिकल टेलीस्कोप (डीओटी) के साथ अन्य बढ़ने वाली छवि के क्वाजर का अध्ययन तथा एआरआईईएस द्वारा संचालित 4एम इंटरनेशनल लिक्विडमिरर टेलीस्कोप (आईएलएमटी) सुविधाओं से ब्रह्मांड की आयु और इसकी विस्तार दर स्वतंत्र रूप से निर्धारित हो सकेगा। 3.6एम डीओटी सुविधा के स्ट्रोनोमर प्रभारी बृजेश कुमार ने कहा कि देवस्थल और फ्रंटलाइन बैकएंड उपकरणों पर उत्कृष्ट स्थितियों को देखते हुए कैंडिटेड बढ़ाने वाले क्वाजर स्रोतों को उचित रूप से 3.6एम डॉट के साथ देखा जा सकता है।

https://pib.gov.in/PressReleasePage.aspx?PRID=1710559

THE TIMES OF INDIA

Fri, 09 April 2021

Gaganyaan: Uncrewed mission may happen without desi relay sat; ISRO may use foreign sat

By Chethan Kumar

New DelhI: ISRO, which has dedicated most of its resources to ensure the uncrewed mission as part of the Gaganyaan programme takes off this year as announced in the union budget, is confident of a December launch even as work on some systems are still ongoing. And, the agency may go ahead with the uncrewed mission without the indigenous data relay satellite and some aspects of the human rating of the systems. But both will be ready much ahead of the launch of humans.

The Gaganyaan Advisory Council (GAC) that met recently has also advised Isro not to delay the uncrewed mission. GAC, the apex panel on Gaganyaan comprises people from various Isro departments, academia, industry, army, navy, IAF, coast guard, DRDO, DST, IISc, IIT-Bombay, all other stakeholders including astronaut Rakesh Sharma, who are contributing to the mission and involved in the operations.

ISRO chairman K Sivan told TOI: "The GAC met at the end of March and unanimously advised us that the first uncrewed mission must happen at the earliest as it would give us crucial input for the manned mission. The relay satellite is required for Gaganyaan, but in case it is not ready by the time we launch the uncrewed mission, we may use another satellite. We are looking to tie up with some other agency. But by the time the manned mission happens, we will have our own."

The data relay satellite — Indian Data Relay Satellite System (IDRSS) — are in the 2,000 kg class that will need the GSLV for their launch into GEO. As per Isro's plans, Gaganyaan will be the first beneficiary of the IDRSS, which will be later also used for space-to-space tracking and communication of all space assets.

"Tracking and communication with any spacecraft will need a network of ground stations which will use the relay satellite to stay in touch with the spacecraft so as to ensure a continuous monitoring of all aspects of the spacecraft, including its path. At any given point — during the launch and even when Gaganyaan spacecraft is orbiting — at least one ground station needs to be able to see it. But with the current network that won't be possible, and that's where the relay satellite comes into play," another senior scientist explained.

Further Sivan said that the first uncrewed mission will demonstrate all the key systems designed and developed for Gaganyaan so as to give the agency time to make any changes that may arise before the manned mission.

"...For instance, the launch vehicle has a new configuration with CES (crew escape system) at the top, which will be flying for the first time. The characterisation of the vehicle, the in-orbit communication, thermal management and protection system during re-entry, control and guidance till the time we touch down and the recovery process upon touch down will all be tested," Sivan said.

He said the process of human rating was ongoing and that testing of the core stage is nearing completion. "Solid motor testing is planned before the first unmanned mission, cryo stage testing is going on. GLSV will be mostly human rated— the ergonomic characteristics and so on — but it will be fully ready before the manned mission," Sivan said.

https://timesofindia.indiatimes.com/india/gaganyaan-uncrewed-mission-may-happen-without-desi-relay-sat-isro-may-use-foreign-sat/articleshow/81974456.cms

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Fri, 09 April 2021

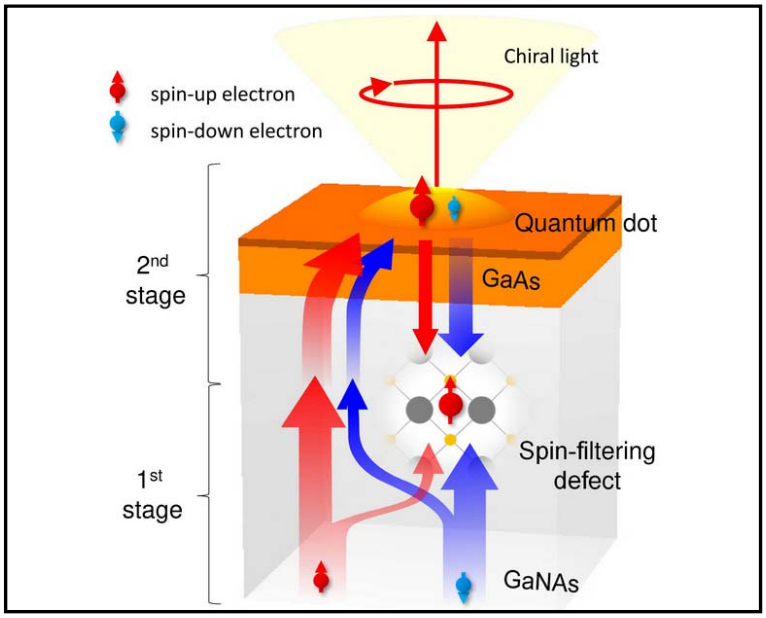
Researchers report breakthrough that enables practical semiconductor spintronics

