

Dec  
2020

# समाचार पत्रों से चयित अंश Newspapers Clippings

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

खंड : 45      अंक : 283      10 दिसंबर 2020  
Vol.: 45      Issue : 283      10 December 2020



रक्षा विज्ञान पुस्तकालय  
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**Ministry of Defence**

*Wed, 09 Dec 2020 3:55PM*

## **Quantum Communication between two DRDO Laboratories**

Secure communications are vital for defence and strategic agencies world over and distribution of encryption keys from time to time is an important requirement in this context. Sharing of keys over the air or wired links requires encryption, which in turn requires encryption keys to be pre-shared. Quantum based communication offers a robust solution to sharing the keys securely. Defence Research & Development Organisation (DRDO) undertook the project for development of this technology.

A milestone of this project was achieved today when DRDO developed Quantum Key Distribution (QKD) technology underwent trials in Hyderabad between two DRDO labs, DRDL and RCI, to show secure communication. Raksha Mantri Shri Rajnath Singh congratulated the DRDO team for successful demonstration of QKD communication.

The technology is developed by CAIR, Bengaluru and DYSL-QT, Mumbai. Quantum Communication using time-bin Quantum Key Distribution (QKD) scheme was performed under realistic conditions. The setup also demonstrated the validation of detection of a third party trying to gain knowledge of the communication. Quantum based security against eavesdropping was validated for the deployed system at over 12kms range and 10dB attenuation over fibre optic channel.

Continuous wave laser source was used to generate photons without depolarization effect. The timing accuracy employed in the setup was of the order of picoseconds. The Single photon avalanche detector (SPAD) recorded arrival of photons and key rate was achieved in the range of kbps with low Quantum bit error rate. Software was developed for data acquisition, time synchronization, post-processing, determining Quantum bit error rate and extracting other important parameters.

The work being done at DRDO will be used to enable start-ups and SMEs in the domain of Quantum information technologies. It will also serve to define standards and crypto policies that can leverage QKD system in a unified Cipher Policy Committee (CPC) framework for more secure and pragmatic key management for current and future military cryptographic systems.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1679349>



## दो डीआरडीओ प्रयोगशालाओं के बीच क्वांटम संचार

रक्षा और सामरिक एजेंसियों के लिए सुरक्षित संचार दुनिया भर में महत्वपूर्ण है और समय-समय पर एन्क्रिप्शन कुंजी का वितरण इस संदर्भ में एक महत्वपूर्ण आवश्यकता है। हवा या वायर्ड लिंक पर कुंजियों को साझा करने के लिए एन्क्रिप्शन की आवश्यकता होती है, जिसके लिए एन्क्रिप्शन कुंजी को पूर्व-साझा करने की आवश्यकता होती है। क्वांटम आधारित संचार कुंजी को सुरक्षित रूप से साझा करने के लिए एक मजबूत समाधान प्रदान करता है। रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) ने इस प्रौद्योगिकी के विकास के लिए परियोजना शुरू की है।

इस परियोजना का एक लक्ष्य आज इस समय हासिल किया गया जब डीआरडीओ ने सुरक्षित संचार दिखाने के लिए दो डीआरडीओ प्रयोगशालाओं, डीआरडीएल और आरसीआई के बीच हैदराबाद में क्वांटम कुंजी वितरण (क्यूकेडी) तकनीक का परीक्षण किया। रक्षा मंत्री श्री राजनाथ सिंह ने क्यूकेडीसंचार के सफल प्रदर्शन के लिए डीआरडीओटीम को बधाई दी।

यह तकनीक सीएआईआर, बेंगलुरु और डीवाईएसएल-क्यूटी, मुंबई द्वारा विकसित की गई है। क्वांटम कम्युनिकेशन टाइम-बिन क्वांटम कुंजी वितरण (क्यूकेडी) योजना का उपयोग करके यथार्थ परिस्थितियों में किया गया था। सेटअप ने संचार की जानकारी प्राप्त करने की कोशिश कर रहे एक तीसरे पक्ष का पता लगाने की पद्धति का भी प्रदर्शन किया। जासूसी गतिविधियों के खिलाफ क्वांटम आधारित सुरक्षा 12 किलोमीटररेंज में तैनात की गई और इसे सिस्टम और फाइबर ऑप्टिक चैनल पर 10डीबीक्षीणता के लिए मान्य किया गया।

सतत तरंग लेजर स्रोत का उपयोग चुम्बकत्व प्रभाव (डीपोलराइजेशन इफैक्ट) के बिना फोटोन उत्पन्न करने के लिए किया गया था। सेटअप में नियत समय सटीकता पिकोसेकंड की थी। सिंगल फोटॉन एवलांच डिटेक्टर (एसपीएडी) ने फोटॉनों के आने को दर्ज किया और कम क्वांटम त्रुटि दर के साथ केपीएस की श्रेणी में कुंजी दर हासिल की गई। सॉफ्टवेयर को डाटा अधिग्रहण, टाइम सिंक्रोनाइजेशन, पोस्ट-प्रोसेसिंग, क्वांटम बिट त्रुटि दर निर्धारित करने और अन्य महत्वपूर्ण मापदंडों को निकालने के लिए विकसित किया गया था।

डीआरडीओ में किए जा रहे काम का उपयोग क्वांटम सूचना प्रौद्योगिकी के क्षेत्र में स्टार्ट-अप और एसएमई को सक्षम करने के लिए किया जाएगा। यह मानकों और क्रिप्टो नीतियों को परिभाषित करने के लिए भी काम करेगा, जोकि वर्तमान और भविष्य के सैन्य क्रिप्टोग्राफिक सिस्टम के लिए एकीकृत संकेताक्षर नीति समिति (सीपीसी) ढांचे में क्यूकेडी प्रणाली का लाभ उठाकर अधिक सुरक्षित और व्यावहारिक कुंजी प्रबंधन प्रदान करेगा।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1679422>



## రెండు డీఆర్డీఓ ప్రయోగశాలల మధ్య 'క్వాంటమ్ కమ్యూనికేషన్'

ప్రపంచ వ్యాప్తంగా రక్షణ, వ్యూహాత్మక ఏజెన్సీల సురక్షితమైన సమాచార మార్పిడి చాలా ముఖ్యమైనది. దీనికి తోడు ఈ నేపథ్యంలో ఎప్పటికప్పుడు 'గుప్తీకరణ కీ'ల పంపిణీ కూడా ఒక అతి ముఖ్యమైన అవసరం. వైర్లెస్ విధానంలో గాలిలో లేదా వైర్లెస్ లింక్లపై సమాచారం పంపకోవడానికి గాను ఎన్క్రిప్షన్ (గుప్తీకరణ) ఎంతో అవసరం. ఇందుకు గాను ముందుగా ఆ గుప్తీకరణ కీలను పంపకోవడం కూడా ఎంతో అవసరం. క్వాంటమ్ ఆధారిత కమ్యూనికేషన్ ఈ తరహా కీలను సురక్షితంగా పంపకోవడానికి ఎంతో బలమైన పరిష్కారాన్ని అందిస్తుంది. డిఫెన్స్ రీసెర్చ్ & డెవలప్ మెంట్ ఆర్గనైజేషన్ (డీఆర్డీఓ) ఈ సాంకేతిక పరిజ్ఞానం అభివృద్ధి కోసం ఈ ప్రాజెక్టును చేపట్టింది. హైదరాబాద్ లో డీఆర్డీఓకు చెందిన రెండు ల్యాబ్ లు డీఆర్డీఓ, ఆర్ సీఐల మధ్య ఈ వ్యవస్థ పరీక్షలు విజయవంతపు నిర్వహణ ద్వారా డీఆర్డీఓ రూపొందించిన క్వాంటమ్ కీ డిస్ట్రిబ్యూషన్ (క్యూకేడీ) సురక్షితమైన సంభాషణను మెరుగైనది నిలిచింది. తద్వారా ప్రాజెక్టులో ఇది ఒక మేటి మైలురాయిని దాటింది. క్యూకేడీ కమ్యూనికేషన్ వ్యవస్థను విజయవంతంగా ప్రదర్శించినందుకు డీఆర్ ఐసీవో బృందాన్ని రక్షణ మంత్రి శ్రీ రాజ్ నాథ్ సింగ్ అభినందించారు. ఈ సాంకేతిక పరిజ్ఞానాన్ని బెంగళూరులోని సీఐఐఆర్ మరియు ముంబైలోని డీవైఎస్ఎల్- క్యూటీ అభివృద్ధి చేశాయి. టైమ్-బిన్ క్వాంటమ్ కీ డిస్ట్రిబ్యూషన్ (క్యూకేడీ) పథకాన్ని ఉపయోగించి క్వాంటమ్ కమ్యూనికేషన్ వాస్తవిక పరిస్థితులలో జరిగింది. కమ్యూనికేషన్ యొక్క జ్ఞానాన్ని పొందడానికి ప్రయత్నిస్తున్న మూడవ పక్షాన్ని గుర్తించే ధృవీకరణను కూడా ఈ సెటప్ ప్రదర్శించింది. ఈవ్ డ్రాపింగ్ కు వ్యతిరేకంగా క్వాంటమ్ ఆధారిత భద్రత 12 కిలోమీటర్ల పరిధిలో మోహరించిన వ్యవస్థకు, పైబర్ ఆప్టిక్ ఛానల్ పై 10 డీబీ అటెన్యూయేషన్ కు ధృవీకరించబడింది. డిపోలరైజేషన్ ప్రభావం లేకుండా ఫోటాన్ల ఉత్పత్తి చేయడానికి నిరంతర వేవ్ లేజర్ మూలాన్ని ఇందులో ఉపయోగించారు. సింగిల్ ఫోటాన్ అవలాంచ్ డిటెక్టర్ (ఎన్ పీఎడీ) ఫోటాన్ల రాకను నమోదు చేసింది. తక్కువ క్వాంటమ్ బిట్ ఎర్రర్ రేట్ తో కేబిపీఎస్ పరిధిలో ఈ కీ రేటు సాధించబడింది. డేటా సముపార్జన, సమయ సమకాలీకరణ, పోస్ట్-ప్రాసెసింగ్, క్వాంటమ్ బిట్ లోపం రేటును నిర్ణయించడం మరియు ఇతర ముఖ్యమైన పారామితులను సేకరించడం కోసం సాఫ్ట్ వేర్ అభివృద్ధి చేయబడింది. డీఆర్డీఓ వద్ద జరుగుతున్న పని క్వాంటమ్ ఇన్ఫర్మేషన్ టెక్నాలజీల డొమైన్ లో స్టార్ట్ అప్ లు మరియు ఎస్ఎంఈలను ప్రారంభించడానికి ఇది ఎంతగానో ఉపయోగపడుతుంది. ప్రస్తుత మరియు భవిష్యత్ సైనిక క్రిప్టోగ్రాఫిక్ వ్యవస్థల కోసం మరింత సురక్షితమైన మరియు ఆచరణాత్మక కీ నిర్వహణ కోసం ఏకీకృత సైఫర్ పాలసీ కమిటీ (సీపీసీ) ప్రిమ్ వర్క్ లో క్యూకేడీ వ్యవస్థను ప్రభావితం చేయగల ప్రమాణాలు మరియు క్రిప్టో విధానాలను నిర్వచించడానికి కూడా ఇది ఉపయోగపడుతుంది.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1679465>

## DRDO successfully tests quantum key distribution tech for secure communication between 2 facilities

*DRDO scientists said that the work being done on QKD technology at DRDO will be used to enable start-ups and small and medium enterprises in the domain of quantum information technologies*

Pune: Achieving an important milestone, the Quantum Key Distribution (QKD) technology developed by the Defence Research and Development Organisation (DRDO) has undergone trials between two laboratories in Hyderabad where the quantum technology- based security was validated for a range of 12 km over a fibre optic channel.

