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World taking note of India's defence manufacturing prowess: PM Modi in Aligarh

India was shedding its image of being a major importer of military hardware and carving an identity for itself as a defence exporter, at a time the government has taken a raft of measures to boost self-reliance in the key sector as well as tap the potential of defence markets globally, he said

By Rahul Singh

Prime Minister Narendra Modi on Tuesday said India is shedding its image of being a major importer of military hardware and carving an identity for itself as a defence exporter, at a time the government has taken several measures to boost self-reliance in the key sector as well as tap the potential of defence markets globally.

The PM said the world had taken note of the strides made by the country in defence manufacturing with locally produced equipment ranging from modern grenades, assault rifles and drones to fighter jets and warships. The PM made the comments during a ceremony to lay the foundation stone of Raja Mahendra Pratap Singh State University at Aligarh in Uttar Pradesh.



PM Modi. (File photo)

The PM made the comments during a ceremony to lay the foundation stone of Raja Mahendra Pratap Singh State University at Aligarh in Uttar Pradesh.

Aligarh, once famous for its locks and lock-making skills (a fact acknowledged by the PM during his speech), is one of the six nodes of the UP's government's ambitious defence industrial corridor project aimed at boosting indigenous defence production and the Make in India initiative. The other five nodes in the state are Agra, Jhansi, Chitrakoot, Kanpur and Lucknow. In the Aligarh Node, land has so far been allotted to 19 firms who will together invest ₹1,245 crore. The Centre has also set up a defence corridor in Tamil Nadu.

India is wooing foreign partners to invest in the defence corridors for co-development and co-production of equipment.

The PM said the hundreds of crores of rupees being invested in the Aligarh node will create thousands of jobs. He said the new industries coming up to support the manufacture of small arms, armaments, drones and aerospace-related products would give a new identity to Aligarh and its nearby areas.

The defence industrial corridors will go a long way in creating much-needed manufacturing hubs in the country that will further help India's transition from a weapons importer to exporter, said Air Marshal Anil Chopra (retd), director general, Centre for Air Power Studies.

"These corridors, along with other steps taken to boost self-reliance, will not only provide fillip to the Make in India initiative but also create an ecosystem that will allow us to strengthen our position as an exporter globally," Chopra said.

The PM's comments come at a time when the domestic defence sector is poised for big leaps in several areas including fighter jets, helicopters, airborne early warning systems, missiles, drones and other weaponry.

State-run plane maker Hindustan Aeronautics Limited (HAL) has set a March 2022 deadline to carry out the first flight of the LCA (light combat aircraft) Mk-1A jet. The defence ministry awarded a ₹48,000-crore contract to HAL for 83 LCA Mk-1A jets for the Indian Air Force (IAF) in February. The first Mk-1A aircraft will be delivered to the air force by March 2024, with the rest slated to join its combat fleet by 2029.

Earlier this month, the PM-headed Cabinet Committee of Security (CCS) cleared two big Make in India projects worth ₹33,000 crore. It cleared the much-delayed purchase of 56 C-295 medium transport aircraft to replace the IAF's ageing fleet of Avro-748 planes. The C-295 project is estimated to be worth ₹22,000 crore.

It also cleared a Defence Research and Development Organisation (DRDO) proposal to develop new airborne early warning and control (AEW&C) aircraft for the IAF using Airbus jets bought from Air India. This project is estimated to be worth around ₹11,000 crore.

Last week, the IAF inducted a medium range surface-to-air-missile (MRSAM) system capable of knocking out aerial threats such as enemy fighter jets, missiles, helicopters and unmanned aerial vehicles at a range of 70 km. India and Israel have jointly developed the MRSAM or the Barak 8 air defence system.

Last month, the Indian Army accepted the delivery of the first batch of multi-mode hand grenades manufactured by a private sector firm. The defence ministry signed a contract with Nagpur-based private firm Economic Explosives Ltd (EEL) last October for supplying 1 million hand grenades to the army. These will replace a World War-II vintage hand grenade design being used by the army.

The government has taken several measures to boost self-reliance in the defence sector over the last two years. These include raising foreign direct investment (FDI) in defence manufacturing, creating a separate budget for buying locally made military hardware and notifying two lists of 209 defence items that cannot be imported (ban to be implemented progressively from 2021 to 2025).

The items that cannot be imported include AEW&C systems (Airborne early warning and control systems), light combat aircraft, missile destroyers, ship-borne cruise missiles, long-range land attack cruise missiles, basic trainer aircraft, specified types of helicopters and artillery guns.

<https://www.hindustantimes.com/india-news/world-taking-note-of-india-s-defence-manufacturing-prowess-pm-modi-in-aligarh-101631621735478.html>

'BrahMos to be made in UP', PM Modi emphasizes on Lucknow node defence corridor usage

Prime Minister Modi said the whole world is witnessing India manufacturing defence equipment from modern grenades and rifles to fighter aircraft, drones and warships

Aligarh: Asserting India is moving out of the image of a big defence importer and moving towards making a new identity of an important defence exporter of the world, Prime Minister Narendra Modi on Tuesday said the BrahMos missiles will be manufactured in Uttar Pradesh.

Prime Minister Modi said the whole world is witnessing India manufacturing defence equipment from modern grenades and rifles to fighter aircraft, drones and warships.

“Whether it is a rifle, fighter jet, drone or warship, there is a mission going on to push ‘Make in India’. India is stepping away from the image of being one of the largest defence importers and is moving ahead with the pledge to become a defence exporter,” he said, UNI reported.

Prime Minister Modi, who laid the foundation stone of Raja Mahendra Pratap Singh State University in Aligarh, said Uttar Pradesh is becoming a huge centre of this transformation and added he took pride in this as he is the Member of Parliament from the state.

“In the Lucknow node of the defence corridor, BrahMos (missiles) will be made,” he said.

Prime Minister Modi informed that one and half dozen defence manufacturing companies will create thousands of jobs with hundreds of crores of rupees investment.

“New industries are coming up to support the manufacture of small arms, armaments, drones and aerospace-related products in the Aligarh node of the defence corridor. This will give new identities to Aligarh and nearby areas,” he said.

The Prime Minister pointed out that Aligarh, which was famous for protecting the houses and shops with its famous padlocks, will now also be famous for creating products that will protect the nation’s boundaries.

“This will create new opportunities for the youth and MSME,” he said.

India, according to a report by Stockholm International Peace Research Institute (SIPRI), was between 2016 and 2020 the world’s second-largest importer of weapons, accounting for 9.5 per cent of the total global arms imports.

India was during the period the world’s 24th largest exporter of weapons, accounting for a 0.2 per cent share of global arms exports.

<https://news.abplive.com/news/india/brahmos-missiles-to-be-manufactured-in-uttar-pradesh-pm-modi-1482137>



BrahMos supersonic cruise missile | File Image

BrahMos cruise missile manufacturing unit to be set up between Lucknow and Jhansi: Report

According to reports, the manufacturing unit for the BrahMos missiles will be set up between Lucknow, Kanpur and Jhansi with an investment of Rs 300 crore. The BrahMos project will provide indirect employment to around 5,000 people and nearly 10,000 will get work through the production centre

Edited By Ritesh K Srivastava

New Delhi: BrahMos, the supersonic cruise missile which is being jointly developed by India and Russia, will be manufactured in the Lucknow node of the Uttar Pradesh Defence Corridor soon.

According to reports, the manufacturing unit for the BrahMos missiles will be set up between Lucknow, Kanpur and Jhansi with an investment of Rs 300 crore. The BrahMos project will provide indirect employment to around 5,000 people and nearly 10,000 will get work through the production centres.



BrahMos Aerospace, a joint venture (JV) of Defence Research and Development Organisation (DRDO) of India and NPO Mashinostroeyenia (NPOM) of Russia, has proposed the setting up of a modern manufacturing facility near Lucknow to the Uttar Pradesh government.

A top-level delegation of BrahMos Aerospace led by the director-general of BrahMos Sudhir K Mishra had earlier met UP Chief Minister Yogi Adityanath and discussed the proposal to set a major manufacturing facility for production and supply of various systems and sub-systems for next-generation missile systems.

Mishra also forwarded a letter to UP Expressway Industrial Development Authority (UPEIDA) CEO and Additional Chief Secretary (home) Awanish Awasthi seeking 200-acre land for the project under the Defence Corridor for making the BrahMos missile.

