CHEMWATCH

Bulletin Board

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SEP. 03, 2021

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ASIA PACIFIC

China MIIT consult on over 300 national and industry standards

2021-08-12

The relevant standardization technical organization has completed the compilation or revision of 290 industry standards and 6 national standards. In addition, 10 industry standards were translated into English.

On July 20, 2021, the Ministry of Industry and Information Technology of the People's Republic of China issued a Notice consulting on over 300 national and industry standards. The relevant standardization technical organization has completed the compilation or revision of 290 industry standards and 6 national standards. In addition, 10 industry standards were translated into English. These standards are publicized before release for public comments, and the deadline is August 20, 2021.

Read More

Chemlinked, 12 August 2021

https://chemical.chemlinked.com/news/chemical-news/china-miit-consults-on-over-300-national-and-industry-standards

China receives RoHS2 conformity assessments for 18,430 products

2021-08-18

More than 1,000 companies upload assessments to online platform

China's Ministry of Industry and Information Technology (MIIT) had received 12,369 conformity assessments covering 18,420 electrical and electronic products (EEPs) on its RoHS2 online compliance platform as of 31 July – an increase of 1,719 and 2,555 respectively since last December.

Since the platform's launch in 2019, 1,140 companies have now uploaded assessments (up from 1,036 in December 2020) covering the 12 categories of products included in the list of EEPs that must comply with the Regulation, the 13 August ministry announcement said.

The assessments apply to listed EEPs shipped or imported on or after 1 November 2019, and the results must be submitted to the online compliance platform.

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Companies have elected to self-declare 13,780 EEP products and to provide mandatory certification for 4,640. This is to demonstrate compliance with hazardous substance restriction limits under RoHS2.

The MIIT issued the Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products (RoHS2) in January 2016. This was followed up in May 2019 when the State Administration for Market Regulation (SAMR) and the MIIT jointly issued the Implementation Measures for Conformity Assessment System for the Restricted Use of Hazardous Chemicals in Electrical and Electronic Products.

Separately, China's Electronics Standardization Institute (Cesi) has almost finished drafting a standard that will outline the acceptable test methods to detect phthalates in EEPs, signalling that the country may place restrictions on the substances in future.

Read More

Chemical Watch, 18 August 2021

https://chemicalwatch.com/318177/china-receives-rohs2-conformity-assessments-for-18420-products

NSW EPA reminds residents to be safe around lead in homes and gardens

2021-08-10

The NSW Environment Protection Authority (EPA) is reminding Wollongong residents to be aware of the risks of exposure to lead and other heavy metal contaminants from a range of historical sources around the home, especially when renovating and gardening.

The safety message follows the publication of a comprehensive report examining legacy heavy metal contamination issues (in particular lead) in the Wollongong Local Government area.

The *Literature review of the levels of lead and other heavy metals in soil and roof dust in Wollongong and measures to manage any associated health risks* examines legacy contamination issues and recommends further testing, including of soil, in the Port Kembla area to provide more site-specific data.

"In response to the recommendations of the report, the EPA will undertake further soil testing to address any data gaps. The EPA will also offer

The safety message follows the publication of a comprehensive report examining legacy heavy metal contamination issues (in particular lead) in the Wollongong Local Government area.

voluntary soil testing for residents who may be interested," EPA Manager Regulatory Operations Peter Bloem said.

"The EPA testing will complement other local contamination studies and help the community understand the risk of exposure from heavy metals, including lead and cadmium, and whether any other actions need to be taken."

The report also recommended the development of a model to assess health risk exposure.

Illawarra Shoalhaven Local Health District's Director of Public Health, Curtis Gregory, said blood lead level testing is the preferred method of assessing health risk exposure.

"Any elevated blood levels are reported to our Public Health Unit, and we work to determine the appropriate health response. Anyone with any concerns about risk of exposure to lead should discuss this with their GP," Mr Gregory said.

A Wollongong City Council spokesperson welcomed the release of the Literature Review.

"As a member of the Lead and Other Heavy Metal Contamination Working group we welcome the release of the Literature Review, that will be of interest to many in our community," the spokesperson said.

"We encourage residents to look through the detailed document and, if they're keen to understand it in more detail or have questions, visit the EPA website."

Read More

EPA NSW, 10 August 2021

https://www.epa.nsw.gov.au/news/media-releases/2021/epamedia210810-nsw-epa-reminds-residents-to-be-safe-around-lead-in-homes-and-gardens

One recent review found that over 40 percent of insects are threatened with extinction.