QKD is primarily a mechanism to undertake secure communication which utilises a cryptographic protocol involving various components of quantum mechanics. The technology enables two communicating sides to come up with random secret keys shared by both of them and known exclusively to them, so only they can use it to encrypt and decrypt messages, thus achieving highly-secure communication.

The technology has been developed by two DRDO facilities, Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, and DRDO Young Scientists' Laboratory – Quantum Technology (DYSL-QT), Mumbai.

Defence Minister Rajnath Singh congratulated the DRDO team for successful demonstration of QKD communication. As part of a successful trial, the technology was tested in real life conditions and performed well on all parameters. As part of the test simulation, an entity trying to gain access to communication was also detected by the system.

DRDO scientists said that the work being done on QKD technology at DRDO will be used to enable start-ups and small and medium enterprises in the domain of quantum information technologies. The technology is expected to help define standards and formulate crypto technology related policies that can use the QKD system in a unified Cipher Policy Committee (CPC) framework in the country for more secure 'key management' for current and future military cryptographic systems, said senior officials.

"Secure communications are vital for defence and strategic agencies world over and distribution of encryption keys from time to time is an important requirement in this context. Sharing of keys over the air or wired links requires encryption, which in turn requires encryption keys to be pre-shared. Quantum-based communication offers a robust solution to sharing the keys securely. DRDO has undertaken the project for development of this technology. A milestone of this project was achieved today when DRDO-developed Quantum Key Distribution technology underwent trials in Hyderabad between two DRDO labs, Defence Research and Development Laboratory (DRDL) and Research Centre Imarat (RCI) to show secure communication," read a press statement from the Ministry of Defence.

"...Quantum Communication using the time-bin Quantum Key Distribution scheme was performed under realistic conditions. The set-up also demonstrated the validation of detection of a third party trying to gain knowledge of the communication. Quantum-based security against eavesdropping was validated for the deployed system at over 12 km range and 10 decibel attenuation over fibre optic channel," added the statement.



Defence Minister Rajnath Singh congratulated the DRDO team for successful demonstration of QKD communication.

Giving further technical details of the process, DRDO said, “A continuous wave laser source was used to generate photons without depolarization effect. The timing accuracy employed in the set-up was of the order of picoseconds. The single photon avalanche detector (SPAD) recorded arrival of photons and key rate was achieved in the range of kbps with low Quantum bit error rate. Software was developed for data acquisition, time synchronization, post-processing, determining quantum bit error rate and extracting other important parameters. “

<https://indianexpress.com/article/india/drdo-successfully-tests-quantum-key-distribution-tech-for-secure-communication-between-2-facilities/>

# अमर उजाला

Thu, 10 Dec 2020

## डीआरडीओ ने दो प्रयोगशालाओं के बीच क्वांटम संचार का सफल परीक्षण किया

नई दिल्ली: रक्षा अनुसंधान व विकास संगठन (डीआरडीओ) ने बुधवार को क्वांटम की डिस्ट्रीब्यूशन (क्यूकेडी) प्रौद्योगिकी का इस्तेमाल कर अपनी दो प्रयोगशालाओं के बीच सफलतापूर्वक संचार किया। यह एन्क्रिप्शन की साझा करने का सबसे मजबूत तरीका है।

इस प्रौद्योगिकी में एन्क्रिप्शन कुंजी को फाइबर ऑप्टिक केबल के जरिये क्यूबिट के रूप में भेजा जाता है। क्वांटम कंप्यूटिंग में इन क्यूबिट का बुनियादी स्रोत के तौर पर इस्तेमाल किया जाता है। यह ठीक उसी तरह है जैसे सामान्य कंप्यूटिंग में बुनियादी स्रोत के रूप में बाइट का इस्तेमाल होता है।

डीआरडीओ ने कहा, पूरी दुनिया में रक्षा व सामरिक एजेंसियों के लिए सुरक्षित संचार काफी महत्वपूर्ण है। इस परिप्रेक्ष्य में समय समय पर एन्क्रिप्शन कुंजी का आदान प्रदान बेहद जरूरी है। इन कुंजियों को सुरक्षित तरीके से साझा करने का समाधान क्वांटम आधारित संचार मुहैया करता है।

रक्षामंत्री राजनाथ सिंह ने हैदराबाद की दो प्रयोगशालाओं के बीच क्वांटम संचार की सफल प्रस्तुति के लिए डीआरडीओ को बधाई दी। परीक्षण के दौरान संचार की जानकारी हासिल करने की कोशिश कर रहे तीसरे पक्ष का पता लगाने की पद्धति का भी प्रदर्शन किया।

<https://www.amarujala.com/india-news/drdo-successfully-tests-quantum-communication-between-two-laboratories>

## Bringing together top Scientists, Researchers on one platform

*The IISF-2020 proposes to bring more than 10,000 researchers, scientists and experts from different subjects to discuss their research findings and exchange innovative ideas on the identified research themes, says Union Minister Dr Harsh Vardhan*

*By Ashish Singh*

New Delhi: Dr Harsh Vardhan, Union Minister of Science & Technology, Earth Sciences and Health & family Welfare, has said that organising the India International Science Festival-2020 this year on a virtual platform due to Covid-19, signifies the indomitable spirit of nurturing and celebrating scientific temperament amongst all the stakeholders of science, technology and innovation. He was addressing the audience through video-conferencing as the Chief Guest at the Curtain Raiser function of IISF-2020 organised by the Defence Institute of High Altitude Research (DIHAR) of the Defence Research and Development Organisation (DRDO), Ladakh.

Dr Harsh Vardhan expressed the hope that “with use of digital platform, IISF will be able to bring together people from the remotest corners of the country in a single click, thereby helping in fulfilling the objectives of organising IISF”. Wishing all the stake holders of science and technology and allied organisations who are part of this festival a grand success, the Minister said, “The IISF-2020 proposes to bring more than 10,000 researchers, scientists and experts from different subjects to discuss their research findings and exchange innovative ideas on the identified research themes”.

The minister explained, “The theme for IISF-2020: ‘Science for Self-Reliant India and Global Welfare’ is very relevant in present context when nation is looking towards Science & Technology for accelerating growth and for spearheading the vision of an ‘Aatmanirbhar Bharat’.” He said, “IISF is a much-awaited annual event for students and science loving citizens from all spheres of life”.

Among the participants in the virtual function included R.K. Mathur, Lt Governor, Ladakh; JamyangTsering Namgyal, Member of Parliament, Ladakh; Tashi Gyalsen, Chief Executive Councilor, LAHDC, Leh-Ladakh; Dr G. Satheesh Reddy, Secretary, DD R&D and Chairman DRDO; Dr O.P. Chaurasia, Director, DIHAR, Leh; Dr A.K. Singh, DS & DG (LS) DRDO.

The Defence Institute of High Altitude Research (DIHAR) of DRDO, located at Leh at an altitude of 11,500 ft, has been chosen for the event due to its unique contributions to the region of Ladakh in improving the living conditions of local population and soldiers through scientific development and also for contributing to military civil fusion in this strategically located area.





Dr Harsh Vardhan expressed his happiness saying, “Today farmers in Ladakh are growing varieties of fruits and vegetables in the uncongenial terrain, which was not possible few decades back.”

He further added, “The contributions of the Institute are true reflection of the power of science and technology to bring changes at grass root level. In my opinion, organisers of the IISF-2020 have made the right selection of the venue for launch of the curtain raiser of this upcoming festival. The work being carried by the institute truly matches with the goal of the event... I have great satisfaction that one of the curtain raisers in the series is being organised at newly established Union Territory of Ladakh.”

Lt Governor of Ladakh UT, R.K. Mathur, in his address, briefed about the role of Science & Technology to improve the socio-economic standard of population as well as its inherent capacity to reach every corner of our country, irrespective of challenging physical boundaries. “This becomes more relevant in Ladakh like region, where the prevailing harsh environment throws great challenge for sustenance of humans and animals. S&T has immensely helped to make livelihood in Ladakh more comfortable for the general public and remunerative for the local farmers, for which contribution of DIHAR is commendable”. He also briefed about the huge potential to exploit renewable energy sources of Ladakh to make the region self sustainable with zero carbon emission.

JamyangTsering Namgyal, MP Ladakh, in his address, spoke about contributions made by DIHAR by developing suitable technologies to increase the availability of vegetable diversity in Ladakh. Endeavours like this, utilising the potential of S&T, have to be disseminated in various other domains and far flung locations, he said.

Dr A.K. Singh, DS & DG (LS), DRDO, talked about the importance of taking science out of R&D premises to the actual field locations so that livelihood of the population is made healthier, economical and sustainable. He further emphasised upon strengthening S&T to find local solutions to the prevailing local problems.

Dr O.P. Chaurasia, Director, DIHAR and overall coordinator of this event at Leh, in his welcome address, mentioned about the importance of organizing such an event in remote location of Ladakh and he pledged to disseminate the developed technologies among the masses in this high altitude region of Ladakh. The event witnessed participation via online media from diverse areas like administration, policy, education, agriculture, entrepreneurship and students.