It may be possible in the future to use information technology where electron spin is used to store, process and transfer information in quantum computers. It has long been the goal of scientists to be able to use spin-based quantum information technology at room temperature. A team of researchers from Sweden, Finland and Japan have now constructed a semiconductor component in which information can be efficiently exchanged between electron spin and light at room temperature and above. The new method is described in an article published in *Nature Photonics*.

It is well known that electrons have a negative charge; they also have another property called spin. This may prove instrumental in the advance of information technology. To put it simply, we can imagine the electron rotating around its own axis, similar to the way in which the Earth rotates around its own axis. Spintronics—a promising candidate for future information technology—uses this quantum property of electrons to store, process and transfer information. This brings important benefits, such as higher speed and lower energy consumption than traditional electronics.

Developments in spintronics in recent decades have been based on the use of metals, and these have been highly significant for the possibility of storing large amounts of data. There would, however, be several advantages in using spintronics based on semiconductors, in the same way that semiconductors form the backbone of today's electronics and photonics.

"One important advantage of spintronics based on semiconductors is the possibility to convert the information that is represented by the spin state and transfer it to light, and vice versa. The technology is known as opto-spintronics. It would make it possible to integrate information processing and storage based on spin with information transfer through light," says Weimin Chen, professor at Linköping University, Sweden, who led the project.



In the opto-spintronic nanostructure, an electron spin polarisation degree greater than 90% is achieved at room temperature in a quantum dot, via remote defect-enabled spin filtering through an adjacent layer of gallium nitrogen arsenide (GaNAs). When such a spin polarised electron recombines, it emits chiral light. The spin state of the electron determines whether the electromagnetic field of the light will rotate clockwise or anticlockwise around the direction of travel. Credit: Yuqing Huang

As electronics used today operates at room temperature and above, a serious problem in the development of spintronics has been that electrons tend to switch and randomize their direction of spin when the temperature rises. This means that the information coded by the electron spin states is lost or becomes ambiguous. It is thus a necessary condition for the development of semiconductor-based spintronics that we can orient essentially all electrons to the same spin state and maintain it, in other words that they are spin polarized, at room temperature and higher temperatures. Previous research has achieved a highest electron spin polarization of around 60% at room temperature, untenable for large-scale practical applications.

Researchers at Linköping University, Tampere University and Hokkaido University have now achieved an electron spin polarization at room temperature greater than 90%. The spin polarization remains at a high level even up to 110 °C. This technological advance, which is described in *Nature Photonics*, is based on an opto-spintronic nanostructure that the researchers have constructed from layers of different semiconductor materials. It contains nanoscale regions called quantum dots. Each quantum dot is around 10,000 times smaller than the thickness of a human hair. When a spin polarized electron impinges on a quantum dot, it emits light—to be more precise, it emits a single photon with a state (angular momentum) determined by the electron spin. Thus, quantum dots are considered to have a great potential as an interface to transfer information between electron spin and light, as will be necessary in spintronics, photonics and quantum computing. In the newly published study, the scientists show that it is possible to use an adjacent spin filter to control the electron spin of the quantum dots remotely, and at room temperature.

The quantum dots are made from indium arsenide (InAs), and a layer of gallium nitrogen arsenide (GaNAs) functions as a filter of spin. A layer of gallium arsenide (GaAs) is sandwiched between them. Similar structures are already being used in optoelectronic technology based on gallium arsenide, and the researchers believe that this can make it easier to integrate spintronics with existing electronic and photonic components.

"We are very happy that our long-term efforts to increase the expertise required to fabricate highly-controlled N-containing semiconductors is defining a new frontier in spintronics. So far, we have had a good level of success when using such materials for optoelectronics devices, most recently in high-efficiency solar-cells and laser diodes. Now we are looking forward to continuing this work and to unite photonics and spintronics, using a common platform for light-based and spin-based quantum technology," says Professor Mircea Guina, head of the research team at Tampere University in Finland.

