VR-Headsets: Caution Necessary

A virtual reality headset is a head-mounted device that provides virtual reality for the wearer. The experience could be amazing but it is not free from dangers.

VR-induced headache and nausea is well known. VR can also have neurological effects because of its strongly realistic simulated motion. These conditions are called “Simulator sickness” and “virtual reality sickness”.

Also, in an animal study, neuroscientists found that virtual reality simulations affect the brain very differently than the real world does. According to research performed at the University of California, Los Angeles, our brains create mental maps of our real-life surroundings using all our available senses. Because virtual reality only uses some of these senses, these maps are incomplete while inside the simulation.

In VR-headset, the mobile screen is only a few centimeters away from our eyes. Even in normal circumstances (when the screen is more than a foot away from our eyes), it causes immense eye strain if used for extended time periods. Due to increasing mobile use, eye diseases like eye fatigue, dry eye,

YEAR round cultivation of cut flowers with longer vase life could be a major income booster for horticulturists. Natural light substantially limits the crop produce in horticulture. Insufficient sunlight and very high intensity light are factors responsible for financial losses in intensive horticulture practices.

Photoperiods of flowers can be manually altered in controlled environments like poly houses for flowers to bloom in non-seasons as well. There are many ways of doing this.

Blocking natural day light using opaque material is the cheapest method in most green houses. Black cloth or black plastic sheets are used by most growers as it is easy to handle and can be withdrawn whenever natural light is expected at maximum. Coverings, sheets, nettings or coatings, and plastic films are installed in green houses. Early flowering is induced in Chrysanthemum and poinsettias by creating artificial short days. Black outs are held to postpone flowering by extending the vegetative phase in LDP’s.

High Intensity Discharge lamps (HID), Light Emitting Diodes (LED), incandescent bulbs (INC) are unexceptional artificial light sources in green houses.

However, sometimes blackouts may lead to rapid shooting up of heat in greenhouses of tropics. This warming effect is mitigated by reducing radiant energy using a reflective layer on the external side of the black out. Often, light from nearby greenhouses and street lights also interrupts the long dark periods. In this case perfect opaque black plastic coats serve as the best option.

Replacing black nets with red and yellow coloured shades for pepper cultivars increases fruit quantity. The fact that coloured materials absorb complementary colours from the visible light spectrum could be the secret behind this specificity. With growing latitudes, polar parts face insufficient light intensity and photo-selective films are fixed to manage this. Fluorescent pigmented films absorb UV radiation emitting back the photo-synthetically active radiation and hence are widely used for strawberry cultivation in the northern horizons of the globe.

Flowers like Centaurea cyanus (Bachelor button), Tagetes popularly known as marigold, Chrysanthemum and cut roses are popular candidates for light manipulation to increase yields or year-round yields. Carnations with longer vase life and distinctive colours are in high demand in the cut flower market. They love long days requiring high light intensities. Around 22500 Lux is provided for their healthy growth.

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etc. are increasing.

Besides, current VR-headsets are bulky and this added weight on the facial bones may cause pain. Particularly, the cheek bones and nasal area may be affected due to heavy head-mounted headsets. The strain of using heavy headsets can also cause neck pain.

So, take frequent breaks, after every 15-30 minutes, remove the headset and let the eyes and face rest for a while. Blinking will also help in preventing dry eyes.

Since the VR headset blocks your view of the surroundings, avoid walking and other movements while wearing VR headset.

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Dual-gated Device Makes Gadgets Power Efficient

OVER the years, transistors – the building blocks of digital devices – have become smaller by the day, making devices faster and compact. But this has also meant increased wastage of power. A group of Indian scientists have found a way to address this problem.

Transistors work by acting like electronic switches controlling the flow of current across circuits. The most common type of transistors called MOSFETs (metal-oxide-semiconductor field-effect transistors) cannot switch from ‘on’ to ‘off’ abruptly and thus leak current even after the device is turned off. The smaller the transistors are more the power they waste. Tunnel FETs (field-effect transistors) waste much less power but are more suited for low performance devices like watches or notebook computers.