The Uttar Pradesh government has also given indications that the production unit for the next-generation state-of-the-art BrahMos missiles will most likely come up in the Defence Corridor in Lucknow.

Besides the BrahMos missile manufacturing, research and development work will also be done in these units. More than 100 BrahMos missiles are planned to be built in the next three years.

In January 2018, Prime Minister Narendra Modi announced the creation of a Defence Corridor in UP during an investors' summit. The UP government also later said that it was setting up defence corridors at Lucknow, Kanpur, Chitrakoot, Jhansi, Agra, and Aligarh nodes.

In the last three years, over 65 big companies have requested the government to provide land in the Defence Industrial Corridor to set up their factories, of which around 19 big companies have been allotted 55.4 hectares of land by the UPEIDA recently.

BrahMos Supersonic Cruise Missile is a state-of-the-art cruise missile that is designed, developed and produced by BrahMos Aerospace, a joint venture of Defence Research and Development Organisation (DRDO) and Russia's NPO Mashinostroeyenia. The next-generation supersonic cruise missile is based on the technology of Russia's P-800 Oniks cruise missile.

<https://zeenews.india.com/india/brahmos-cruise-missile-manufacturing-unit-to-be-set-up-between-lucknow-and-jhansi-report-2393710.html>

DNA Explainer: What is BrahMos and how it helps India maintain missile supremacy?

Jointly developed by India and Russia, Brahmos is the world's fastest anti-ship cruise missile in operation

- *A new manufacturing unit for the BrahMos missile is set to come up in the Uttar Pradesh Defence Corridor. The supersonic cruise missile is one of India's most potent strategic defence assets,*
- *The new missile factory will reportedly be located near Lucknow and will be set up in a 200-acre area with an investment of Rs 300 crore. Apart from missile manufacturing, the facility will also engage in research and development activities.*
- *More than 100 BrahMos missiles will be made over the next three years in a project that will not just create thousands of jobs but will also be immensely significant in India's future defence strategies.*

1. Jointly developed by India and Russia

The state-of-the-art cruise missiles are designed and produced by BrahMos Aerospace, a joint venture between India's Defence Research and Development Organisation (DRDO) and Russia's NPO Mashinostroyeniya. The name BrahMos is a comes from combining the names of India's Brahmaputra and Russia's Moskva rivers.



2. Strategic importance to India

The world's fastest anti-ship cruise missile, BrahMos is a part of the arsenal of all three arms of the Indian defence forces - Army, Navy, and Air Force. Several versions of BrahMos exist which can be fired from land, from water via warships and submarines and from air via the Sukhoi-30 fighter jets. The Indian Navy and Army have had BrahMos capabilities since 2005 and 2007 respectively. In 2019, version entered service with the Air Force.

3. BrahMos Missile details

It is a two-stage missile with ranges 290 kilometres in the earliest versions to around 400 kilometres with the newer versions. The first stage is a solid propellant booster while the second is a liquid ramjet. Versions with higher ranges up to 1000 kilometres are currently under development. Sukhoi-30s armed with BrahMos missiles and having a range of 1,500 kilometres act as a key tool of strategic deterrence to hostile neighbours across land borders as well as India's ocean waters.

4. Next-gen Brahmos

The BrahMos Aerospace JV which proposed the missile manufacturing unit to the UP Government, is also developing a next-gen hypersonic version, BrahMos-II. This missile will reportedly have a speed in excess of Mach 7-8 along with extended range. The UP government has also signalled intent for a production unit for the next-gen BrahMos missiles to also come up in the state's Defence Corridor.

<https://www.dnaindia.com/explainer/photo-gallery-dna-explainer-what-is-brahmos-and-how-it-helps-india-maintain-missile-supremacy-drdo-up-defence-corridor-2911119/strategic-importance-to-india-2911121>

DRDO partners with AU for setting up a Food Testing Lab in Vizag

The Defence Research and Development Organisation (DRDO) will be part of the Food Testing Lab (FTL) set up by Andhra University (AU) in Vizag. On Monday, Associate Director of the Mysore-based Defence Food Research Lab (DFRL), Dr R Kumar, visited the varsity and had an interaction with AU Vice-Chancellor PVGD Prasad Reddy. DFRL is an Indian defence laboratory of DRDO. They research food science and the development of convenience foods, preservation of foods, nutritional and biochemical evaluation, food safety, and food packaging.



Speaking about the new food testing lab in collaboration with DRDO, the VC said that this will be the first organic testing lab set up in Andhra University. It will be funded by the Rashtriya Uchchar Shiksha Abhiyan (RUSA). The lab will conduct analysis, research, and testing of food. The VC said that DRDO's help in conducting the research could give great results for the development of the nation. He also shared details about the pharma testing and genetic testing labs being set up by the university.

The DFRL Associate Director, Dr R Kumar, shared details on the poke facilities and technical support required for the food testing lab. It is said that a Memorandum of Understanding (MoU) for the food testing lab will be soon taken up, between Andhra University and DRDO in Vizag, so as to begin research on food technology.

A similar food lab with an estimated cost of Rs. 20 crore is coming up in Vizag. This will be the first lab in Andhra Pradesh by the Food Control Department, Andhra Pradesh. Currently, food samples from any raids conducted are sent to Hyderabad for a final report on the food quality checking and food quality control. Once the new lab starts functioning in the city, it will have quality checks on the food samples brought from surprise raids made at the eateries.

<https://www.yovizag.com/drdo-partners-with-au-for-setting-up-a-food-testing-lab-in-vizag/>



Wed, 15 Sept 2021

DRDO to manufacture oxygen generators with Godrej, 9 other cos

Each generator can produce 250 litres of oxygen per minute which can cater to 50 patients, it added

Mumbai: The Defence Research and Development Organisation (DRDO) has contracted 10 private sector players, including city-based Godrej & Boyce (G&B), to manufacture oxygen generators.

Godrej Precision Engineering (GPE), a unit of G&B, has received the order from the Defence Bio-engineering and Electromechanical Laboratory, a DRDO laboratory in Bengaluru, to manufacture oxygen generators, G&B said in a statement.

The second wave of the pandemic exposed the severe shortfall of oxygen across the country, which forced the state agencies to source it from all the available resources across the country to save lives. Oxygen, which is generally used in industrial plants, was ferried through tankers on the road, through railway and also by air.

The first batch of medical oxygen generators has been deployed in hospitals across Uttar Pradesh, Uttarakhand and Madhya Pradesh, it added.

"With the pandemic still rampant with newer variants emerging, the need for medical oxygen has increased exponentially," it said.

Each generator can produce 250 litres of oxygen per minute which can cater to 50 patients, it added.

G&B said this is not its first partnership with DRDO. It pointed to the past collaborations like Godrej Aerospace developing and delivering 5,000 proportional solenoid valves, a critical component for making ventilators, and GPE's work on the Brahmos missile system and naval diving gear, among others.

In a separate regulatory filing, Isgec Heavy Engineering Ltd said it has bagged an order from DRDO for supply of 25 medical oxygen plants.

"Isgec is proud to have received an order for 25 medical oxygen plants from DRDO, Ministry of Defence, Govt. of India," the company said. "These plants have a capacity of 250 LPM (litre per minute) each....The design for these oxygen plants has been developed by DRDO on the Pressure Swing Adsorption (PSA) principle," it said.

This is the first order Isgec has received for medical oxygen plants from DRDO, it said. "The scope of work includes manufacturing, supplying, installing, and commissioning," it said. Isgec is a diversified heavy engineering company engaged in manufacturing and project businesses with an extensive global presence.

<https://www.deccanherald.com/national/drdo-to-manufacture-oxygen-generators-with-godrej-9-other-cos-1030310.html>



Godrej partners with DRDO to manufacture oxygen generators

The first batch of medical oxygen generators deployed in hospitals across Uttar Pradesh, Uttarakhand and Madhya Pradesh

Godrej & Boyce, the flagship company of the Godrej Group, has announced that one of its businesses, Godrej Precision Engineering has received an order from the Defence Bio-engineering and Electromechanical Laboratory, (DEBEL), a Defence Research and Development Organisation (DRDO) laboratory in Bengaluru to manufacture oxygen generators to support India's oxygen buffer plan.

DRDO has transferred the technology from the existing technology partner to 10 private sector companies including Godrej & Boyce.