More information: Room-temperature electron spin polarization exceeding 90% in an opto-spintronic semiconductor nanostructure via remote spin filtering, *Nature Photonics* (2021). DOI: 10.1038/s41566-021-00786-y

Journal information: *Nature Photonics*

https://phys.org/news/2021-04-breakthrough-enables-semiconductor-spintronics.html

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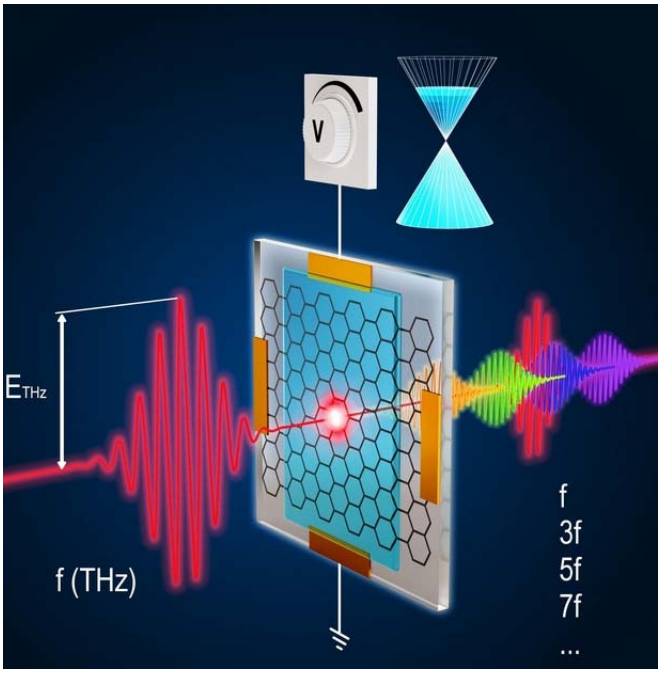
Fri, 09 April 2021

Research team demonstrates control mechanism for quantum material

How can large amounts of data be transferred or processed as quickly as possible? One key to this could be graphene. The ultra-thin material is only one atomic layer thick, and the electrons it contains have very special properties due to quantum effects. It could therefore be very well suited for use in high-performance electronic components. Up to this point, however, there has been a lack of knowledge about how to suitably control certain properties of graphene. A new study by a team of scientists from Bielefeld and Berlin, together with researchers from other research institutes in Germany and Spain, is changing this. The team's findings have been published in the journal *Science Advances*.

Consisting of carbon atoms, graphene is a material just one atom thick where the atoms are arranged in a hexagonal lattice. This arrangement of atoms is what results in graphene's unique property: the electrons in this material move as if they did not have mass. This "massless" behavior of electrons leads to very high electrical conductivity in graphene and, importantly, this property is maintained at room temperature and under ambient conditions. Graphene is therefore potentially very interesting for modern electronics applications.



When a control voltage is applied to graphene, the frequency conversion of the current can be controlled. Credit: Juniks, Dresden. CC-BY

It was recently discovered that the high electronic conductivity and "massless" behavior of its electrons allows graphene to alter the frequency components of electric currents that pass through it. This property is highly dependent on how strong this current is. In modern electronics, such a nonlinearity comprises one of the most basic functionalities for switching and processing of electrical signals. What makes graphene unique is that its nonlinearity is by far the strongest of all electronic materials. Moreover, it works very well for exceptionally high electronic frequencies, extending into the technologically important terahertz (THz) range where most conventional electronic materials fail.

In their new study, the team of researchers from Germany and Spain demonstrated that graphene's nonlinearity can be very efficiently controlled by applying comparatively modest electrical voltages to the material. For this, the researchers manufactured a device resembling a transistor, where a control voltage could be applied to graphene via a set of electrical contacts. Then, ultrahigh-frequency THz signals were transmitted using the device: the transmission and subsequent transformation of these signals were then analyzed in relation to the voltage applied. The researchers found that graphene becomes almost perfectly transparent at a certain voltage—its normally strong nonlinear response nearly vanishes. By slightly increasing or lowering the voltage from this critical value, graphene can be turned into a strongly nonlinear material, significantly altering the strength and the frequency components of the transmitted and remitted THz electronic signals.

"This is a significant step forward towards implementation of graphene in electrical signal processing and signal modulation applications," says Prof. Dmitry Turchinovich, a physicist at Bielefeld University and one of the heads of this study. "Earlier we had already demonstrated that graphene is by far the most nonlinear functional material we know of. We also understand the physics behind nonlinearity, which is now known as thermodynamic picture of ultrafast electron transport in graphene. But until now we did not know how to control this nonlinearity, which was the missing link with respect to using graphene in everyday technologies."