Scientists at the Indian Institute of Science (IISc) at Bengaluru have combined these two different types of transistors into a single device that can easily switch between power-efficient and high performance modes, depending on the need. The device has a special type of metal-semiconductor junction which can be tweaked to make it behave either like a MOSFET or a tunnel FET.

“MOSFETs typically work like floodgates in a dam – they have a source, a drain, and a gate that controls flow of electrons between the two. When the gate is in the off position, there is a large energy barrier which prevents electrons from crossing over. When gate is turned on with voltage, height of the barrier is reduced and electrons can jump over. The smaller the supply voltage to turn the transistor on, the more efficient is the device,” explained Dr. Navakanta Bhat, head of the Centre for Nano Science and Engineering at IISc who led the research team.

However, he said, bringing down supply voltage for MOSFETs proportionately with transistor size is difficult because of a fundamental design flaw. A factor called sub-threshold swing, which determines the minimum gate voltage required for the transistor to switch from on to off, restricts the supply voltage to be not less than 1 volt.

To overcome this, scientists have tried using tunnel FETs in which instead of the height, the width of the electron barrier is reduced to a point where electrons are able to “tunnel” through instead of jumping over it. Tunnel FETs can operate at lower supply voltages but the current flowing when the transistor is on is greatly reduced.

The research results have been published in the journal Applied Physics Letters. The team included Dr. Bhat and Shubhadeep Bhattacharjee.

Sunderarajan Padmanabhan, India Science Wire

Top-gate: HfO₂ (30 nm) e-beam PVD

Sulfur Treated Contacts

Top-Gate

Flow of electrons

MoS₂ channel

Back Gate: SiO₂ (285 nm)

Si p++ substrate

March 2018 | Science Reporter | 11
A new form of matter that can lead to unlocking more levels of the puzzle of Quantum mechanics has been discovered. It is excitonium.

The term was first coined by a Harvard theoretical physicist Bert Halperin in the 1960s. Its presence was recently confirmed by a team of scientists led by Prof. Peter Abbamonte from the University of Illinois, Urbana-Champaign, the University of California, Berkeley and the University of Amsterdam in a paper in *Science* (December 8, 2017).

They achieved it by studying the non-doped crystals of the oft-analyzed transition metal dichalcogenide titanium diselenide (1T-TiSe2) and have produced their results repeatedly five separate times on different cleaved crystals. Jasper van Wezel, Professor of Physics at the University Amsterdam provided the critical theoretical interpretation of the experimental results.

Excitonium is made up of a kind of boson, a composite particle that could allow the matter to act as a superfluid, superconductor or even as an insulating electronic crystal. This condensate is made up of excitons, particles that are formed in a very strange quantum mechanical pairing of escaped electrons and the “holes” they left.

It took such a long time to confirm the existence of exciton because of the difficulty caused due to another phenomena called Peierls phase, which although unrelated, shares some observable characteristics with the quasi particle. The scientists did not have the experimental tools to distinguish with certainty whether they were detecting excitonium or another similar phase of matter.

So, Abbamonte and his graduate students Anshul Kogar and Minday Rak with inputs from other colleagues developed a new technique called

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**Mercury-free Lamp Purifies Water**

**THE** use of ultraviolet lamps in water purifiers is common but the presence of mercury in these lamps could be potentially hazardous. Now a group of Indian scientists have developed a mercury-free ultraviolet lamp that can be used in water purifiers.

Scientists have engineered an optimized dielectric discharge based mercury-free vacuum UV/UV light source for water sterilisation. The lamp can produce the desired level of wavelengths for deactivation of bacteria within ten seconds without the use of mercury.

The lamp has been developed by scientists from two CSIR labs – Central Electronics Engineering Research Institute (CEERI), Pilani and the National Environmental Engineering Research Institute (NEERI), Nagpur – working along with the Birla Institute of Scientific Research (BISR), Jaipur.

In addition to being mercury-free, the lamp has a filament-less light source and there are no end sleeves. Since it uses dielectric-barrier discharge or DBD source, start-up time is negligible. It has broader wavelength coverage due to dimer radiations and medium pressure.