The first batch has been manufactured and supplied to rural hospitals across Uttar Pradesh, Uttarakhand and Madhya Pradesh within a record period of one month.

The system utilises an air compressor to provide compressed air to the oxygen plant which is filtered and dried by a refrigerant air dryer and further filtered before the air is admitted to the oxygen generator through adsorption towers.

The oxygen generator removes the nitrogen from the air by absorbing it in the molecular sieves and produces an output with 93±3 per cent oxygen. For separating oxygen from the air, the medical oxygen generator employs the Pressure Swing Adsorption (PSA) technique. The output is stored in a storage tank. Each generator can produce 250 litres of oxygen per minute which can cater to 50 patients.

<https://www.biospectrumindia.com/news/43/19555/godrej-partners-with-drdo-to-manufacture-oxygen-generators-.html>



नवभारत टाइम्स

डीआरडीओ ने गोदरेज, नौ अन्य कंपनियों के साथ ऑक्सीजन जेनरेटर विनिर्माण का करार किया

मुंबई: रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) ने गोदरेज एंड बॉयस (जीएंडबी) सहित निजी क्षेत्र की 10 कंपनियों के साथ ऑक्सीजन जेनरेटर के विनिर्माण के लिए अनुबंध किया है।

जीएंडबी की इकाई गोदरेज प्रीसिशन इंजीनियरिंग (जीपीई) को डीआरडीओ प्रयोगशाला डिफेंस बायो-इंजीनियरिंग एंड इलेक्ट्रोमेकेनिकल लैब से ऑक्सीजन जेनरेटर के विनिर्माण का ऑर्डर मिला है। जीएंडबी ने बयान में यह जानकारी दी।

कोविड-19 महामारी की दूसरी लहर के दौरान देशभर में ऑक्सीजन का भारी संकट हो गया था, जिसकी वजह से राज्य की एजेंसियों को लोगों का जीवन बचाने के लिए देश में सभी उपलब्ध स्रोतों से ऑक्सीजन

मंगानी पड़ी थी। उस समय सड़क मार्ग में टैंकरों से लेकर रेलवे और हवाई मार्ग से ऑक्सीजन का प्रबंध करना पड़ा था।

बयान में कहा गया है कि मेडिकल ऑक्सीजन जेनरेटर का पहला बैच उत्तर प्रदेश, उत्तराखंड तथा मध्य प्रदेश के अस्पतालों में लगाया गया है।

बयान में कहा गया है कि प्रत्येक जेनरेटर प्रति मिनट 250 लीटर ऑक्सीजन का उत्पादन कर सकता है जो 50 मरीजों की जरूरत को पूरा करेगा।

<https://navbharattimes.indiatimes.com/business/business-news/drdo-ties-up-with-godrej-nine-other-companies-to-manufacture-oxygen-generators/articleshow/86202360.cms>

Business Standard

Wed, 15 Sept 2021

ISGEC Heavy ends higher after bagging order from DRDO

ISGEC Heavy Engineering surged 8.99% to end at Rs 795.05 after the company received an order for 25 Medical Oxygen Plants from the Defence Research & Development Organisation (DRDO), Ministry of Defence, Govt. of India.

The scope of work includes manufacturing, supplying, installing, and commissioning.

These plants have a capacity of 250 LPM (litre per minute) each and oxygen concentration of 93 (+/- 3%). The design for these oxygen plants has been developed by DRDO on the pressure swing adsorption (PSA) principle.

This is the first order Isgec has received for medical oxygen plants from DRDO. The project aims to augment the medical oxygen infrastructure in India in order for the nation to be in a stronger position to fight the on-going COVID-19 pandemic.

The announcement was made in the last hour of trade today, 14 September 2021.

ISGEC Heavy Engineering is a diversified heavy engineering company engaged in manufacturing and project businesses with an extensive global presence.

The company's consolidated net profit dropped 66.93% to Rs 13.63 crore on a 5.38% increase in net sales to Rs 1128.38 crore in Q1 FY22 over Q1 FY21.

(This story has not been edited by Business Standard staff and is auto-generated from a syndicated feed.)

https://www.business-standard.com/article/news-cm/isgec-heavy-ends-higher-after-bagging-order-from-drdo-121091400904_1.html

Defence Strategic: National/International



Press Information Bureau
Government of India

Ministry of Defence

Tue, 14 Sept 2021 5:47PM

Chief of Army Staff concludes two day visit to Mumbai

General MM Naravane, Chief of Army Staff, concluded a two-day visit to important Army and Naval installations at Mumbai. On 13 September 2021, the Army Chief visited HQ Western Naval Command where he reviewed a ceremonial guard of honour and interacted with Vice Admiral R Hari Kumar, Flag Officer Commanding in Chief of Western Naval Command. The COAS also visited 'INS Teg', a Missile Frigate affiliated with the 'Sikh Light Infantry Regiment'. In the evening, the COAS called on Shri Bhagat Singh Koshyari, the Honourable Governor of Maharashtra, and discussed issues of mutual interest including welfare and resettlement of Veterans in the State. Later, he also interacted with representatives of major business houses involved in the manufacture and supply of state of the art equipment for the Defence Forces.

On 14 September 2021, the COAS visited the Headquarters Maharashtra, Gujarat and Goa Area and different administrative echelons located in Mumbai. Lt Gen SK Prashar, GOC briefed him on the functioning of the Area HQ and their contributions in various humanitarian assistance during COVID-19 and flood relief operations this year. The Army Chief appreciated the various welfare initiatives and projects undertaken to improve the quality of life of troops, their families and veterans by the Area HQ.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754818>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Tue, 14 Sept 2021 5:47PM

सेना प्रमुख का दो दिवसीय मुम्बई दौरा संपन्न

थल सेनाध्यक्ष जनरल एम एम नरवणे ने मुंबई में महत्वपूर्ण थल सेना और नौसेना प्रतिष्ठानों के दो दिवसीय दौरे का समापन किया। दिनांक 13 सितंबर 2021 को सेना प्रमुख ने पश्चिमी नौसेना कमान मुख्यालय का दौरा किया, जहां उन्होंने गार्ड ऑफ ऑनर की औपचारिक समीक्षा की और पश्चिमी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग इन चीफ वाइस एडमिरल आर हरि कुमार के साथ बातचीत की। सेना प्रमुख ने 'सिख लाइट इन्फैंट्री रेजिमेंट' से संबद्ध मिसाइल फ्रिगेट 'आईएनएस तेग' का भी दौरा किया। शाम को सेना प्रमुख ने महाराष्ट्र के माननीय राज्यपाल श्री भगत सिंह कोश्यारी से मुलाकात की और राज्य में पूर्व सैनिकों के कल्याण और पुनर्वास सहित पारस्परिक हित के मुद्दों पर चर्चा की। बाद में उन्होंने रक्षा

बलों के लिए अत्याधुनिक उपकरणों के निर्माण और आपूर्ति में शामिल प्रमुख व्यापारिक घरानों के प्रतिनिधियों के साथ भी बातचीत की।

दिनांक 14 सितंबर 2021 को सेना प्रमुख ने महाराष्ट्र, गुजरात और गोवा एरिया मुख्यालय और मुंबई में स्थित विभिन्न प्रशासनिक क्षेत्रों का दौरा किया। लेफ्टिनेंट जनरल एस के पराशर, जीओसी ने उन्हें एरिया मुख्यालय के कामकाज और इस वर्ष कोविड-19 और बाढ़ राहत कार्यों के दौरान विभिन्न मानवीय सहायता में उनके योगदान के बारे में जानकारी दी। सेना प्रमुख ने क्षेत्र मुख्यालय द्वारा सैनिकों, उनके परिवारों और पूर्व सैनिकों के जीवन की गुणवत्ता में सुधार के लिए शुरू की गई विभिन्न कल्याणकारी पहलों और परियोजनाओं की सराहना की।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754868>



Press Information Bureau
Government of India

Ministry of Defence

Tue, 14 Sept 2021 12:40PM

Handing over ceremony interim lease passenger variant Dornier (PVD)

An official ceremony was conducted at Maritime Air Squadron of National Coast Guard, Mauritius on 13 September 2021 for handing over of the Passenger Variant Dornier (PVD). The aircraft has been presented to Mauritius Police Force by the Indian Navy, on lease. The Minister of Land Transport and Light Rail, Minister of Foreign Affairs, Regional Integration and International Trade, Honourable Alan Ganoo, the High Commissioner of India, Smt Nandini K Singla, the Commissioner of Police and various other dignitaries were present for the ceremony.