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AMERICA

Pesticides can amplify each other. Bees have become the victims.

2021-08-17

Open your pantry. What do you see?

A third or more of the food before you likely depends on natural pollinators like bees. Without them, foods like apples, almonds, and squash wouldn't exist. Neither would certain kinds of coffee, chocolate, or the majority of the world's 100 top crop varieties.

That's one reason why insects are so important, and why we should be concerned that they're in decline. One recent review found that over 40 percent of insects are threatened with extinction. Meanwhile, beekeepers in the US and Europe have been reporting high rates of colony collapse for years.

Scientists have long known that pesticides are part of the problem. These chemicals are literally designed to kill insects and we spray a billion pounds of them across the US each year. Now researchers are learning that they may be having an even larger impact on the natural world than previously known.

When different pesticides mix together, as they often do on farms, they can amplify the effect of one another, according to a new study published in the journal *Nature*. In deadly combination, they can be even more damaging to bees. Previous research has found that these "synergies" can harm fish and other creatures, too.

What's most troubling is that regulators in the US and elsewhere don't take the dangers of these interactions fully into account — even though they've long been aware of them. The Environmental Protection Agency, which oversees pesticides in the US, effectively ignored a recommendation to determine which chemicals farmers most commonly mix together, and what risk those combinations pose to bees. Europe is making more progress, but its regulations still fall short, experts say.

Read More

Vox, 17 August 2021

https://www.vox.com/22612979/pesticide-mixtures-kill-bees-insects-pollinators

EPA issues final SNUR for certain multiwalled carbon nanotubes

2021-08-18

On August 18, 2021, the U.S. Environmental Protection Agency (EPA) issued several significant new use rules (SNUR) under the Toxic Substances Control Act (TSCA) for chemical substances that were the subject of premanufacture notices (PMN), including the chemical substance identified generically as multiwalled carbon nanotubes (PMN P-18-182). 86 Fed. Reg. 46133. The SNUR requires persons who intend to manufacture (defined by statute to include import) or process multiwalled carbon nanotubes (PMN P-18-182) for an activity that is designated as a significant new use to notify EPA at least 90 days before commencing that activity.

Read More

Nano and Other Emerging Chemical Technologies Blog, 18 August 2021

https://nanotech.lawbc.com/2021/08/epa-issues-final-snur-for-certain-multiwalled-carbon-nanotubes

Activist group identifies nearly 30,000 "suspected" industrial PFAS dischargers

2021-08-19

Based on their new analysis of government data, the activist Environmental Working Group (EWG) projects that nearly 30,000 industrial sites may be using, making or releasing per- and polyfluoroalkyl substances (PFAS) -- a number much larger than previously identified estimates.

In releasing an updated map of PFAS manufacturers and users, EWG said that the industrial sites are not known dischargers of the substances, but they are known or suspected to make, use or release the chemicals. EWG has long tracked PFAS issues, identifying areas where the persistent class of chemicals has impacted water supplies, and advocating for regulatory action.

The EWG analysis broke down the sites by industry sector, which appear to be more heavily concentrated in the eastern half of the country. According to this breakdown, EWG says that of the sites on its list, more than 4,700 use PFAS for electroplating and polishing; more than 3,000 are petroleum stations and terminals; more than 2,300 are chemical manufacturers; over 2,200 are metal product manufacturers; more

On August 18, 2021, the U.S.

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than 2,100 are commercial printing facilities; over 1,800 are plastics and resin manufacturing sites; greater than 1,500 are paint and coating manufacturers; over 1,200 are semiconductor manufacturers; and more than 1,000 are electric component manufacturers. EWG also stated that after adding landfills and sewage treatment plants, the estimated number of sites that could be discharging PFAS is more than 41,000.

Read More

Products Finishing, 19 August 2021

https://www.pfonline.com/news/activist-group-identifies-nearly-30000-suspected-industrial-pfas-dischargers

EPA collaborates with Unilever to advance non-animal approaches for chemical risk assessment

2021-08-20

On August 19, 2021, the U.S. Environmental Protection Agency (EPA) **announced** a collaborative agreement with Unilever to explore better ways to assess chemical risks associated with consumer products. According to EPA, this agreement builds on prior cooperation between EPA and Unilever regarding New Approach Methods (NAM), "which are a promising alternative to conventional toxicity testing that are intended to reduce reliance on the use of animals." EPA states that the collaboration aims to establish a framework for the Next Generation of Risk Assessments based on NAMs. The collaboration will bring together more than $2 million in both monetary and in-kind contributions, including scientific expertise and equipment, to develop a comprehensive NAMs dataset for a minimum of 40 chemicals. According to EPA, the chemicals will be selected and grouped such that half will be benign and the other half will have known adverse implications for human health. These chemicals will be tested using a wide variety of NAMs, and the results will be compared between the two groups to determine how well particular NAMs can infer differences in risk. EPA states that these data will be used in case studies to evaluate the potential to use NAMs in regulatory decisions. All data generated through the collaboration will be in the public domain, allowing academic, corporate, government, and nonprofit scientists to use the project results in their own research.