Established in 1960, DIHAR has developed regionally suited agro-animal technologies for the unique terrain and climatic conditions. The institute continues to carry on the good work to fuse economic and social development strategies for local populace with security strategies for the country to build an integrated national strategic system and capabilities in support of national rejuvenation goals which is the need of the day. DIHAR under the aegis of DRDO endeavours to strengthen food, health and energy security of the troops deployed in high Himalayas through scientific innovations, transfer of technologies and involvement of the local population to augment the availability of fresh food for the army. Over the years, DIHAR has evolved as a doyen of high altitude research and pioneered the development of the cold arid agro-animal technologies for high altitude to ensure sustenance and enhancing the performance of troops guarding the northern frontiers.

The 6th IISF-2020 is being organised from 22 to 25 December 2020 in virtual mode. It is in this context that a series of curtain raisers are being organised in different regions of country so that maximum population can benefit from the event. This is the largest science festival on virtual platform. This year, 41 events will be organised under 9 verticals. This year IISF 2020 is attempting entries in Guinness World Records under five different categories. The registration is open for 33 events out of 41 events. The participation in the overseas ministers and diplomats’ conclave, state S&T conclave, science education in India and Guinness World Records will be through nominations and direct invitation.

<https://thedailyguardian.com/bringing-together-top-scientists-researchers-on-one-platform/>

## India offers LCA Tejas trainer variant to US Navy: Report

*To replace the US Navy's T-38 Goshawk, India touts the LIFT variant of the LCA Tejas*

In response to the US Navy's Request for Information (RFI) for a jet trainer to replace its Boeing T-45 Goshawk, India has reportedly offered the Lead in Fighter Trainer (LIFT) variant of the HAL Tejas. According to a report published in the Economic Times, India has responded to the RFI with a detailed project plan for the LIFT variant. The US is said to be still evaluating the offer.

This would be the first time India has offered the domestically-developed fighter to a developed nation. In the past, India has offered the Tejas to Malaysia, and has exhibited it at the Bahrain Air Show. Sri Lanka and Egypt had both shown interest in the fighter in 2018.

The LIFT variant of the Light Combat Aircraft (LCA) Tejas will be based on the Mk-1A variant that is on order by the Indian Air Force.

"We have done all the work in house," Hindustan Aeronautics Ltd (HAL) chairperson R. Madhavan told ET. "The same platform can be used to mimic any other platform. All that needs to be done is put in the flying characteristics and things will change to the selected aircraft. For example, if they Rafale characteristics, to the pilot it will seem like he is flying Rafale, which will help in the advanced training process."



A collage of the naval LCA (DRDO) and the INS Vikramaditya (Indian Navy)

The US Naval Air Systems Command (NAVAIR) requirement to replace the Goshawk, curiously, is not for a carrier-capable fighter. According to the RFI, as reported by Janes in May, the requirement seeks a twin-seat land-based jet trainer aircraft design capable of performing land-based Field Carrier Landing Practice (FCLP) events and ship-based carrier touch-and-go events for US Navy and US Marine Corps (USMC) pilots.

While the Indian Navy has conducted carrier trials of the naval variant of the Tejas, it has not made plans to acquire the same in its present form, after rejecting the aircraft in 2016 for being too heavy. The Navy has instead sought to see the Tejas used to develop and test technologies for use on a planned twin-engine deck based fighter (TEDBF). The Navy has been looking to acquire up to 57 jets for the same at a cost of \$9.6 billion, a number that has reportedly been trimmed to 36. Several international players have been bidding for the same including Boeing and Dassault.

However, in 2018, HAL began work on the Supersonic Omni Role Trainer Aircraft (SpORT)—which was in October renamed the Lead-In Fighter Trainer (LIFT)—in order to participate in the US' T-X programme which sought to replace the Northrop T-38 Talon. However, the US Air Force went on to select the T-7 Red Hawk.

In a bid to market the Tejas to other countries, India has planned to set up logistics bases in Malaysia, Vietnam, Indonesia and Sri Lanka, PTI reported in March. According to HAL Chairman and Managing Director R. Madhavan, HAL was seriously focusing on boosting exports in syncs with the government's priority and had identified South East Asia, West Asia and North Africa to sell key platforms like Tejas, the Rudra attack helicopter, and the advanced light helicopter Dhruv.

<https://www.theweek.in/news/india/2020/12/09/india-offers-lca-tejas-trainer-variant-to-us-navy-report.html>

# Big 2020 for Indian Armed Forces: China escalation to indigenisation push, 10 developments

*2020 has been a big year for the Indian Armed Forces, with indigenisation, upgrades, rule-changes and other matters, along with elevated tensions with China*

*By Vishal Tiwari*

2020 has been an extraordinary year for the Indian defence forces as the country achieved greater heights in terms of military cooperation with other nations, in modernising and replenishing its arsenal, and also in pushing for indigenisation of military hardware to cut short its reliance on imports and to boost exports. This becomes pertinent given the sharp escalation witnessed in India-China ties in addition to the constant menace of Pakistan-sponsored terrorism.

The tensions with China spiked when 20 Indian Jawans were martyred on the icy heights of Galwan valley in an ambush by the Chinese PLA on the intervening night of June 15 and 16 - the first time casualties had resulted from a clash between the two powerful neighbours in decades. The tell-tale Chinese attempt at expansion came amid Beijing facing heat from all sides owing to the Coronavirus pandemic originating from its shores. India stood firm faced with the dragon, however, making moves diplomatically, militarily as well as in its internal policies to corner China. Prime Minister Narendra Modi called out 'vistarvaad' on numerous forums, most significantly by personally going to Leh and addressing the troops at what is undoubtedly India's territory.



India stood firm faced with the dragon, however, making moves diplomatically, militarily as well as in its internal policies to corner China. Prime Minister Narendra Modi called out 'vistarvaad' on numerous forums, most significantly by personally going to Leh and addressing the troops at what is undoubtedly India's territory.

India which has the world's third-largest military budget, increased its expenditure this year by a whopping \$10 billion as the government wants the tri-services to use more homegrown technologies as opposed to foreign-made hardware in line with the Make in India initiative. Let's take a look at some of the most significant developments that took place this year in the Indian defence sector.

## 1. Rafale fighter jets arrive in India

In July, the first batch of French-developed Rafale fighter jets arrived in India to provide a much-needed boost to the country's air power. India received another three jets earlier last month with IAF inducting a total of eight Rafale fighter jets so far. India had signed a Rs 59,000 crore deal with France in 2016 under which 36 Rafale jets are expected to be delivered by 2022.

## 2. Permanent Commission for Women In Army

In 2020, the Indian Army took a step towards gender equality in the armed forces as it kickstarted the process to grant eligible women officers Permanent Commission. The decision came after a historic Supreme Court ruling that directed the Indian Army to grant eligible women officers Permanent Commission. Earlier, women officers were hired under the short services schemes for five years, which was subject to extension for up to 14 years. But now women can serve in the Indian Army till retirement age.

## 3. Testing of BrahMos missile

The Indian Armed Forces, including the Navy and the Air Force, have been testing a more enhanced version of BrahMos missiles that can be fired from land, sea and air. The updated version of the missile that the Indian tri-services are testing will provide a range of around 400 kilometres as compared to the 290-kilometres version, which is already in service of the Indian Navy and

Indian Army. The name BrahMos is a combination of India's Brahmaputra River and Russia's Moskva River. The missile technology has been developed as a joint-venture by India and Russia and is considered the fastest supersonic cruise missile in the world.

#### **4. Akash air defence missile**

Indian Air Force recently carried out test-firing of home-grown Akash air defence missiles developed by Defence Research and Development Organisation (DRDO). The Akash air defence missile system can detect and bring down aircraft up to 30 kilometres away. The Akash missiles, initially developed in 2009, was recently upgraded and have been equipped with a seeker that will help the system to neutralise targets more efficiently and effectively. The Defence Ministry said that the 10 Akash missiles fired during the recent test directly hit their targets.

#### **5. Armenia pens defence deal with India**

Earlier this year, India signed an agreement with Armenia to supply indigenous SWATHI weapon-locating radars developed by DRDO. India has agreed to sell four SWATHI radars to Armenia after Yerevan gave the deal a go-ahead following trials of similar technologies from Russia and Poland. SWATHI radar system can accurately detect weapons such as shells, mortars, and rockets within a 50-kilometre range. The deal is in line with the government's Make in India initiative, and opens up a much-desired scenario where India becomes an exporter of military technology.

#### **6. India's IOR Strategic Supremacy**

2020 has opened new gates for India to assert its influence in the Indian Ocean Region (IOR) with all four QUAD nations deciding to participate in the Malabar exercise for the first time since 2007. The exercise, which was meant to target China's influence in the Indo-Pacific, was held in two phases last month. The Malabar exercise saw the participation of the Australian fleet for the first time since the quadrilateral dialogue between India, US, Japan and Australia expired in 2007.

#### **7. India restricts defence imports to boost domestic production**

India in August announced restrictions on military imports stopping the country's Armed forces from buying 101 defence items from foreign countries as a step to boost domestic defence production. The list includes artillery guns, short-range surface to air missiles, cruise missiles, offshore patrol vessels, electronic warfare systems, next-generation missile vessels, floating dock, anti-submarine rocket launchers, basic trainer aircraft among other items.

#### **8. Rudram & Dhruvastra Missiles test-fired:**

The Indian Air Force test-fired the Rudram missile earlier this year, which is capable of disabling the enemy's radar system and transmitters. The missile has been developed by DRDO and if inducted in the Indian Air Force, India will become only the fourth country after the US, Russia, and Germany to have the technology. India also tested the Dhruvastra missile, which is a helicopter version of the Nag Helina and is capable of destroying enemy bunkers, battle tanks, and armoured vehicles. These tests were a part of India's accelerated missile-testing in the wake of elevated tensions with China.

#### **9. Defence Ministry approves proposal to acquire 33 new fighter aircraft from Russia**

The Defence Ministry in July approved the proposal to acquire 33 fighter jets from Russia at a low-cost of Rs. 18,148 crore. To replenish the sanctioned strength of the air power of the Indian Air Force, the defence ministry agreed to procure 12 Su-30MKIs and 21 MiG-29 fighter jets from Russia. Under the deal, 59 MiG-29 fighter jets will also be upgraded. The decision came amid the tensions between India and China.

#### **10. Indian Navy & Coast Guard fight fire aboard oil tanker off Sri Lanka's coast**

The Indian Navy helped Sri Lanka contain the fire onboard oil tanker MT New Diamond earlier in September. The ship was on its way to India when it caught fire. One person died in the accident while the Indian Navy rescued 22 people who were on board the vessel at the time of the incident. Sri Lankan President Gotabaya Rajapaksa took to social media for the efforts made by the Indian

defence forces in controlling the fire. This continues Indian forces' proud tradition of leading humanitarian and rescue missions the world over.