The High Commissioner of India to Mauritius, emphasised on the friendly ties and naval cooperation existing between Mauritius and India, a relation which has only flourished with time. She highlighted that MSN 4059 has been leased to MPF by Indian Navy on a gratis basis to support the current increased load of airoperations. She also mentioned that next year, HAL shall be handing over a brand new State-of-the-Art PVD to Mauritius and this purchase has been facilitated by the Line of Credit under the Government of Mauritius. The gathering was then addressed by the Minister of Land Transport and Light Rail, Minister of Foreign Affairs, Regional Integration and International Trade, Honourable Alan Ganoo, who emphasized on the continued support given by India and thanked Indian Navy for sparing a Dornier from its inventory for use by the National Coast Guard. The interim lease PVD was then handed over by the High Commissioner of India Smt Nandini K Singla to the Minister of Land Transport and Light Rail, Minister of Foreign Affairs, Regional Integration and International Trade, Honourable Alan Ganoo officially.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754715>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Tue, 14 Sept 2021 12:40PM

पैसेंजर वैरियंट डोर्नियर (पीवीडी) को अंतरिम पट्टे पर सौंपने के लिए समारोह आयोजित किया गया

पैसेंजर वैरियंट डोर्नियर (पीवीडी) को सौंपने के लिए नेशनल कोस्ट गार्ड, मॉरीशस के मेरीटाइम एयर स्क्वाड्रन में 13 सितंबर, 2021 को एक आधिकारिक समारोह आयोजित किया गया। मॉरीशस पुलिस बल को भारतीय नौसेना की ओर से पट्टे पर विमान प्रदान किया गया है। भूतल परिवहन एवं लाइट रेल, विदेश, क्षेत्रीय समन्वय एवं अंतरराष्ट्रीय व्यापार मंत्री श्री एलन गानू, भारत की उच्चायुक्त श्रीमती नंदिनी के. सिंगला, पुलिस आयुक्त और कई अन्य गणमान्य व्यक्ति समारोह में उपस्थित थे।

मॉरीशस में भारत के उच्चायुक्त ने मॉरीशस और भारत के बीच मैत्रीपूर्ण संबंधों और नौसैनिक सहयोग पर जोर दिया, एक ऐसा संबंध जो समय के साथ विकसित हुआ है। उन्होंने कहा कि भारतीय नौसेना द्वारा एमपीएफ को हवाई संचालन पर वर्तमान बड़े हुए भार को ध्यान में रखते हुए सहायता के तौर पर एमएसएन 4059 को लीज पर प्रदान किया गया है। उन्होंने यह भी बताया कि अगले साल, एचएएल मॉरीशस को एक नया अत्याधुनिक पीवीडी सौंपेगा और इस खरीद को मॉरीशस सरकार के तहत क्रेडिट लाइन द्वारा सुगम बनाया गया है। सभा को भूतल परिवहन और लाइट रेल, विदेश मामले, क्षेत्रीय एकीकरण और अंतरराष्ट्रीय व्यापार मंत्री श्री एलन गानू ने संबोधित किया। उन्होंने भारत द्वारा दिए गए निरंतर समर्थन पर जोर देते हुए अपने भंडार से नेशनल कोस्टगार्ड के इस्तेमाल के लिए एक डोर्नियर प्रदान करने के लिए भारतीय नौसेना को धन्यवाद दिया। इसके बाद (पीवीडी) का अंतरिम पट्टा भारत के उच्चायुक्त श्रीमती नंदिनी के सिंगला द्वारा श्री एलन गानू को आधिकारिक तौर पर सौंप दिया गया।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1754734>

Exclusive | Non-contact warfare doctrine, local languages in military & more: task force to track work on PM's directives

The task force will meet to discuss road map for the timely implementation of the PM's directives

By Amrita Nayak Dutta

A task force headed by Chief of Defence Staff (CDS) General Bipin Rawat will track the implementation of a set of directives by Prime Minister Narendra Modi, including drafting a doctrine for non-contact warfare, reforming public sector units in defence, handholding the domestic defence industry and ensuring greater use of indigenous languages in the military.

Defence sources told News18.com that the task force featuring top officers from the defence ministry, the armed forces and the National Security Council Secretariat (NSCS) will meet at South Block to discuss charting a road map for the timely implementation of the PM's directives that came during the Combined Commanders' Conference (CCC-2021) at Gujarat's Kevadia in March.

CCC is a brain-storming event for top military commanders of the army, navy and the air force.

According to the defence sources cited above, an instruction to set up the task force to monitor work on the PM's directive came from his office in April. The sources said the task force will also look into the implementation of a set of directives by defence minister Rajnath Singh over the last two years.

The task force has held its first meeting. It will submit a quarterly report to the Prime Minister's Office (PMO) and the defence minister's office on the progress.

Area of interest

India's top defence officials have agreed in the past that there is an increased need to bolster capabilities and prepare for non-contact warfare, which has been emerging as a bigger challenge than conventional warfare.

Non-contact warfare comprises all non-kinetic forms, including those related to information, cyberspace and psychological domains, even though the military aspect of such warfare could involve drones and other such munitions.

A single doctrine is needed to coordinate and synergise all constituents of non-contact warfare, which could intimidate the adversary without any physical contact, a senior defence official said.

"A joint doctrine for three services will help integrate activities of all stakeholders to ensure a cohesive approach," the official explained.

At present, triservices bodies such as the defence cyber agency and the defence space agency are working together on these areas.

More on the agenda

Some of the other directives by the PM, which are being reviewed by the task force, relate to plans for celebrating 75 years of independence next year. This, among others, involves identifying



India's top defence officials have agreed in the past that there is an increased need to bolster capabilities and prepare for non-contact warfare. (PTI File)

several obsolete laws and practices in defence that can be done away with, and a greater focus on the use of indigenous languages in the Indian military to mark the occasion.

All central ministries are planning a range of activities for the occasion next year under the theme of “Azaadi Ka Amrit Mahotsav”.

A top defence source told News18.com that the PM’s directives include putting stress on modernisation of existing military technology, streamlining long-drawn capital procurement processes and a push to self-reliance in defence programmes — all of which are in sync with the government’s larger “Atmanirbhar Bharat” policy.

“The PM’s directives also underline the need for creating dual-use infrastructure (which can be used by both military and civil population), aside from optimising defence expenditure and manpower,” the source said.

With the capital budget of defence being 28% of the overall budget, authorities believe greater self-reliance in defence will help revitalise the economy by creating business opportunities, jobs and auxiliary industries.

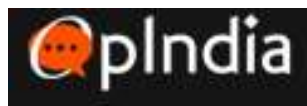
The list of the PM’s directives also features ensuring regular interaction between the military establishment and its veterans, and exploring ways to boost India’s defence research capabilities, the source added.

Another source said responsibilities have been drawn department-wise for the implementation of each of the PM’s directives. Their progress will be regularly reviewed and monitored by the CCC task force for speedy implementation.

The sources said the defence minister’s directives include ensuring that grievances of the kin of martyrs are addressed timely, preparing for non-traditional security threats, and a continued focus on border infrastructure.

Improved border infrastructure has been a priority for India in the wake of the military standoff with China in eastern Ladakh that began in May 2020.

<https://www.news18.com/news/india/exclusive-non-contact-warfare-doctrine-local-languages-in-military-more-task-force-to-track-work-on-pms-directives-4202078.html>



Wed, 15 Sept 2021

BHU’s new Hindu Studies course to include topics on ancient warfare, military strategy, women in military: Report

Commenting on the need for such a subject, a senior university official said, “We have references of military sciences and military strategies in Vedic literature that are not brought into the knowledge and practice as of now. It is necessary for the students to study Hindu military science and strategy through the curriculum.”

The Banaras Hindu University had introduced a new course on Hindu Studies this year, the first of its kind in India. As per reports, the MA course in Hindu Studies is offered by the Bharat Adhyayan Kendra (BAK) in the University’s Faculty of Arts.

As per a report in Hindustan Times, the course structure is said to include topics on ancient warfare in India’s ancient texts. The role of female soldiers, military strategy, setting up of camps and military negotiations as envisaged in Indic scriptures are to be included under the topics.