Naturally available water may contain pathogenic organisms and toxic compounds. UV radiation is preferable for water purification over chemical treatment. UV radiation is widely used for water sterilization as it does not create any by-product during treatment and does not alter the taste of water. It also does not eliminate minerals. But it has several disadvantages which include start-up time, filament failure, sleeve breakage, dimensional restrictions and non-reparability. Mercury-containing UV-lamps generate a considerable amount of toxic mercury waste at the end of their life as a typical UV lamp contains 20 to 200 mg of mercury.

“We have engineered an optimized dielectric discharge based mercury-free VUV/UV light source with a novel structural design that produces strong spectral bands peaking at wavelengths 253 nanometer and 172 nanometer along with a weak band peaking at wavelength 265 nanometer, that has been tested on a few representative bacteria to show its usefulness for efficient water sterilization,” explained Dr. Ram Prakash from CEERI.

The unique structural design of the lamp enables it to produce desired UV wavelengths. The lamp has been tested for five types of bacteria – *E. coli*, *Shigellaboydii*, *Vibrio*, coliforms and fecal coliform. Within ten seconds, all bacteria got deactivated.

The results of the research work have appeared in the journal *Scientific Reports*. The research team included Dr. Ram Prakash, Afaque M. Hossain, Dr. U. N. Pal, Dr. N. Kumar, Dr. K. Khairnar, and Dr. M. Krishna Mohan.

Dr. Vaishali Lavekar, *India Science Wire*, Vigyan Prasar
Geospatial Study in Namdapha National Park

A study was carried out by the Indira Gandhi Conservation Monitoring Centre (IGCMC), WWF-India, supported by the Ministry of Environment, Forest and Climate Change (MoEFCC) to develop a management plan for the Namdapha National Park in Arunachal Pradesh. Habitat Suitability Map for Tiger in the national park along with the identification of potential sites for location of watch towers in the Park was prepared using Geo-spatial techniques.

Located in the Eastern Himalayas, Namdapha National Park in the Changlang district of Arunachal Pradesh harbours rich plant diversity apart from being a Tiger Reserve.

As per the literature recorded, the various threats in the park include hunting, illegal fishing and trapping of wild fauna, illegal felling of trees and collection of non-timber forest products for their livelihood by local inhabitants (Lisu, Chakma and Mishmi). Habitat destruction poses further threat to wildlife.

The study generated primary input for planning management interventions and developing policy decisions for tiger conservation. An analysis was carried out (i) to identify key species, important habitat areas which will assist in developing specific conservation action plans for biodiversity conservation and (ii) to identify potential sites for location of watch towers and construction of water holes.

Using habitat suitability mapping potential suitable habitats for tigers were identified within the Park. This will help in prioritising areas for tiger conservation. The potential suitable habitats need better protection and conservation efforts so as to sustain viable tiger populations.

For deriving the suitability map five parameters were used namely, vegetation type, vegetation density, elevation, slope and distance from anthropogenic disturbances. Thematic layers depicting each of the three factors were also generated. The set of input layers were run on ArcMap 9.3 using weighted sum spatial analyst. Input set of factors in the raster format were run using weighted sum approach. The vector layers were converted into raster format. Higher the value, greater is the suitability with respect to tiger habitats.

Watch towers are usually located at higher points within the protected areas so that a larger area can be kept under observation at any point of time. Using GIS we can find sites where watch towers should actually be located within the park area for better vigilance.

The rivers flowing through the park area are seasonal with limited water flow during dry season. Hence, to cater to the needs of the inhabiting wildlife throughout the year water holes or water reservoirs need to be constructed within the park area.

A monitoring system taking into consideration the local people’s knowledge about natural resources utilization and management thereof and encouraging participation of local communities in protected area management is the need of the hour. People should be given incentives for conservation efforts or sustainable use of bio-resources.

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momentum-resolved electron energy-loss spectroscopy (M-EELS) that can monitor the momentum of the electron with high precision to overcome it. Using the new technique the researchers for the first time were able measure collective excitations of the low-energy bosonic particles, the paired electrons and the “holes”, regardless of their momentum.

According to Prof. Abbamonte “this result is of cosmic significance” holding great promise for unlocking further quantum mechanical mysteries.