According to EPA, this agreement builds on prior cooperation between EPA and Unilever regarding New Approach Methods (NAM), "which are a promising alternative to conventional toxicity testing that are intended to reduce reliance on the use of animals."

Read More

TSCS Blog, 20 August 2021

http://www.tscablog.com/entry/epa-collaborates-with-unilever-to-advance-non-animal-approaches-for-chemica

EUROPE

Revision of EU legislation on hazard classification, labelling and packaging of chemicals

2021-08-09

Revision of EU legislation on hazard classification, labelling and packaging of chemicals

About this consultation

Feedback period

09 August 2021 - 15 November 2021 (midnight Brussels time)

Topic Environment

Target audience

We would like to hear the views of citizens, researchers, businesses including small and medium-sized enterprises, industry, industrial associations and trade bodies, governmental and non-governmental organisations (international, European, national and more local), social partners and social actors. You can respond to the public consultation in a personal or organisational/institutional capacity by filling in the questionnaire. Registered stakeholder organisations can also submit a position paper.

Why we are consulting

This consultation aims to seek views from different stakeholders and citizens on the revision of the CLP Regulation (Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures). The revision of the CLP Regulation was announced by the Chemicals Strategy for Sustainability adopted on 14 October 2020. The objective of this targeted revision is to improve in the EU the safe use of chemicals and to simplify existing CLP rules.

Responding to the questionnaire

Registered stake-holder organisations can also submit a position paper.

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You can contribute to this consultation by filling in the online questionnaire. If you are unable to use the online questionnaire, please contact us using the email address below.

Questionnaires are available in some or all official EU languages. You can submit your responses in any official EU language.

For reasons of transparency, organisations and businesses taking part in public consultations are asked to register in the EU's Transparency Register.

Read More

European Commission, 9 August 202

https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12975-Revision-of-EU-legislation-on-hazard-classification-labelling-and-packaging-of-chemicals/public-consultation_en

Export and import of hazardous chemicals (PIC) eBulletin

2021-08-20

Notifying exports of PIC chemicals for 2022

HSE, the GB PIC Designated National Authority (DNA), is inviting companies to start submitting notifications for exports of chemicals in the GB PIC List that are expected to take place during 2022.

The GB PIC Regulation requires the first export of a listed chemical in any calendar year to any country to be notified to the DNA at least 35 days before the intended date of export. Export includes the movement of a listed chemical from GB to NI.

Early notification ensures HSE has sufficient time to process notifications and seek the explicit consent of the importing country, where required, or to consider evidence for the granting of a waiver where there is no response to repeated requests for consent.

What you need to do

Export notifications

- The GB PIC export notification form is available on HSE's website, where you can find further informationand supporting guidancefor completing the form. Please send completed forms to ukdna@hse.gov.uk.

Export includes the movement of a listed chemical from GB to NI.

- To avoid delays in processing export notifications, please include the following details in the subject line of your email:

GB PIC - notification - company name - chemical/mixture - importing country name - 2022

- When submitting your export notifications, attach one form and accompanying safety data sheet (SDS) per email. In addition to an SDS in English, please provide an SDS in the official language of the importing country, if available, or in one of its principal languages. If you do not attach an SDS, sections 4 and 5 of the form become mandatory.
- Some countries have more than one DNA. To ensure HSE sends your notification to the relevant authority in the destination country, please be as accurate as possible in describing the foreseen use in the importing country (section 3.3 of the export notification form). This will also be helpful to the importing DNA when making decisions on consent, where applicable.
- If you are intending to export a number of mixtures containing a chemical in the GB PIC List to the same importing country, **where those mixtures differ only, for example, by colour and there are no differences in their classification and labelling or intended use**, we can accept a single notification covering several mixtures. Whenever changes in the concentration of PIC chemical(s) in a mixture trigger new labelling requirements, a new notification will be required.