<https://www.republicworld.com/india-news/general-news/big-2020-for-indian-armed-forces-china-escalation-to-indigenisation-push-10-developments.html>

## Defence News

# Defence Strategic: National/International

## ThePrint

Thu, 10 Dec 2020

### With China factor in play, Modi govt now open to Navy's third aircraft carrier demand

*Although the current focus is on submarines, there is a change in the government's position regarding a third aircraft carrier for the Navy*

*By Snehesh Alex Philip*

New Delhi: With China flexing its muscles, the Narendra Modi government is now looking favourably at the Navy's need for a third aircraft carrier as the "situation of peace" has changed, ThePrint has learnt.

Top government sources told ThePrint that while the current focus is on submarines, for which the government will soon set the ball rolling for six more conventional submarines under Project 75I, there is a change in the government's position regarding a third aircraft carrier.

"The times have changed. Earlier it was time of peace and now it is not," a top government source said, in what appeared to be a reference to the current tensions between India and China in Eastern Ladakh.

The Indian Navy operates the Russian-built INS Vikramaditya and a second indigenously-built carrier is in the final stages of construction.

But even though the Navy has been firm on its plan to have a second indigenous aircraft carrier, the government wasn't so convinced until now.

Chief of Defence Staff Gen. Bipin Rawat in February had said that the approval for a third carrier would take time as, according to him, the Navy needed submarines and not aircraft carriers as "anything on surface can be picked up by satellites and knocked off by missiles".

Explaining the new thinking, government sources said there is no doubt that future operations and requirements have to be kept while planning.

"The role of India in the global scene is increasing," a government source said. "For us to have a larger presence in the Indian Ocean Region and beyond where trade and commerce is increasing, a third aircraft carrier is important."

#### Navy's pitch for another aircraft carrier

The Navy has been pitching for a third aircraft carrier.



File photo of INS Vikramaditya | @DefenceDecode | Twitter

Just last week, Navy chief Admiral Karambir Singh had emphatically come out in support of a third aircraft carrier.

Addressing the annual press conference, the Admiral said the Navy will formally move the proposal to the government for a third aircraft carrier after gathering technical information sought from various countries.

“As the Navy, we are absolutely clear of the utility of the carrier,” he said. “This is because air operations are integral to naval operations, and air power at sea is required since the Navy is all about reach and sustenance.

“If you are a nation that is aspirational and you want to become a \$5 trillion economy shortly and you want to do well, you will have to go outwards and seek the world,” he said. “The nation does not want the Navy tethered to the shore. For that, aircraft carriers are absolutely necessary.”

Navy sources in February had told ThePrint that even if a decision is taken to have a third carrier now, it will come into action only by 2033 at the earliest.

They also said shore-based air operations were still limited by range, and this is where the aircraft carriers come into play.

They had said that External Affairs Minister S. Jaishankar had defined the Indian Ocean Region (IOR) as including countries fringing the entire Indian Ocean, from the Strait of Hormuz to Reunion Island, from East Africa to Australia, and from Lombok Strait to Malacca Strait.

This vast oceanic expanse, they said, was well beyond the capability of strike aircraft operating from the Indian mainland, which would barely cover even 20 per cent of this area and thus leave vast swathes of IOR unchallenged.

<https://theprint.in/defence/with-china-factor-in-play-modi-govt-now-open-to-navys-third-aircraft-carrier-demand/563496/>



Thu, 10 Dec 2020

## **Explained: Submarine Day, celebrating the memory of INS Kalvari**

*INS Kalvari was a diesel-electric submarine of the Foxtrot Class from the erstwhile USSR. It was a 91.3-metre-long submarine, which carried a crew of 75. It had a surface speed of 16 knots while the submerged speed was 15 knots*

*By Man Aman Singh Chhina*

The Indian Navy celebrated Submarine Day on Tuesday. It was on December 8 that the Indian Naval Ensign was unfurled on INS Kalvari, the first submarine to be inducted in the Indian Navy, at Riga in Latvia, the erstwhile USSR, in 1967. Kalvari is the Malayalam name for Tiger Shark, a predator in the Indian Ocean. The Kalvari was decommissioned in 1996 after 29 years of service.

### **What kind of submarine was INS Kalvari?**

INS Kalvari was a diesel-electric submarine of the Foxtrot Class from the erstwhile USSR. It was a 91.3-metre-long submarine, which carried a crew of 75. It had a surface speed of 16 knots while the submerged speed was 15 knots. It had a range of 32,000 km at a speed of 8 knots when on surface and a submerged range of 610 km at a speed of 10 knots. It could carry 22 torpedoes and 42 mines in lieu of torpedoes.

Commander KS Subramanian, the first Commanding Officer of INS Kalvari, brought the



Indian Naval Ship (INS) Vagir is the fifth among the six Kalvari-class submarines being constructed by the public sector shipbuilder Mazagon Dock Ltd (MDL) in Mumbai. (PTI Photo)

submarine from St Petersburg in Russia to Vishakhapatnam in India. After INS Kalvari, three more submarines — Karanj, Khanderi and Kursura — were commissioned in the Indian Navy along with submarine support vehicle Amba. A submarine rescue ship, INS Nistar, was also commissioned in 1972.

### What kind are the present Kalvari Class submarines in Indian Navy?

The Indian Navy is inducting several submarines in Kalvari Class, named after the very first submarine inducted into service. INS Kalvari, a diesel-electric submarine of Scorpene-class, was inducted into service in 2017 after having been built at the Mazagon dock in Mumbai. It has been designed by French company DCNS. INS Khanderi is the other submarine of Kalvari class currently in service. The other submarines slated to join service under this class are Vela, Karanj, Vaghir and Vaghsheer.

<https://indianexpress.com/article/explained/explained-submarine-day-celebrating-the-memory-of-ins-kalvari-7098340/>

# अमरउजाला

Thu, 10 Dec 2020

## 'स्मैश-2000 प्लस' का ऑर्डर, राइफल पर फिट कर गिराएंगे दुश्मन के ड्रोन

नई दिल्ली: भारतीय नौसेना ने दुश्मन के छोटे ड्रोन से निपटने के लिए इस्राइल को सीमित संख्या में 'स्मैश-2000 प्लस' का ऑर्डर दिया है। यह एंटी-ड्रोन हथियार कंप्यूटराइज्ड फायर कंट्रोल और इलेक्ट्रो-ऑप्टिक साइट प्रणाली से लैस है। इसे बंदूक और राइफल के ऊपर फिट किया जा सकता है। हथियारों पर लगाने के बाद इसकी मदद से दिन या रात के समय में किसी भी छोटे ड्रोन को हवा में मार गिराया जा सकता है।

नौसेना के मुताबिक, स्मैश की मदद से दुश्मन देश के ड्रोन हमले और उससे जुड़ी जानकारी जुटाने में भी मदद मिलेगी। इस सिस्टम की पहली डिलीवरी अगले साल तक होने की संभावना है। गौरतलब है कि हाल के दिनों में पाकिस्तान से लगने वाली पश्चिमी सीमा पर कई ड्रोन उड़ते हुए नजर आए हैं।

सूत्रों ने बताया, एक स्मैश सिस्टम की कीमत 10 लाख रुपये होगी। इसे राइफल्स के ऊपर लगाया जा सकता है और इसकी मदद से छोटे और तेज गति से मूवमेंट करने वाले ड्रॉन्स को हवा में ही ढेर किया जा सकता है। इसकी मदद से दुश्मन ड्रॉन्स को 120 मीटर की दूरी से मार गिराया जा सकता है।

हाल के दिनों में सेना के लिए छोटे ड्रोन बड़े खतरे के रूप में उभरे हैं। खास तौर पर जब एक साथ कई छोटे ड्रॉन्स सीमा की तरफ बढ़ रहे हों। ऐसे में स्थिति ज्यादा खतरनाक साबित हो सकती है। झुंड में भेजे गए ड्रॉन्स अपने दुश्मन के एयर डिफेंस को पूरी तरह से तहस-नहस कर सकते हैं।

भारत में लगातार हथियारों को स्वदेशी तकनीक पर तैयार करने की कवायद जारी है। इसी कड़ी में, भारत अमेरिका के साथ हवाई-लॉन्च वाले छोटे एरियल सिस्टम या ड्रोन स्वार्म विकसित करने के लिए भी तैयारी कर रहा है। इसके अलावा, द्विपक्षीय रक्षा प्रौद्योगिकी और व्यापार पहल (डीटीटीआई) के तहत 'काउंटर-यूएस रॉकेट, आर्टिलरी और मोर्टार सिस्टम' नामक ड्रोन विरोधी तकनीक को भी तैयार करने में जुटा हुआ है।

<https://www.amarujala.com/india-news/indian-navy-procuring-israeli-smash-2000-plus-anti-drone-sights-for-destroying-adversary-drones>



Smash-2000 Plus - फोटो : social media

## India's weapons procurement from US rises to USD 3.4 Billion in 2020: Report

*As per the data released by the United States' Defense Security Cooperation Agency (DSCA), the jump in the sale of American weapons to India comes at a time when sale of weapons from the US to other countries has dipped to USD 50.8 billion in 2020 from USD 55.7 billion in 2019*

Washington: India's weapons procurement from the United States jumped from a meagre USD 6.2 million to a whopping USD 3.4 billion in the final year of the Donald Trump administration, according to latest official data.

As per the data released by the United States' Defense Security Cooperation Agency (DSCA), the jump in the sale of American weapons to India comes at a time when sale of weapons from the US to other countries has dipped to USD 50.8 billion in 2020 from USD 55.7 billion in 2019.

In 2019, the sale of US weapons to foreign countries was USD 55.7 billion. In 2017, it was USD 41.9 billion, it said.

Major buyers of American weapons in 2020 were India (USD 3.4 billion up from USD 6.2 million in fiscal year 2019), Morocco (USD 4.5 billion up from USD 12.4 million), Poland (USD 4.7 billion up from USD 673 million), Singapore (USD 1.3 billion up from USD 137 million), Taiwan (USD 11.8 billion up from USD 876 million), and the United Arab Emirates (USD 3.6 billion up from USD 1.1 billion), the data showed.

Several countries reported a drop in purchase of weapons from the US.

Prominent among them were Saudi Arabia which came down from USD 14.9 billion in 2019 to USD 1.2 billion in 2020, Afghanistan (USD 1.1 billion down from USD 1.6 billion), Belgium (USD 41.8 million down from USD 5.5 billion), Iraq (USD 368 million down from USD 1.4 billion), and South Korea (USD 2.1 billion down from USD 2.7 billion).