The HT report mentioned that officials at the university explained that the topics aim to introduce the idea of the military to uncover the references of ‘defence studies’ in Vedic literature and to use it in contemporary times to solve present challenges.

According to the official document accessed by the Hindustan Times, there are four units under one of the papers titled 'Indian military, science and strategy'. These units focus on topics like

1. Definitions of enemies and allies
2. Ways to mitigate enemies and promote allies
3. Idea of women in military
4. Construction of camp and fort
5. Right time and place of way to war
6. Making of war strategy and its implementation and
7. Strategy after victory and defeat, among others.



BHU course on Hindu Studies

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"In this programme, the students will study two important books: Vasistha's 'Dhanurveda Samhita' and Vaishampayan's 'Neeti Prakashika', both in Sanskrit, which exclusively deal with military strategy and nobody knows about them," the official added.

The official on the condition of anonymity further revealed that countries like China use ancient military knowledge in the present context. India's ancient texts too possess crucial information on the formation of the strategies for national security and how to deal with external as well as internal enemies.

It is notable here that many Indian texts focus on the idea of warfare, politics, national strategy and administration. However, the studies and research on these topics are limited to history courses and have rarely been implemented in the mainstream syllabus.

The MA course on Hindu Studies, a joint effort by BHU's Department of Philosophy and Religion, Bharat Adhyayan Kendra, Department of Sanskrit, Department of Ancient History, Culture, and Archeology, is the first of its kind in India.

'Women in military'

As per the HT report, the official further emphasized the role played by women in the military. "We have a great history of participation of women in the military. For example, Rani Ahilyabai Holkar and Rani Laxmibai. Both have fought on the battlefields. Presently, women are part of our defence services. Students should know the origin of the concept of women in the military," said the official.

Interestingly, people from various parts of the country have shown a great deal of interest to learn more about Hindus and their civilisation. "A large number of these queries are from NRIs who have a keen willingness in staying connected with their roots and gain more knowledge," Arts faculty dean Vijay Bahadur Singh was quoted in the HT report.

40 students will be admitted in the first batch this year. The 2-year MA course will include 9 compulsory and 7 optional papers.

This is, perhaps, for the first time in the country that the various fields of Hindu scriptures such as military science, philosophy, epistemology have been given an academic format. The syllabus includes the tradition of Hinduism, which mainly consists of the principles, interpretations, debates and methods of determining the meaning of scriptures, Western knowledge epistemology, Ramayana, Mahabharata, architecture, folklore, folk-drama, linguistics and ancient military science.

<https://www.opindia.com/2021/09/bhu-hindu-studies-course-topics-ancient-warfare-military-strategy-women/>



Wed, 15 Sept 2021

ISRO's new series of heavy-lift rockets to carry between 5-16 tons to Geosynchronous Transfer Orbit

This will be an enormous improvement over the current maximum lift capability of 4 tons that the GSLV Mk3 rocket has performed to GTO

By Sidharth MP

New Delhi: To attain total self-reliance in the launch of heavy satellites (weighing above 4 tons) and to meet future demands, the Indian Space Research Organization (ISRO) is working on a fleet of five new rockets. According to a senior official, the five Heavy-lift Launch Vehicles (HLV) are in their project report stage and in terms of design and appearance, these new fleet of rockets would be quite similar to the existing SSLV, PSLV and GSLV and GSLV Mk3 rockets, but they would be powered by even more capable, powerful and technologically advanced engines.

Presently, India pays and utilizes the services of Ariane-5, a foreign rocket, to launch satellites that weigh over 4 tons.

Speaking at a virtual event organized by ISRO and CII, N Sudheer Kumar, Director, Capacity Building Programme Office, ISRO, revealed that variants of this new fleet of heavy-lift rockets would be able to place a payload weighing anywhere between 4.9 tons to over 16 tons in the Geosynchronous Transfer Orbit (GTO).

This is an enormous improvement over the current maximum lift capability of 4 tons that the GSLV Mk3 rocket has performed to GTO.

GTO, notably, is an intermediary orbit (180 km at its closest point to earth and 36,000 km at its farthest point from earth) in which rockets place heavy satellites. After being placed in GTO, the satellites use their on-board propulsion to reach the circular orbit - 36,000 kms above the earth (it is at the same distance from the earth at any given point of time).

Being in the 36,000 km circular orbit (known as Geostationary or GSO orbit) enables communication, monitoring of a large part of the earth.

Upto three satellites in the GSO orbit are capable of covering nearly the entire globe.

According to Kumar, the work to upgrade the lift capability of GSLV Mk3 to 7.5 tons to GTO is on the verge of being concluded.

This major upgrade to India's rocket is being made possible owing to the development of two kinds of rocket engines- a Semi-cryogenic engine that burns a special variant of Kerosene (dubbed ISROsene) and Liquid oxygen; and a Cryogenic engine that burns a mixture of Liquid hydrogen and liquid oxygen. The said Semi-Cryogenic engine stage is dubbed as SC120 and the upgraded cryogenic Engine Stage is dubbed as C32.

As per ISRO's naming convention for rocket stages, the letter(s) refer to the type of engine fuel - Solid(S), Liquid(L), Semi-cryogenic(SC) and Cryogenic(C) and the accompanying number refers to the mass (in tons) of propellant carried. In simple words, a rocket is a combination of multiple engines(stages) that are vertically stacked.

"Soon the stage will be inducted into the rocket, then we need not depend on Foreign sources for the launch of heavy communication satellites(weighing over 4 or 5 tons)," Kumar said.

Regarding ISRO's ongoing projects, he outlined that work was underway on the full-scale model of the Reusable Launch vehicle technology Demonstrator (RLV-TD), besides work to scale up the proto-model of the air-breathing engine.

For ISRO, these are crucial technologies to master, in order to develop a fully reusable space vehicle dubbed the 'TSTO' or Two Stage to Orbit.

The Director of ISRO's CBPO also shared the configuration of the fleet of five heavy-lift rockets that were in their project report stage. The configurations make reference to new and more powerful rocket stages - SC400 semi-cryogenic stage, C27 Cryogenic stage, S250 Solid rocket booster.

Simply put, depending on the type of mission, payload to be lifted and rocket required, different variants of engines would be stacked vertically to run a relay race to space. Each stage would detach from the rocket after it propels the rocket to a certain altitude and speed, then the next engine would take over. This process goes on until the satellite(payload) reaches its final orbital destination.

In terms of materials, ISRO is said to be working on developing carbon-carbon composites, ceramic matrix composite for reusable vehicles, metal-foams for crash landing interplanetary probes, besides crucial components such as solar panels, fibre optics Atomic clocks, deployable antennas, lithium-ion batteries, Application Specific Integrated Circuits (ASICs) and Micro Electro Mechanical System (MEMS) Devices

<https://zeenews.india.com/india/isro-s-new-series-of-heavy-lift-rockets-to-carry-between-5-16-tons-to-geosynchronous-transfer-orbit-2393970.html>



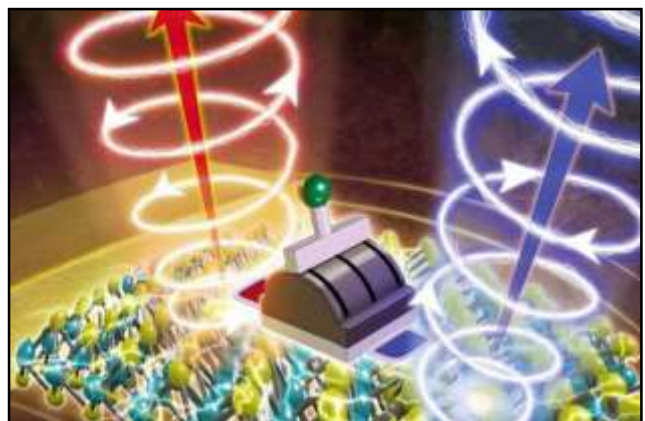
Wed, 15 Sept 2021

Future of quantum information processing: Twisting light that switches direction at room temperature

Scientists have generated circularly polarized light and controlled its direction without using clunky magnets or very low temperatures. The findings, by Nagoya University researchers and colleagues in Japan, and published in the journal *Advanced Materials*, show promise for the development of materials and device methods that can be used in optical quantum information processing.

Light particles called photons have interesting properties that can be exploited for storing and transporting data, and show tremendous promise for use in quantum computing.