"By applying the control voltage to graphene, we were able to alter the number of electrons in the material that can move freely when the electrical signal is applied to it," explains Dr. Hassan A. Hafez, a member of Professor Dr. Turchinovich's lab in Bielefeld, and one of the lead authors of the study. "On one hand, the more electrons can move in response to the applied electric field, the stronger the currents, which should enhance the nonlinearity. But on the other hand, the more free electrons are available, the stronger the interaction between them is, and this suppresses the nonlinearity. Here we demonstrated—both experimentally and theoretically—that by applying a relatively weak external voltage of only a few volts, the optimal conditions for the strongest THz nonlin-earity in graphene can be created."

"With this work, we have reached an important milestone on the path towards to using graphene as an extremely efficient nonlinear functional quantum material in devices like THz frequency converters, mixers, and modulators," says Professor Dr. Michael Gensch from the Institute of Optical Sensor Systems of the German Aerospace Center (DLR) and the Technical University of Berlin, who is the other head of this study. "This is extremely relevant because graphene is perfectly compatible with existing electronic ultrahigh-frequency semiconductor technology such as CMOS or Bi-CMOS. It is therefore now possible to envision hybrid devices in which the initial electric signal is generated at lower frequency using existing semiconductor technology but can then very efficiently be up-converted to much higher THz frequencies in graphene, all in a fully controllable and predictable manner."

Researchers from Bielefeld University, the Institute of Optical Sensor Systems of the DLR, the Tech-nical University of Berlin, the Helmholtz Center Dresden-Rossendorf, and the Max Planck Institute for Polymer Research in Germany, as well as the Catalan Institute of Nanoscience and Nanotechnology (ICN2) and the Institute of Photonic Sciences (ICFO) in Spain participated in this study.

More information: Sergey Kovalev et al. Electrical tunability of terahertz nonlinearity in graphene, *Science Advances* (2021). DOI: 10.1126/sciadv.abf9809

Journal information: *Science Advances*

https://phys.org/news/2021-04-team-mechanism-quantum-material.html

EXPRESS HEALTHCARE

Fri, 09 April 2021

One in ten experience long-term effects eight months after mild COVID-19: Research

Eight months after mild COVID-19, one in ten people experience at least one moderate to severe symptom that is perceived to have a negative impact on their work, social or personal life, according to a study.

The study, published in the journal JAMA, found that the most common long-term symptoms are loss of smell and taste, and fatigue.

Researchers at Danderyd Hospital and Karolinska Institutet in Sweden have been conducting the so-called COMMUNITY study since spring last year, with the main purpose of examining immunity after COVID-19.

"We investigated the presence of long-term symptoms after mild COVID-19 in a relatively young and healthy group of working individuals, and we found that the predominant long-term symptoms are loss of smell and taste," said Charlotte Thalin, lead researcher for the COMMUNITY study at Danderyd Hospital and Karolinska Institutet.

"Fatigue and respiratory problems are also more common among participants who have had COVID-19 but do not occur to the same extent," Thalin said.

In the first phase of the study, blood samples were collected from 2,149 employees at Danderyd Hospital, of whom about 19 per cent had antibodies against SARS-CoV-2.

The researchers collected blood samples every four months, and study participants responded to questionnaires regarding long-term symptoms and their impact on the quality of life.

In the third follow-up in January this year, the team examined self-reported presence of long-term symptoms and their impact on work, social and home life for participants who had had mild COVID-19 at least eight months earlier.

This group consisted of 323 healthcare workers — 83 per cent women with a median age of 43 years — and was compared with 1,072 healthcare workers comprising 86 per cent women with median age of 47 years who did not have COVID-19 throughout the study period.

The results show that 26 per cent of those who had COVID-19 previously, compared to nine per cent in the control group, had at least one moderate to severe symptom that lasted more than two months.

About 11 per cent, compared to 2 per cent in the control group, had a minimum of one symptom with negative impact on work, social or home life that lasted at least eight months, according to the researchers.

The most common long-term symptoms were loss of smell and taste, fatigue, and respiratory problems, they said.

However, the researchers did not see an increased prevalence of cognitive symptoms such as brain fatigue, memory and concentration problems or physical disorders such as muscle and joint pain, heart palpitations or long-term fever.

Despite the fact that the study participants had a mild COVID-19 infection, a relatively large proportion report long-term symptoms with an impact on quality of life, they said.

“In light of this, we believe that young and healthy individuals, as well as other groups in society, should have great respect for the virus that seems to be able to significantly impair quality of life, even for a long time after the infection,” said Sebastian Havervall, a PhD student in the project at Karolinska Institutet.

The researchers said that the COMMUNITY study will continue, with the next follow-up taking place in May when a large proportion of study participants are expected to be vaccinated.

https://www.expresshealthcare.in/covid19-updates/one-in-ten-experience-long-term-effects-eight-months-after-mild-covid-19-research/428055/