According to the 2020 edition of the Historical Sales Book, India purchased weapons worth USD 754.4 million in 2017 and USD 282 million in 2018. Between 1950 and 2020, US sale of weapons to India under Foreign Military Sales (FMS) category was USD 12.8 billion.

The US designated India as a "Major Defence Partner" in 2016 which allows New Delhi to buy more sophisticated and sensitive technologies from America at par with that of the US' closest allies and partners.

For Pakistan, the official figures reflected that sale of weapons under FMS did happen, even though there was a freeze in any military and security assistance to Islamabad from the Trump administration.

In 2020, US sale of weapons to Pakistan was USD 146 million, in 2018 it was USD 65 million and in 2017 it was USD 22 million.

In 2019, there was no sale of US military weapons to Pakistan. In fact, the US refunded USD 10.8 million to Pakistan, taken for the purchase of weapons.

Between 1950 and 2020, Pakistan purchased weapons worth USD 10 billion from the US under the FMS.

However, the total supply of American military weapons to Pakistan is much more, as a major chunk of weapons to Pakistan has gone from the United States as military and security assistance.



US designated India a "Major Defence Partner". India can buy more sophisticated, sensitive tech



According to the Assistant Secretary of State for Political Military Affairs Clarke Cooper, fiscal 2020 saw a total of USD 175.8 billion in US government-authorized arms exports. This is overall a 2.8 per cent increase since fiscal year 2019.

The overall value of State Department-authorized government-to-government FMS cases implemented by the DSCA decreased 8.3 per cent from USD 55.39 billion in Fiscal Year 2019 to USD 50.78 billion in Fiscal Year 2020.

"The dollar value of potential FMS sales, formally notified to Congress, also rose by more than 50 per cent from USD 58.33 billion to USD 87.64 billion. This was driven by the July potential sale of USD 23.11 billion worth of F-35 aircraft to Japan, which was the second largest single FMS notification ever authorized by the Department of State, Mr Cooper said.

The Direct Commercial Sales (DCS), which is the Department of State-authorized commercial export licenses, totalled USD 124.3 billion in fiscal year 2020, and this was up from USD 114.7 billion in fiscal year 2019, he said.

"This represented an 8.4 per cent increase. This total value covers authorizations of hardware, defense services, and technical data. The total number of licenses issued decreased by 20-per cent from 36,111 in Fiscal Year 2019 to 28,800 in Fiscal Year 2020," Mr Cooper said.

The top commercial DCS notified to Congress in Fiscal Year 2020 included a USD 8.39 billion sale to Australia, Canada, Denmark, Italy, Japan, and the United Kingdom for F-35 components.

This also included a USD 3.2 billion sale to Australia for P-8 aircraft parts, and a USD 2.48 billion sale to the United Kingdom and Australia for E-7 airborne early warning and control aircraft, Mr Cooper said.

*(Except for the headline, this story has not been edited by NDTV staff and is published from a syndicated feed.)*

<https://www.ndtv.com/india-news/indias-weapons-procurement-from-us-rises-to-usd-3-4-billion-in-2020-report-2336551>



Thu, 10 Dec 2020

## Is a Russia-India Navy Alliance Brewing?

*Just two weeks after the Indian Navy's flagship aircraft carrier INS Vikramaditya took part in the second phase of Malabar 2020 joint exercises with the United States Navy, which also included drills with the navies of Australia and Japan, India warships took part in another exercise where it operated alongside the Russian Navy in the eastern Indian Ocean in a "passing exercise" (PASSEX)*

*By Peter Suci*

Just two weeks after the Indian Navy's flagship aircraft carrier INS *Vikramaditya* took part in the second phase of Malabar 2020 joint exercises with the United States Navy, which also included drills with the navies of Australia and Japan, India warships took part in another exercise where it operated alongside the Russian Navy in the eastern Indian Ocean in a "passing exercise" (PASSEX).

The two-day joint naval drills took place the first week of December, and included the domestically-built INS *Shivalik*, the first stealth multi-role frigate built by India, and the anti-submarine warfare (ASW) corvette INS *Kadmatt*. The two Indian warships were joined by the Russian Navy's missile cruiser *Varyag*, large ASW warship *Admiral Panteleyev* and tanker *Pechenga*.



The drills were aimed to increase the operational compatibility, improve mutual understanding and exchange advanced experience between two friendly navies, Indian Navy Spokesman Vivek Madhwal told Tass. Due to the still ongoing novel coronavirus pandemic, the ships reportedly only interacted at sea without personal contact between the sailors of the two nations.

The PASSEX was conducted between the two navies to ensure they are able to communicate and cooperate in times of war or humanitarian relief, and likely included the typical flashing light drills, semaphore drills and flag hoist drills. The Indian Navy also reported that during the drills the two navies also conducted joint measures, took part in exercises against underwater targets and in helicopter operations.

In addition to practicing cooperation, such exercises are also to “show the flag” and highlight the potential cooperation of the two nations. In this case, New Delhi has continued to show that it has many international partners—and that message was likely directed towards Beijing as the two nations continue their standoff in the Himalayan Mountains thousands of miles away from the exercise.

This year the Indian Navy has participated in thirteen bilateral and multilateral exercises, The Hindu.com reported. This included the recent Malabar 2020, as well as a passage exercise with the U.S. Navy’s USS *Nimitz* Carrier Strike Group near the Andaman and Nicobar (A&N) islands in July and a more recent PASSEX with the Japanese Navy.

This most recent PASSEX between India and Russia comes a year after Moscow announced that it was boost naval cooperation with India’s chief rival Pakistan. Last December, Russian Navy’s Commander-in-Chief Admiral Nikolai Anatolyevich Yevmenov met Pakistani Naval Chief Admiral Zafar Mahmood Abbasi in Islamabad. Pakistan also agreed to pay off \$93.5 million it had borrowed from the Soviet Union, removing a major obstacle that had impacted Pakistan-Russia relations.

It is clear that just as India has tried to maintain close relationships with both Washington and Moscow, Russia too is trying to hedge its bets by working with both Islamabad and New Delhi.

<https://nationalinterest.org/blog/buzz/russia-india-navy-alliance-brewing-174127>

**THE TIMES OF INDIA**

*Thu, 10 Dec 2020*

## **US dominated global arms trade in 2019, India 2nd top importer**

New Delhi: India was the world's 2nd biggest arms importer in 2019, according to a report by the Stockholm International Peace Research Institute. The country was in the third spot in terms of total spend on military.

Also in terms of total military spend, India ranked high up at No. 3, behind only US and China. However none of the three biggest spenders were in the top 10 list of military spend taken as a percentage of GDP.

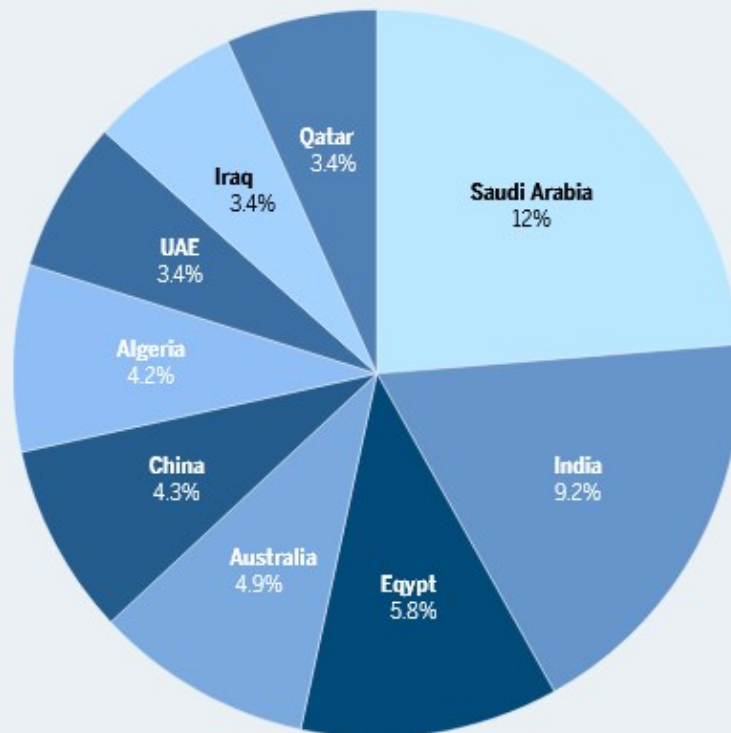
Here's a look at the world's biggest military spenders, arms sellers and buyers, explained in charts.

The US was the most dominant player in arms export, accounting for 36% of the global trade, while the Middle East made its first appearance among the 25 biggest weapons manufacturers during the year.

The total sales by the "top 25" companies, in 2019, rose by 8.5 per cent to \$361 billion, equivalent to 50 times the annual budget of the UN's peacekeeping operations.

## India second biggest importer of arms (2015-19)

World's largest arms importers (% share in total imports)



## India third largest military spender in world (2019)

Country	Spending (\$bn)	% of GDP
United States	732.0	3.4
China	261.0	1.9
India	71.10	2.40
Russia	65.1	3.9
Saudi Arabia	61.9	8.0
France	50.1	1.9
Germany	49.3	1.3
UK	48.7	1.7
Japan	47.6	0.9

## World's top arm sellers in 2019

Top 25 manufacturers

Company	Country	Sales (\$bn)
Lockheed Martin	US	53
Boeing	US	34
Northrop Grumman	US	29
Raytheon	US	25
General Dynamics	US	25
AVIC	China	23
BAE Systems	UK	22
CETC	China	15
Norinco	China	15
L3Harris Tech	US	14
UT	US	13
Leonardo	Italy	11
Airbus	Trans-Europe	11
Thales	France	10
Almaz -Antey	Russia	9
HII	US	8
DAG	France	6
Honeywell Int.	US	5
Leidos	US	5
BAH	US	5