For this to happen, information is first stored in electrons that then interact with matter to generate data-carrying photons. Information can be encoded in the direction of an electron's spin, just as it is stored in the form of 0 and 1 in the 'bits' of computers. Data can also be stored when electrons occupy 'valleys' found in the energy bands they move between while they



The team developed a room-temperature, electrically tunable chiral light-emitting diode based on strained monolayer semiconductors. Credit: Nagoya Univ. Takenobu Lab

orbit an atom. When these electrons interact with specific light-emitting materials, they generate twisting 'chiral' 'valley-polarized light,' which shows potential for storing large amounts of data.

So far, however, scientists have only managed to generate this type of circularly polarized light using magnets and very cold temperatures, making the technique impractical for widespread use.

Nagoya University applied physicists Taishi Takenobu and Jiang Pu led a team of scientists to develop a room-temperature, electrically controlled approach for generating this chiral valley-polarized light.

First, they grew a monolayer of semiconducting tungsten disulfide on a sapphire substrate and covered it with an ion-gel film. Electrodes were placed on either end of the device and a small voltage was applied. This generated an electric field and ultimately produced light. The team found that chiral light was observed between -193 degrees Celsius and room temperature from the portions of the device where the sapphire substrate was naturally strained as a result of the synthetic process. It could only be generated from the strain-free areas, however, at much colder temperatures. The scientists concluded that strain played a crucial role in generating room temperature valley-polarized light.

They then manufactured a bending stage on which they placed a tungsten disulfide device on a plastic substrate. They used the bending stage to apply strain to their material, driving an electric current in the same direction of the strain and generating valley-polarized light at room temperature. Applying an electric field to the material switched the chiral light from moving in one direction to moving in the other. "Our use of strained monolayer semiconductors is the first demonstration of a light-emitting device that can electrically generate and switch right- and left-handed circularly polarized light at room temperature," says Takenobu.

The team will next further optimize their device with the aim of developing practical chiral light sources.

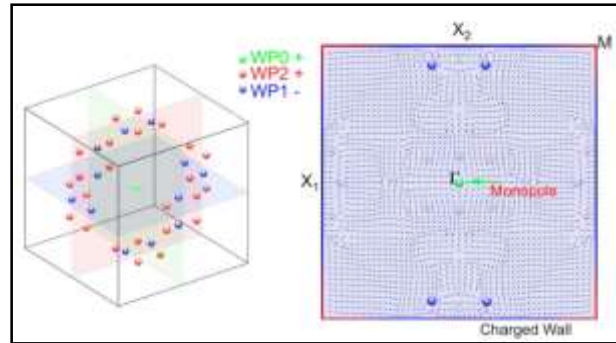
More information: Jiang Pu et al, Room-Temperature Chiral Light-Emitting Diode Based on Strained Monolayer Semiconductors, *Advanced Materials* (2021). [DOI: 10.1002/adma.202100601](https://doi.org/10.1002/adma.202100601)

Journal information: [Advanced Materials](https://phys.org/news/2021-09-future-quantum-room-temperature.html)
<https://phys.org/news/2021-09-future-quantum-room-temperature.html>

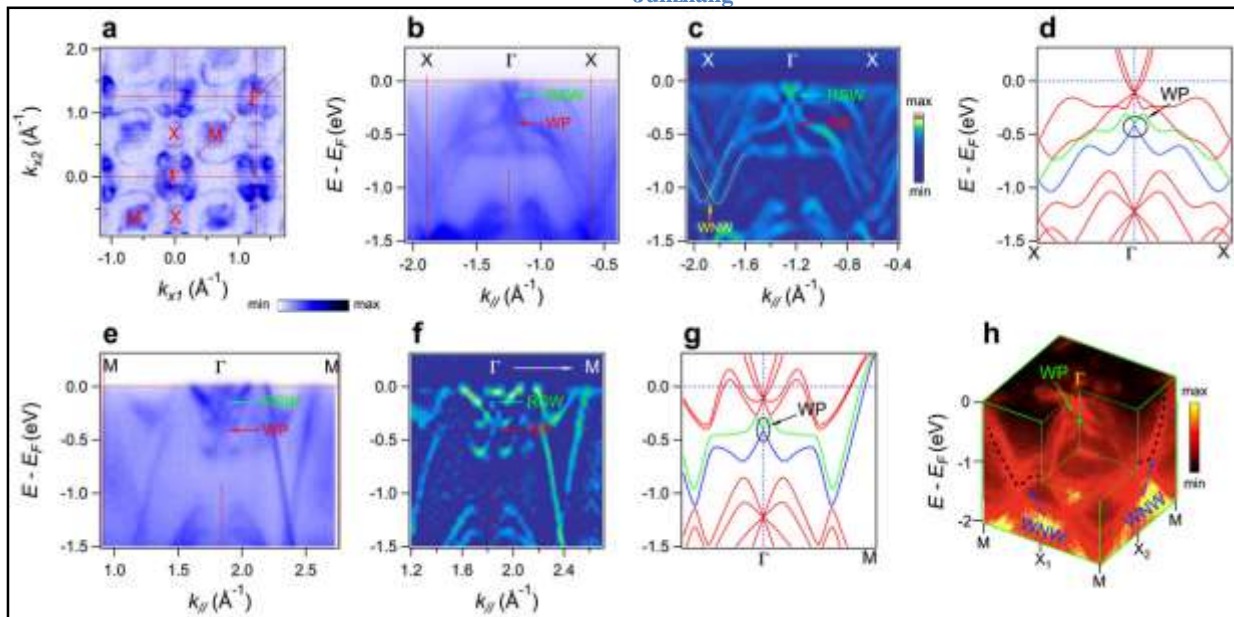
Physicist observes the first unpaired Weyl magnetic monopole

Similar to a magnet that always has both south and north poles, a kind of special quasiparticles in condensed matter called "Weyl Fermions" always appear in pairs with opposite chirality. There had been no experimental report that unpaired Weyl points exist in condensed matter until recently, a City University of Hong Kong (CityU) physicist observed the first unpaired singular Weyl magnetic monopole in a specific kind of single crystalline solid.

The research work was co-led by Dr. Ma Junzhang, Assistant Professor in the Department of Physics at CityU and collaborating scientists from École Polytechnique Fédérale de Lausanne



The 37 unpaired Weyl points in the 3D reciprocal space of GaPt, and the Berry curvature field (analogous to magnetic field) component in the $k_z=0$ plane. Credit: Dr. Ma Junzhang



Experimental observation of unpaired magnetic monopole in energy-momentum space of PtGa. Credit: Dr. Ma Junzhang

(EPFL) and Paul Scherrer Institute (PSI) in Switzerland. It was published in *Nature Communications*, titled "Observation of a singular Weyl point surrounded by charged nodal walls in PtGa."

"Our group is the first to see and record an unpaired Weyl magnetic monopole in the experiment. The findings open a new avenue to search for the bulk topological properties of unpaired Weyl magnetic monopoles in solids, which will promote the understanding of basic topological physics, and the application of Weyl semimetals into spintronics," Dr. Ma said.

Weyl points: similar properties with magnetic monopoles

In the real world, a magnet must have south and north poles simultaneously. Modern physics theories suggest the existence of a magnetic monopole, i.e. a quantum elementary unit of magnet with just one pole. But so far, there has been no known experimental or observational evidence that

magnetic monopoles exist. Searching for magnetic monopole has been a dream for the modern physics community.

Similarly, Weyl points in condensed matter (including semimetal crystal) have the similar properties as the magnetic monopoles. "Therefore, Weyl points in condensed matter are also called Weyl magnetic monopoles," explained Dr. Ma.

But there is one difference for Weyl points, based on many physicists' perceptions. It is widely believed that the existence of an unpaired Weyl magnetic monopole in solids is impossible due to the well-known Nielsen-Ninomiya no-go theorem. As a result, it is thought that Weyl magnetic monopoles in semimetals should always appear in pairs with opposite charges in the 3D momentum space. And the projections of the monopoles on the surface of the single crystal should always be connected by one kind of conducting state called Fermi arcs, which acts like an electronic channel that electrons can transport through it.

No successful experimental precedent

Considerable theoretical efforts have been dedicated to searching unpaired Weyl monopoles beyond this no-go theorem, but no successful experiment was reported in the past. Many scientists thought that such kind of "unpaired substance" was hard to exist in single crystalline solids.