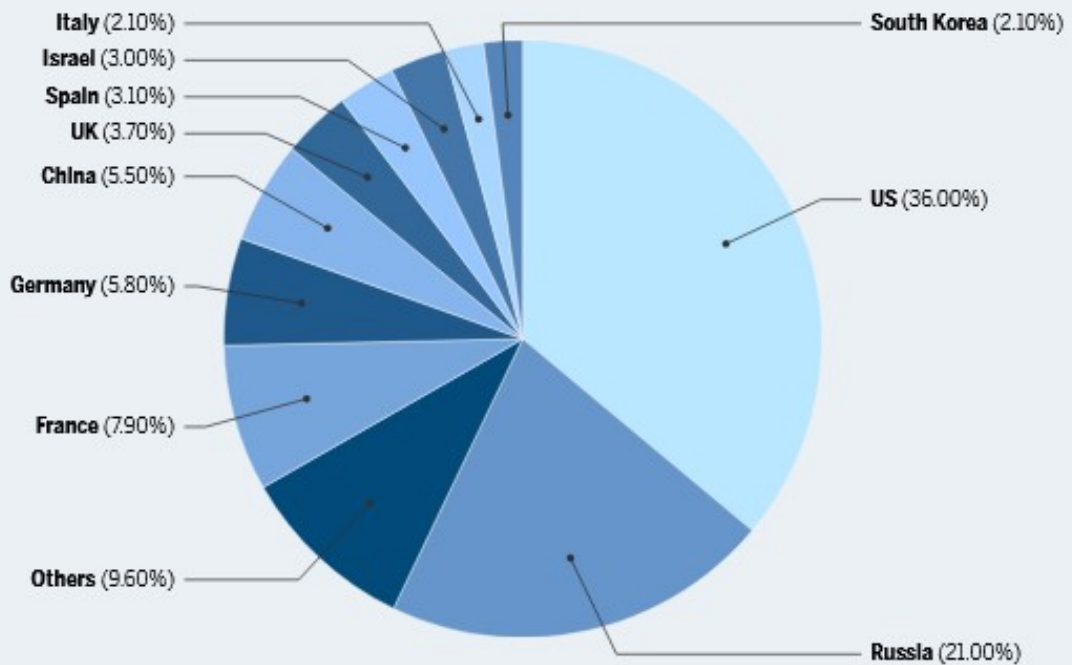
## Share of the combined arms sales of the "Top 25" by country



TOI

## USA top arms exporter (2015–19)

Share of major arms exports by 10 largest exporters



TOI

Source SIPRI

<https://timesofindia.indiatimes.com/world/us-china-dominated-arms-market-in-2019-all-you-need-to-know-in-5-charts/articleshow/79607686.cms>

Thu, 10 Dec 2020

## China offered 'five differing explanations' on troops buildup along LAC: EAM S Jaishankar

*The Indian Army has completed the establishment of habitat facilities for all troops deployed in eastern Ladakh to ensure operational efficiency in the harsh winter months*

New Delhi: Union External Affairs Minister S Jaishankar Wednesday called out China for giving "five differing explanations" on its deployment of thousands of troops along the Line of Actual Control, which led to the deteriorating of bilateral ties to an all-time low and a deadly standoff in Eastern Ladakh.

"We are today probably at the most difficult phase of our relationship with China, certainly in the last 30 to 40 years...or even more," the minister said in an online conversation with the Australian think tank Lowy Institute.

The minister said that China has "very significantly damaged" the relationship because all positive developments in the past 30 years were based on the fact that both sides will maintain peace and tranquility in border areas.

"Now for some reason, for which the Chinese have to date given us five differing explanations, the Chinese have violated it.

"The Chinese have literally brought tens of thousands of soldiers in full military preparation mode right to the LAC in Ladakh. Naturally, the relationship would be profoundly disturbed by this," he said.

Amid border standoff with China along the Line of Actual Control (LAC) in Ladakh, India has deployed its marine commandos MARCOS in the Pangong Tso lake area, one of the key friction points with the Chinese PLA troops.

With the standoff in its eighth month, the Indian Army has completed the establishment of habitat facilities for all troops deployed in eastern Ladakh to ensure operational efficiency in the harsh winter months.

The two sides have been engaged in an ugly standoff since May this year and suffered the loss of lives. At least 20 Indian soldiers were killed after Chinese troops ambushed them while patrolling on the Indian side of the border. The clashes also resulted in the deaths of as many as 40 Chinese soldiers but Beijing didn't revealed the actual number of casualties.

<https://english.jagran.com/india/china-offered-five-differing-explanations-on-troops-buildup-along-lac-eam-s-jaishankar-10020928>



Thu, 10 Dec 2020

## ISRO NavIC Gets International Maritime Organisation Recognition: All You Need to Know

*ISRO NavIC has been recognised by the International Maritime Organisation (IMO) as a component of the World-Wide Radio Navigation System (WWRNS)*

ISRO NavIC, which is the operational name for the Indian Regional Navigation Satellite System (IRNSS), has been recognised by the International Maritime Organisation (IMO) as a component of the World-Wide Radio Navigation System (WWRNS). This recognition was awarded to ISRO NavIC in the 102nd meeting of the Maritime Safety Committee of IMO (MSC 102) held in November 2020.

The International Maritime Organization is the United Nations' specialized agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships. "The committee stated that NavIC meets the operational requirements to assist in the navigation of ships in ocean waters within the area covered by 55 degrees E longitude, 50 degrees N latitude, 110 degrees E longitude and 5 degrees S latitude. NavIC has been represented at IMO by the Directorate General of Shipping (DGS), Ministry of Ports, Shipping and Waterways with technical support from ISRO," said a statement from ISRO.



This latest development will enable the utilisation of ISRO NavIC in the fields of maritime navigation, surveying, and geodesy among others. NavIC or IRNSS is an independent regional navigation satellite system developed by India. The Indian GPS-like system is designed to provide accurate position information service to users in India as well as the region extending up to 1500 km from its boundary, which is its primary service area.

### Applications of ISRO NavIC or IRNSS

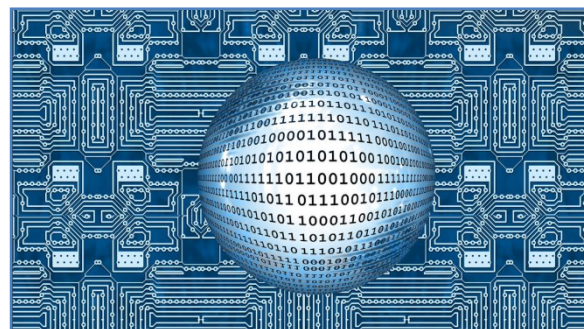
- Terrestrial, aerial and marine navigation.
- Disaster management.
- Vehicle tracking and fleet management.
- Integration with mobile phones.
- Precise timing.
- Mapping and geodetic data capture.
- Terrestrial navigation aid for hikers and travellers.
- Visual and voice navigation for drivers.

<https://www.dqindia.com/isro-navic-gets-international-maritime-organisation-recognition-need-know/>

## Scientists model photoluminescence kinetics in semiconductor nanoplatelets for better optoelectronics

Researchers from Skoltech and their colleagues have built two models that accurately explain the light-emitting behavior of semiconductor nanoplatelets, minuscule structures that can become the building blocks for optoelectronics of the future. The paper was published in the journal *Physical Chemistry Chemical Physics*.

Optoelectronics, a field of photonics that exploits quantum mechanical effects of light on electronic materials, in particular semiconductors, has gained a lot of traction for its promise in all sorts of applications. These range from solar cells and LEDs to colloidal lasers, a technology expected to replace conventional semiconductor laser diodes used in barcode scanners and fiber optic communications.



Credit: CC0 Public Domain

In the search for materials with better optical properties more suitable for use in optoelectronics, research has focused on nanoplatelets, which are highly promising low-dimensional semiconductor nanocrystals. These are flat structures, just a few nanometers in size, and remarkably versatile and tunable. Modern precision synthesis techniques allow researchers to grow them essentially on-demand, controlling their shape, thickness, and crystal structure. These parameters directly affect the photoluminescence capability and properties.

"Tailoring the synthesis of photoluminescent nanocrystals for specific applications may require predictions of spectral and relaxation characteristics. Hence, we need a detailed understanding and modeling of the underlying kinetics," Skoltech Provost Keith Stevenson, professor at the Center for Energy Science and Technology and a co-author of the paper, explains.

Stevenson, Ph.D. graduate Aleksandr Kurilovich and Vladimir Palyulin, Assistant Professor at the Center for Computational and Data-Intensive Science and Engineering, joined their colleagues in focusing on a way to explain non-trivial kinetics of semiconductor nanoplatelet photoluminescence in experiments. According to the researchers, earlier theoretical descriptions and experimental findings have always assumed an exponential decay of photoluminescence intensity in nanoplatelets. But more recent measurements showed a stark power-law behavior of the long-time, pointing to complexity.

The team built two models, a simulation one and a theoretical one, describing the kinetics of photoluminescence in nanoplatelets through the activity of excitons, quasiparticles in the semiconductor that are responsible for light emission in the case of their recombination. The models point to trapping of excitons at surface defects and its interplay with diffusion as key reasons for the complex kinetics. This allowed to successfully interpret experimental results from composite nanoplatelets made of cadmium selenide and cadmium sulfide.

"The model shows the importance of defects at long times and their ability to delay the recombination. This could be used to estimate the needed defect density for slowing down the emission, thus, extending the emission time," Stevenson says.



Other organizations involved in this research include Lomonosov Moscow State University, Institute for Physics & Astronomy at the University of Potsdam, and Akhiezer Institute for Theoretical Physics, National Science Center "Kharkov Institute of Physics and Technology".

**More information:** A. A. Kurilovich et al, Complex diffusion-based kinetics of photoluminescence in semiconductor nanoplatelets, *Physical Chemistry Chemical Physics* (2020). DOI: [10.1039/D0CP03744C](https://doi.org/10.1039/D0CP03744C)

**Journal information:** *Physical Chemistry Chemical Physics*  
<https://phys.org/news/2020-12-scientists-photoluminescence-kinetics-semiconductor-nanoplatelets.html>



Thu, 10 Dec 2020

## Engineering discovery challenges heat transfer paradigm that guides electronic and photonic device design

By Karen Walker

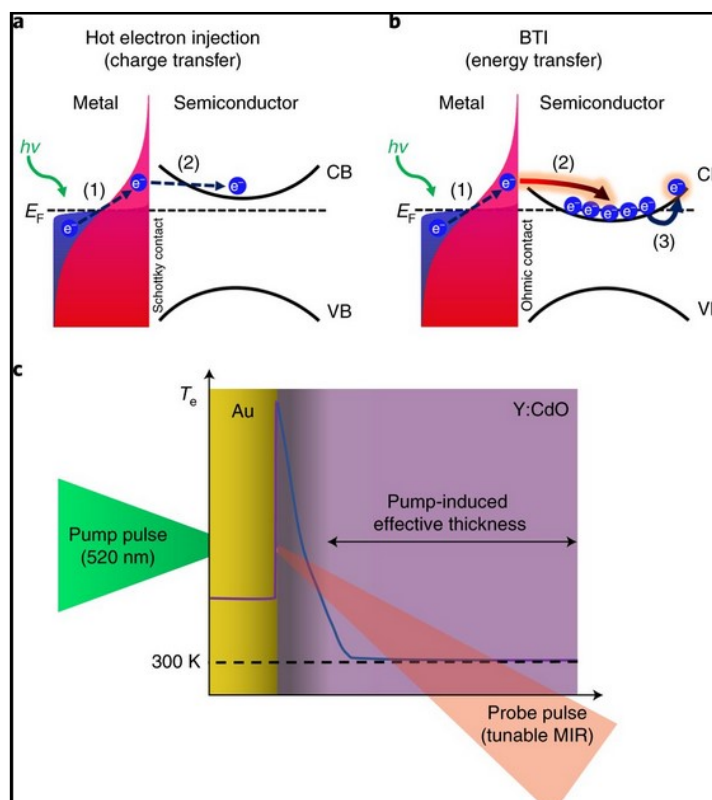
A research breakthrough from the University of Virginia School of Engineering demonstrates a new mechanism to control temperature and extend the lifetime of electronic and photonic devices such as sensors, smart phones and transistors.

The discovery, from UVA's experiments and simulations in thermal engineering research group, challenges a fundamental assumption about heat transfer in semiconductor design. In devices, electrical contacts form at the junction of a metal and a semiconducting material. Traditionally, materials and device engineers have assumed that electron energy moves across this junction through a process called charge injection, said group leader Patrick Hopkins, professor of mechanical and aerospace engineering with courtesy appointments in materials science and engineering and physics.

Charge injection posits that with the flow of the electrical charge, electrons physically jump from the metal into the semiconductor, taking their excess heat with them. This changes the electrical composition and properties of the insulating or semiconducting materials. The cooling that goes hand-in-hand with charge injection can significantly degrade device efficiency and performance.

Hopkins' group discovered a new heat transfer path that embraces the benefits of cooling associated with charge injection without any of the drawbacks of the electrons physically moving into the semiconductor device. They call this mechanism ballistic thermal injection.

As described by Hopkins' advisee John Tomko, a Ph.D. student of materials science and engineering: "The electron gets to the bridge between its metal and the semiconductor, sees another electron across the bridge



Proposed mechanism of interfacial energy transfer and experimental schematic. Credit: *Nature Nanotechnology* (2020). DOI: [10.1038/s41565-020-00794-z](https://doi.org/10.1038/s41565-020-00794-z)

and interacts with it, transferring its heat but staying on its own side of the bridge. The semiconducting material absorbs a lot of heat, but the number of electrons remains constant."

"The ability to cool electrical contacts by keeping charge densities constant offers a new direction in electronic cooling without impacting the electrical and optical performance of the device," Hopkins said. "The ability to independently optimize optical, electrical and thermal behavior of materials and devices improves device performance and longevity."

Tomko's expertise in laser metrology—measuring energy transfer at the nanoscale—revealed ballistic thermal injection as a new path for device self-cooling. Tomko's measurement technique, more specifically optical laser spectroscopy, is an entirely new way to measure heat transfer across the metal-semiconductor interface.

"Previous methods of measurement and observation could not decompose the heat transfer mechanism separately from charge injection," Tomko said.

For their experiments, Hopkins' research team selected cadmium oxide, a transparent electricity-conducting oxide that looks like glass. Cadmium oxide was a pragmatic choice because its unique optical properties are well suited to Tomko's laser spectroscopy measurement method.

Cadmium oxide perfectly absorbs mid-infrared photons in the form of plasmons, quasiparticles composed of synchronized electrons that are an incredibly efficient way of coupling light into a material. Tomko used ballistic thermal injection to move the light wavelength at which perfect absorption occurs, essentially tuning the optical properties of cadmium oxide through injected heat.

"Our observations of tuning enable us to say definitively that heat transfer happens without swapping electrons," Tomko said.

Tomko probed the plasmons to extract information on the number of free electrons on each side of the bridge between the metal and the semiconductor. In this way, Tomko captured the measurement of electrons' placement before and after the metal was heated and cooled.

The team's discovery offers promise for infrared sensing technologies as well. Tomko's observations reveal that the optical tuning lasts as long as the cadmium oxide remains hot, keeping in mind that time is relative—a trillionth rather than a quadrillionth of a second.

Ballistic thermal injection can control plasmon absorption and therefore the optical response of non-metal materials. Such control enables highly efficient plasmon absorption at mid-infrared length. One benefit of this development is that night vision devices can be made more responsive to a sudden, intense change in heat that would otherwise leave the device temporarily blind.

"The realization of this ballistic thermal injection process across metal/cadmium oxide interfaces for ultrafast plasmonic applications opens the door for us to use this process for efficient cooling of other device-relevant material interfaces," Hopkins said.

Tomko first-authored a paper documenting these findings. *Nature Nanotechnology* published the team's paper, Long-lived Modulation of Plasmonic Absorption by Ballistic Thermal Injection, on November 9; the paper was also promoted in the journal editors' News and Views. The *Nature Nanotechnology* paper adds to a long list of publications for Tomko, who has co-authored more than 30 papers and can now claim first-authorship of two *Nature Nanotechnology* papers as a graduate student.

The research paper culminates a two-year, collaborative effort funded by a U.S. Army Research Office Multi-University Research Initiative. Jon-Paul Maria, professor of materials science and engineering at Penn State University, is the principal investigator for the MURI grant, which includes the University of Southern California as well as UVA. This MURI team also collaborated with Josh Caldwell, associate professor of mechanical engineering and electrical engineering at Vanderbilt University.

The team's breakthrough relied on Penn State's expertise in making the cadmium oxide samples, Vanderbilt's expertise in optical modeling, the University of Southern California's computational modeling, and UVA's expertise in energy transport, charge flow, and photonic interactions with plasmons at heterogeneous interfaces, including the development of a novel ultrafast-pump-probe laser experiment to monitor this novel ballistic thermal injection process.

**More information:** John A. Tomko et al, Long-lived modulation of plasmonic absorption by ballistic thermal injection, *Nature Nanotechnology* (2020). DOI: [10.1038/s41565-020-00794-z](https://doi.org/10.1038/s41565-020-00794-z)

**Journal information:** *Nature Nanotechnology*  
<https://phys.org/news/2020-12-discovery-paradigm-electronic-photonic-device.html>



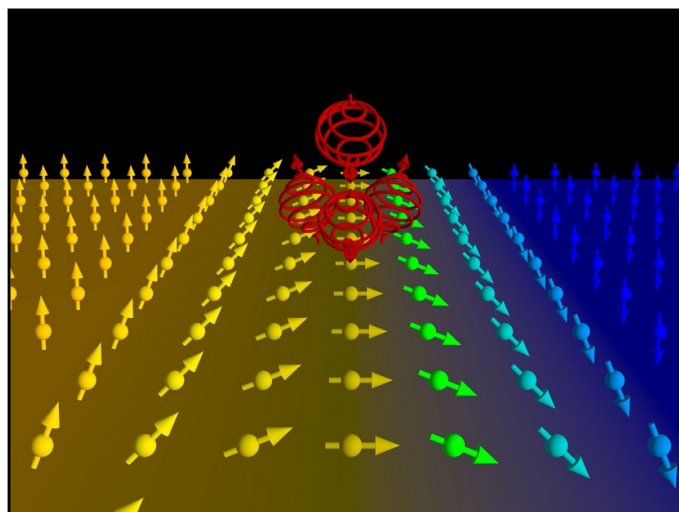
Thu, 10 Dec 2020

## Ultrafast dynamics of chiral spin structures observed after optical excitation

A joint research project of Johannes Gutenberg University Mainz (JGU), the University of Siegen, Forschungszentrum Jülich, and the Elettra Synchrotron Trieste has achieved a new milestone for the ultra-fast control of magnetism. The international team has been working on magnetization configurations that exhibit chiral twisting. Chirality is a symmetry breaking, which occurs, for example, in nature in molecules that are essential for life. Chirality is also referred to as handedness, since hands are an everyday example of two items that—arranged in a mirror-inverted manner—cannot be superimposed onto each other. Magnetization configurations with a fixed chirality are currently investigated intensively due to their fascinating properties such as enhanced stability and efficient manipulation by current. These magnetic textures thus promise applications in the field of ultrafast chiral spintronics, for example in ultrafast writing and controlling of chiral topological magnetic objects such as magnetic skyrmions, i.e., specially twisted magnetization configurations with exciting properties.

The new insights published in *Nature Communications* shed light on the ultrafast dynamics after optical excitation of chiral spin structures compared to collinear spin structures. According to the researchers' findings, the chiral order restores faster compared to the collinear order after excitation by an infrared laser.

The research team performed small angle X-ray scattering experiments on magnetic thin film samples stabilizing chiral magnetic configurations at the free electron laser (FEL) facility FERMI in Trieste in Italy. The facility provides the unique possibility to study the magnetization dynamics with femtosecond time resolution by using circular left polarized or right polarized light. The results indicate a faster recovery of chiral order compared to collinear magnetic order dynamics, which means that twists are more stable than straight magnetic configurations.



Incoming circular left polarized (CL) and right polarized (CR) x-ray pulses scatter differently on chiral magnetic domain walls, leading to an asymmetry observed in the difference signal (CL-CR). Credit: Frank Freimuth

### Cooperation with leading international partners as the cornerstone of successful research

"We have worked on this experiment for a long time. Now that we know that the ultrafast dynamics of chiral and collinear spin structures differs, we can focus on tackling the dependence of ultrafast dynamics on material properties such as the Dzyaloshinskii-Moriya interaction, an interaction that can lead to the stabilization of chiral spin structures," said Nico Kerber of the Institute of Physics at Mainz University, lead author of the article.

"We are especially grateful to our Italian colleagues who performed a part of the experiment during the first coronavirus lockdown in Europe. These additional scans were vital for our study and we are happy that video support and the mail-in of samples worked out here. But we are also looking forward to being able to perform these experiments again in person with our colleagues at FERMI," added Professor Christian Gutt from the University of Siegen, corresponding author of the paper.

"I am very happy to see the next step taken to enable the use of chiral magnetization configurations in novel spintronic devices. The international collaboration with major facilities such as FERMI is crucial to enable such work. Collaborations like this are a cornerstone of our graduate education programs and research centers," emphasized Professor Mathias Kläui from JGU, supervisor of the first author and director of the Dynamics and Topology (TopDyn) excellence project. "We foster these collaborations with funding from the Collaborative Research Center CRC/TRR 173 Spin+X, the two graduate programs Materials Science in Mainz (MAINZ) and Max Planck Graduate Center with Johannes Gutenberg University Mainz (MPGC), and the TopDyn research area."