But Dr. Ma didn't think so. He searched thousands of compounds in the database and finally discovered that a few dozens of them are the potential candidates hosting unpaired Weyl monopoles. His suggestions were supported by theoretical colleagues Dr. Wu Quansheng, and Professor Oleg Yazyev from EPFL. After that, a team led by Dr. Ma and Professor Shi Ming from PSI started a series of photoemission experiments at the Swiss Light Source at PSI and successfully proved the primary ideas.

Combining angle-resolved photoemission spectroscopy (ARPES) experiments with density functional theory calculations, the research team revealed for the first time that unpaired Weyl monopoles can emerge in various compounds. In studying the promising candidate, semimetal crystal platinum gallium (PtGa), the research team identified 37 Weyl monopoles in the momentum space, and found out that the system hosts odd number 37 Weyl points with either +1 charge or -1 charge that prevent them pair together.

They also demonstrated experimentally for the first time that unpaired magnetic monopole can exist in the momentum space of solid without surface Fermi arc. The geometry of the unpaired Weyl point is quite different from that of normal Weyl semimetals, so the properties are expected to change significantly in this new kind of materials, which defines a new study direction.

A new research direction

Dr. Ma believes that the groundbreaking discovery of unpaired Weyl magnetic monopole can provide new insight into the fundamental physics of Weyl magnetic monopole in condensed matter. And the special properties of Weyl magnetic monopole, such as high electronic mobility, special response to an outside magnetic field and low heat rate, can make it a good candidate for spintronic computer devices like quantum computing and neuromorphic computing in the future.

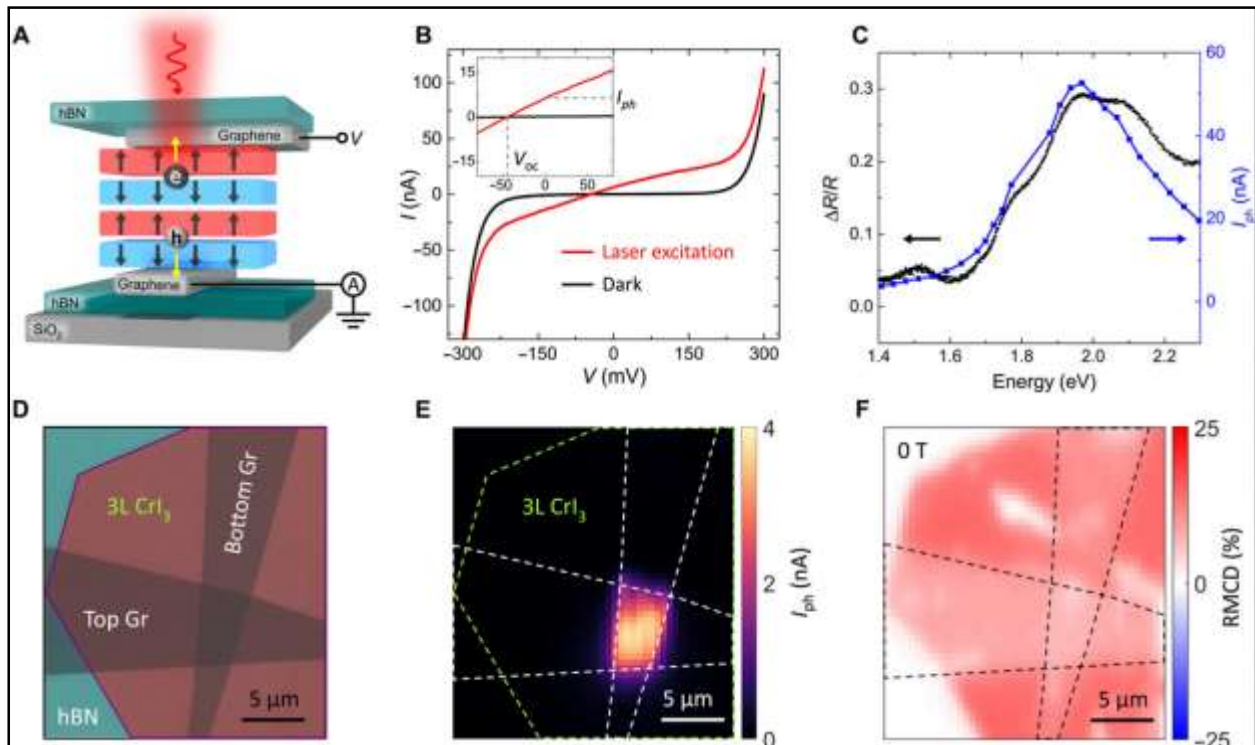
More information: J.-Z. Ma et al, Observation of a singular Weyl point surrounded by charged nodal walls in PtGa, *Nature Communications* (2021). DOI: [10.1038/s41467-021-24289-0](https://doi.org/10.1038/s41467-021-24289-0)

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Spin photovoltaic effects in magnetic van der Waals heterostructures

Thamarasee Jeewandara

In a new report now published on *Science Advances*, Tiancheng Song and a research team at the department of physics, University of Washington, U.S., and materials and nanoarchitectronics in



Photocurrent response of CrI₃ junction device. (A) Schematic of a four-layer CrI₃ junction device in AFM ground state ($\uparrow\downarrow\uparrow\downarrow$), with top and bottom graphene contacts and hBN encapsulation. (B) I-V curves of a four-layer CrI₃ junction (D2) under dark condition (black curve) and with $1 \mu\text{W}$ of 1.96-eV laser excitation (red curve). Inset is a zoomed-in view of the generated photocurrent at zero bias I_{ph} and open-circuit voltage V_{oc} . (C) Differential reflectance ($\Delta R/R$; black dots) and photocurrent (I_{ph} ; blue squares) as a function of photon energy for trilayer (3L) CrI₃ at -2 T . The photocurrent is measured from a trilayer CrI₃ junction device (D1) with an optical power of $10 \mu\text{W}$. (D) Optical microscopy image of the 3L CrI₃ junction device (D1). Scale bar, $5 \mu\text{m}$. (E and F) Spatial maps of photocurrent and RMCD signal measured from the same device at 0 T with an optical power of $1 \mu\text{W}$. Scale bars, $5 \mu\text{m}$. Credit: *Science Advances*, 10.1126/sciadv.abg8094

Japan and China, detailed spin photovoltaic effects in van der Waals (vdW) heterostructures of two-dimensional (2D) magnetic chromium triiodide (CrI₃) sandwiched by graphene contacts.

The concept of van der Waals crystals and their heterostructures are of interest in materials science, applied physics and optoelectronics, to explore the optoelectronic properties within the two-dimensional (2D) limit. It is possible to integrate 2D magnets to realize 2D spin-optoelectronics with controlled spin degrees of freedom. The photocurrent of the CrI₃ displayed a distinct dependence on light helicity, which Song et al. tuned by varying the magnetic states and photon energy. The research highlighted the potential to study the emergent phenomenon of photospinronics by engineering magnetic vdW heterostructures.

Spin photovoltaic effects

Spintronics aim to regulate the spin degree of freedom in electronic systems in order to facilitate new functions. The generation and control of spins can open new emerging opportunities in spin electronics to explore new spin photovoltaic effects and spin photocurrents. The spin photovoltaic effects can be realized using different mechanisms in various heterostructures, among which two-dimensional materials such as transition metal dichalcogenides are a promising system for spin-

optoelectronics. The discovery of 2D van der Waals magnets have provided scientists a new platform to study spin-photovoltaic effects based on atomically thin materials with intrinsic magnetic order. Of these, chromium triiodide is of interest due to its layered antiferromagnetism (AFM), where the spin configurations can be regulated by a surrounding magnetic field. The field can switch the sample between the AFM ground states and fully spin-polarized states via a series of flip-transitions. The setup provides an ideal platform to highlight the spin-optoelectronic effects at the atomically thin limit.

Photocurrent response of the CrI₃ junction device and its dependence on magnetic order

The researchers developed a vertical heterostructure to study the photocurrent response of CrI₃ and to allow for efficient photodetection. The heterostructure contained an atomically thin CrI₃ flake sandwiched by two graphene sheets as bias electrodes encapsulated by thin hexagonal boron nitride to prevent degradation. Using photocurrent microscopy, Song et al. further investigated the spatial distribution of the photocurrent and used reflective magnetic circular dichroism to map the trilayer CrI₃ flake, where the photocurrent response showed a strong dependence on magnetic order. The team assigned the low and high photocurrent plateaus to the antiferromagnetism ground states and to the fully spin-polarized states. Comparatively, the intermediate magnetic states resulted in a lower photocurrent. The optical excitation generated photoexcited carriers in the conduction bands where asymmetric extraction by the top and bottom graphene electrodes resulted in the measured photocurrent. The spin-optoelectronic device presented here provided a novel photo-magnetocurrent effect compared to giant magnetoresistance and tunnel magnetoresistance devices. The resulting giant and tunable photo-magnetocurrent was useful for optically driven magnetic sensing and data storage devices.

Dependence of the photocurrent on light helicity and other effects

Song et al. showed the dependence of the photocurrent on light helicity using a trilayer CrI₃ device with 1.96 eV of excitation. The resulting unique spin photovoltaic effect originated from the helicity dependence of charge-transfer excitons in CrI₃ coupled to the underlying magnetic order. The helicity-dependence absorption of the device revealed the optical selection rules of the charge-transfer transitions between the spin-polarized valence and conduction bands to form the resulting velocity-dependent spin photovoltaic effect. Further observations also confirmed the underlying magnetic order to be the origin of the helicity dependence of the charge transfer excitons.

Outlook

In this way, Tiancheng Song et al. studied the spin photovoltaic effects in atomically thin CrI₃ van der Waals heterostructures. The photocurrents showed distinct responses to the spin configurations in CrI₃ alongside a giant photo-magnetocurrent effect. The combined helicity-dependent photocurrent and circular polarization-resolved absorption measurements revealed the interplay between the spin photocurrent and the underlying excitons, as well as contributions of the magnetic order, photon energy and helicity. The 2D photovoltaic device developed here used the intrinsic magnetic order in few layer CrI₃ as a proof-of-concept. The resulting atomically thin CrI₃ formed an archetypal 2D magnet to study the photocurrent generated in a vertical junction device. The device can be adapted with alternate 2D magnets for potential applications in magnetic sensing and data storage. The underlying dynamics of magnetic order-coupled charge-transfer exciton states could generate a photocurrent to probe the magnetic order in CrI₃ and show distinct responses to photon energy and helicity. The results highlight applications of the photocurrent as a new method to probe magnetic order, charge-transfer exciton states and magnetoexciton-photon coupling. The approach can be used to study other 2D magnetic systems including the dynamics of zig-zag antiferromagnetic order-coupled excitons and charge transfer processes at graphene interfaces.

More information: Song T. et al, Spin photovoltaic effect in magnetic van der Waals heterostructures, *Science Advances* (2021). [DOI: 10.1126/sciadv.abg8094](https://doi.org/10.1126/sciadv.abg8094)

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Journal information: [Science](#) , [Science Advances](#) , [Nature Nanotechnology](#)
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COVID-19 Research News

ScienceDaily®

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Study links severe COVID-19 to increase in self-attacking antibodies

Summary:

Hospitalized COVID-19 patients are substantially more likely to harbor autoantibodies -- antibodies directed at their own tissues or at substances their immune cells secrete into the blood -- than people without COVID-19, according to a new study.

Hospitalized COVID-19 patients are substantially more likely to harbor autoantibodies -- antibodies directed at their own tissues or at substances their immune cells secrete into the blood -- than people without COVID-19, according to a new study.

Autoantibodies can be early harbingers of full-blown autoimmune disease.

"If you get sick enough from COVID-19 to end up in the hospital, you may not be out of the woods even after you recover," said PJ Utz, MD, professor of immunology and rheumatology at Stanford Medicine.

Utz shares senior authorship of the study, which will be published Sept. 14 in *Nature Communications*, with Chrysanthi Skevaki, MD, PhD, instructor of virology and laboratory medicine at Philipps University Marburg in Germany, and Eline Luning Prak, MD, PhD, professor of pathology and laboratory medicine at the University of Pennsylvania. The study's lead authors are Sarah Chang, a former technician in Utz's lab; recent Stanford undergraduate Allen Feng, now a technician in the Utz lab; and senior research investigator Wenshao Meng, PhD, and postdoctoral scholar Sokratis Apostolidis, MD, both at the University of Pennsylvania.

The scientists looked for autoantibodies in blood samples drawn during March and April of 2020 from 147 COVID-19 patients at the three university-affiliated hospitals and from a cohort of 48 patients at Kaiser Permanente in California. Blood samples drawn from other donors prior to the COVID-19 pandemic were used as controls.

The researchers identified and measured levels of antibodies targeting the virus; autoantibodies; and antibodies directed against cytokines, proteins that immune cells secrete to communicate with one another and coordinate their overall strategy.

Upward of 60% of all hospitalized COVID-19 patients, compared with about 15% of healthy controls, carried anti-cytokine antibodies, the scientists found. This could be the result of immune-system overdrive triggered by a virulent, lingering infection. In the fog of war, the abundance of cytokines may trip off the erroneous production of antibodies targeting them, Utz said.

If any of these antibodies block a cytokine's ability to bind to its appropriate receptor, the intended recipient immune cell may not get activated. That, in turn, might buy the virus more time to replicate and lead to a much worse outcome.

Tracking down autoantibodies

For about 50 patients, blood samples drawn on different days, including the day they were first admitted, were available. This enabled the researchers to track the development of the autoantibodies.

"Within a week after checking in at the hospital, about 20% of these patients had developed new antibodies to their own tissues that weren't there the day they were admitted," Utz said. "In many cases, these autoantibody levels were similar to what you'd see in a diagnosed autoimmune disease."

In some cases, the presence of those newly detected autoantibodies may reflect an increase, driven by the immune response, of antibodies that had been flying under the radar at low levels, Utz said. It could be that inflammatory shock to the systems of patients with severe COVID-19 caused a jump in previously undetectable, and perhaps harmless, levels of autoantibodies these individuals may have been carrying prior to infection.

In other cases, autoantibody generation could result from exposure to viral materials that resemble our own proteins, Utz said.

"It's possible that, in the course of a poorly controlled SARS-CoV-2 infection -- in which the virus hangs around for too long while an intensifying immune response continues to break viral particles into pieces -- the immune system sees bits and pieces of the virus that it hadn't previously seen," he said. "If any of these viral pieces too closely resemble one of our own proteins, this could trigger autoantibody production."

The finding bolsters the argument for vaccination, he added. Vaccines for COVID-19 contain only a single protein -- SARS-CoV-2's so-called spike protein -- or the genetic instructions for producing it. With vaccination, the immune system is never exposed to -- and potentially confused by -- the numerous other novel viral proteins generated during infection.

In addition, vaccination is less intensely inflammatory than an actual infection, Utz said, so there's less likelihood that the immune system would be confused into generating antibodies to its own signaling proteins or to the body's own tissues.

"Patients who, in response to vaccination, quickly mount appropriate antibody responses to the viral spike protein should be less likely to develop autoantibodies," he said.

Identifying autoantibody triggers

Indeed, a recent study in *Nature* to which Utz contributed showed that, unlike SARS-CoV-2 infection, the COVID-19 vaccine produced by Pfizer doesn't trigger any detectable generation of autoantibodies among recipients.

"If you haven't been vaccinated and are telling yourself, 'Most people who get COVID get over it and are OK,' remember that you can't know in advance that when you get COVID-19 it will be a mild case," Utz said.

"If you do get a bad case, you could be setting yourself up for a lifetime of trouble because the virus may trip off autoimmunity. We can't say yet that you'll definitely get an autoimmune disease -- we haven't studied any patients long enough to know whether these autoantibodies are still there a year or two later, although we hope to study this -- but you certainly might. I wouldn't want to take that chance."

Utz intends to study blood samples from SARS-CoV-2-infected people who are asymptomatic or who've had mild COVID-19 symptoms. That could help determine whether the massive hyperactivation of the immune system, which doesn't occur in mildly symptomatic or asymptomatic people, is what causes trouble, or whether the mere molecular resemblance of SARS-CoV-2 proteins is enough to trigger autoantibody generation.

Utz is a member of Stanford Bio-X, the Stanford Institute for Immunity, Transplantation and Infection and the Stanford Maternal and Child Health Research Institute.

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Other researchers at the University of Pennsylvania, Philipps Marburg University, the University of Tennessee, Oklahoma Medical Research Foundation and Kaiser Permanente Northern California contributed to the work.

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