**More information:** Nico Kerber et al. Faster chiral versus collinear magnetic order recovery after optical excitation revealed by femtosecond XUV scattering, *Nature Communications* (2020). DOI: [10.1038/s41467-020-19613-z](https://doi.org/10.1038/s41467-020-19613-z)

**Journal information:** [Nature Communications](https://www.nature.com)  
<https://phys.org/news/2020-12-ultrafast-dynamics-chiral-optical.html>



Thu, 10 Dec 2020

## 'Game changer' perovskite can detect gamma rays

Perovskites are materials made up of organic compounds bound to a metal. Propelled into the forefront of materials' research because of their structure and properties, perovskites are earmarked for a wide range of applications, including in solar cells, LED lights, lasers, and photodetectors.

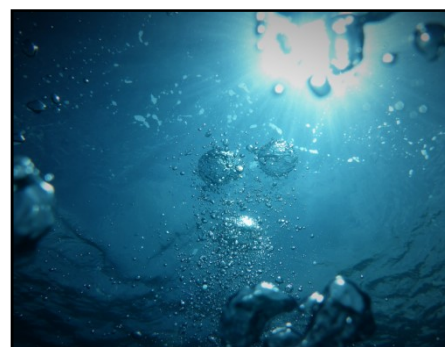
That last application, photo—or light—detection, is of particular interest to scientists at EPFL's School of Basic Sciences who have developed a perovskite that can detect gamma rays. Led by the labs of Professors László Forró and Andreas Pautz, the researchers have published their work in *Advanced Science*.

"This photovoltaic perovskite crystal, grown in this kilogram size, is a game changer," says Forró. "You can slice it into wafers, like silicon, for optoelectronic applications, and, in this paper, we demonstrate its utility in gamma-ray detection."

### Monitoring gamma rays

Gamma-rays are a kind of penetrating electromagnetic radiation that is produced from the radioactive decay of atomic nuclei, e.g., in nuclear or even supernovae explosions. Gamma-rays are on the shortest end of the electromagnetic spectrum, which means that they have the highest frequency and the highest energy. Because of this, they can penetrate almost any material, and are used widely in homeland security, astronomy, industry, nuclear power plants, environmental monitoring, research, and even medicine, for detecting and monitoring tumors and osteoporosis.

But exactly because gamma rays can affect biological tissue, we have to be able to keep an eye on them. To do this, we need simple, reliable, and cheap gamma-ray detectors. The perovskite that



Schematic structure of electrical contacts and wires of the perovskite solar cell in an ESR sample tube. Credit: University of Tsukuba

the EPFL scientists developed is based on crystals of methylammonium lead tribromide (MAPbBr<sub>3</sub>) and seems to be an ideal candidate, meeting all these requirements.

### **Crystal-clear advantages**

Perovskites are first "grown" as crystals, and the quality and clarity of the crystals determines the efficiency of the material when it is turned into thin films that can be used in devices like solar panels.

The perovskite crystals that the EPFL scientists made show high clarity with very low impurities. When they tested gamma-rays on the crystals, they found that they generated photo-carriers with a high 'mobility-lifetime product,' which is a measurement of the quality of radiation detectors. In short, the perovskite can efficiently detect gamma rays at room temperatures, simply by resistivity measurement.

### **Cheaper and scalable synthesis**

The MAPbBr<sub>3</sub> part of the "metal halide" family of perovskites, meaning that, unlike market-leading crystals, its crystals can be grown from abundant and low-cost raw materials. The synthesis takes place in solutions close to room temperature without needing expensive equipment.

Of course, this is not the first perovskite made for gamma ray-detection. But the volume of most lab-grown metal halide perovskites used for this is limited to about 1.2 ml, which is hardly scalable to commercial levels. However, the team at EPFL also developed a unique method called 'oriented crystal-crystal intergrowth' that allowed them to make a whole liter of crystals weighing 3.8 kg in total.

"Personally, I enjoyed very much to work at the common frontiers of condensed matter physics, chemistry and reactor physics, and to see that this collaboration could lead to important application to our society," says Pavao Andricevic, the lead author.

**More information:** Kilogram-scale crystallography of halide perovskites for gamma-rays dose rate measurements. *Advanced Science*, 07 December 2020. DOI: [10.1002/advs.202001882](https://doi.org/10.1002/advs.202001882)  
<https://phys.org/news/2020-12-game-changer-perovskite-gamma-rays.html>



Thu, 10 Dec 2020

## **Shining a light on what's really happening in perovskite solar cells**

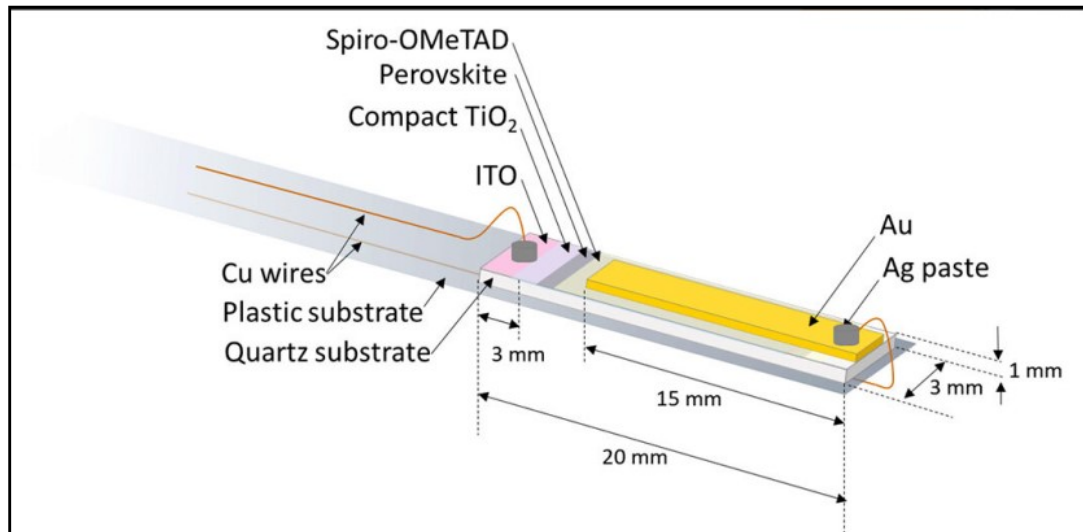
Consumers worldwide are demanding greener energy sources; therefore, optimizing the performance and economic viability of solar cells is an important research focus. Improving the efficiency of perovskite solar cells has been a particular priority; however, less emphasis has been placed on understanding what makes the cell performance deteriorate. Now, recent findings from researchers at the University of Tsukuba provide a microscopic-level study of perovskite solar cells to address the knowledge gap.

Organic-inorganic hybrid perovskites are attractive materials for use in solar cells because they are easy and cheap to prepare and absorb light over a wide range of wavelengths. Solar cells that use perovskite layers as the photoactive material are continually being improved, with a particular focus on their power conversion efficiency (PCE), which can now exceed 25%.

However, focusing on improving PCEs alone could be causing researchers to miss the significant steps forward that might result from a more detailed understanding of the underlying mechanisms. For example, the question of what causes the performance of perovskite solar cells to deteriorate is an important one that has not been comprehensively answered.

External factors such as oxygen and moisture in the air are known to compromise perovskite layers. However, the internal changes that affect the performance of cells are not as well

understood. The researchers have therefore probed the deterioration mechanism using electron spin resonance (ESR) spectroscopy.



"We carried out ESR spectroscopy on perovskite solar cells while they were in use, which gave us a real-time picture of the molecular-level changes," study corresponding author Professor Kazuhiro Marumoto explains. "Specifically, we observed the charges and defects, and related spin states, in the solar cell layers while the current-voltage characteristics of the solar cells were being measured. This allowed us to understand the relationships between these factors."

This in-depth investigation of perovskite solar cells in operation showed that changes in the spin states result from changes in hole transport as well as the formation of interfacial electric dipole layers. It was therefore concluded that cell deterioration could be prevented by improving charge mobility in the hole transport material and preventing electric dipole layer formation.

"Establishing that changes in spin states are correlated with device performance has significantly broadened our understanding of perovskite solar cells," Professor Marumoto says. "We hope that our findings will provide a valuable new starting point for the continued development of solar cells and help accelerate the reality of cost-effective green energy."

**More information:** Takahiro Watanabe et al, Deterioration mechanism of perovskite solar cells by operando observation of spin states, *Communications Materials* (2020). DOI: [10.1038/s43246-020-00099-7](https://doi.org/10.1038/s43246-020-00099-7)

## Sore eyes are the most significant vision-based indicator of Covid-19: Study

*The study helps understand how Covid-19 can infect the conjunctiva, and then spread through the body, said the researchers*

*By Prashasti Awasthi*

New research carried out by researchers at the Anglia Ruskin University (ARU) has revealed that sore eyes are the most significant vision-based indicator of Covid-19.

The study, published in the journal BMJ Open Ophthalmology, found that sore eyes were significantly more common when the participants had Covid-19.

For the study, the researchers asked people who had a confirmed Covid-19 diagnosis to answer a questionnaire about their symptoms, and how those compared with before they tested positive.

The study revealed that 16 per cent of the participants reported the issue as one of their symptoms. Just 5 per cent reported having had the condition beforehand.

Eighteen per cent of the people reported suffering from photophobia (light sensitivity) as one of their symptoms. This was only a 5 per cent increase from their pre-Covid-19 state.

Of the 83 respondents, 81 per cent reported ocular issues within two weeks of other Covid-19 symptoms. Of those, 80 per cent reported their eye problems lasted less than two weeks.

The most common reported symptoms overall were fatigue (suffered by 90 per cent of respondents), fever (76 per cent) and dry cough (66 per cent).

Lead author Professor Shahina Pardhan, Director of the Vision and Eye Research Institute at ARU, said: "This is the first study to investigate the various eye symptoms indicative of conjunctivitis in relation to Covid-19, their time frame in relation to other well-known Covid-19 symptoms and their duration."

While it is important that ocular symptoms are included in the list of possible Covid-19 symptoms, we argue that sore eyes should replace 'conjunctivitis' as it is important to differentiate from symptoms of other types of infections, such as bacterial infections, which manifest as mucous discharge or gritty eyes, she added.

The researchers believe that the study is important because it helps them understand more about how Covid-19 can infect the conjunctiva and how this then allows the virus to spread through the body.

<https://www.thehindubusinessline.com/news/science/sore-eyes-are-the-most-significant-vision-based-indicator-of-covid-19-study/article33287236.ece>