Special RINS

- You can also start to submit Special RIN requests for 2022 using the relevant form. Special RINs are required for PIC chemicals exported for the purpose of research or analysis in quantities of 10 kgs or less per exporter, per year and per importing country and so are otherwise exempt from the requirements of the Regulation. A Special RIN is also required where an importing country has waived its right to receive an export notification and has notified a positive import response under the Rotterdam Convention for the chemical being exported.
- Please send completed forms to ukdna@hse.gov.ukand include the following details in the subject line of your email:

GB PIC – Special RIN request - company name – chemical/mixture – importing country name – 2022

- For exports of PIC chemicals to the EU, each Special RIN covers exports of up to 10kg of the substance for research and analysis purposes to each EU importing country.

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HSE, 20 August 2021

https://www.hse.gov.uk/pic/

Publication of GB mandatory classification and labelling (GB MCL) technical reports

2021-08-18

A GB MCL technical report is an independent scientific evaluation of the information submitted under the stand-alone GB MCL process or as part of the EU harmonised classification and labelling process.

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what that GB MCL should be.

A new batch of 11 GB MCL technical reports is now available for download at the end of the GB MCL publication table.

These GB MCL technical reports relate to substances for which the Committee for Risk Assessment (RAC) published RAC Opinions under Article 37(4) of EU CLP during 2021, based on information submitted under the EU CLP Regulation. The scientific information supporting the RAC Opinion is evaluated under the GB MCL system.

At the time of publication, the classifications and labelling proposed in these technical reports have not been agreed and/or adopted in Great Britain.

For information on the next steps in the process, please see our webpage on the GB MCL system.

We expect to publish our next batch of technical reports in September 2021. CLP e-Bulletin alerts will be issued when technical reports are published on the HSE website.

If you have any questions or feedback on the GB MCL technical reports, please contact us at: GBCLP.GBMCL@hse.gov.uk

Read More

HSE, 18 August 2021

GB MCL system.

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what that GB MCL should be.

INTERNATIONAL

UPL chemical disaster: A gaping legal loophole or jaw-dropping negligence?

YYYY-MM-DD

The agro-chemical giant UPL seemingly sidestepped crucial regulatory defences against environmental and health hazards at its warehouse in Durban – something for which residents, wetlands, rivers and beaches have paid the price since the facility was set alight on 12 July during civil unrest.

One immediate consequence was that firefighters called on to extinguish the blaze – in the middle of widespread chaos – were unaware they were walking into a hazardous dangerous chemical fire, which put their lives at risk and hampered firefighting efforts.

The contents of the warehouse were largely kept secret until amaBhungane revealed an inventory detailing the massive quantities of extremely dangerous materials stored there.

Among the chemicals stored were several banned in other countries, including at least 26 000kg of Masta 900, an insecticide containing the "very potent neurotoxin" methomyl, which is banned in India, where UPL is headquartered, and for which "contact with skin, inhalation of dust or spray, or swallowing may be fatal".

Read More

News24, 20 August 2021

https://www.news24.com/news24/southafrica/news/upl-chemical-disaster-a-gaping-legal-loophole-or-jaw-dropping-negligence-20210819

World marks anniversary of agreement against toxic mercury

2021-08-16

In August 2017, one of the world's most recent environmental accords came into force: The Minamata Convention on Mercury.

Its aim has been to protect human health and the environment from the adverse effects of mercury, a ubiquitous element that can cause everything from birth defects to kidney disease. It addresses anthropogenic mercury releases through its entire lifecycle: mining,

Among the chemicals stored were several banned in other countries, including at least 26 000kg of Masta 900, an insecticide containing the "very potent neurotoxin" methomyl[.]

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import and export, products and processes, emissions to air, releases to land and water, contaminated sites, waste management, and many others.

This week, the world is celebrating the fourth anniversary of the convention. Since the Minamata Convention on Mercury entered into force in 2017, 132 parties from around the world have been working together to disrupt the trade, raise public awareness, build institutional capacity, and create mercury-free products.

To mark the occasion, and in preparation for the fourth meeting of the Conference of the Parties (COP-4), the secretariat of the convention has launched a new website. It features data, enhanced accessibility and a fresh new look. It relies on a knowledge management platform that is interoperable with other systems, such as the United Nations Information Portal on Multilateral Environmental Agreements (InforMEA). This is expected to better serve the parties of the convention and to inform the public at large about the work undertaken.

Read More

UNEP, 16 August 2021

https://www.unep.org/news-and-stories/story/world-marks-anniversary-agreement-against-toxic-mercury

ECHA public consultation: call for comments (deadline 8 October 2021)

2021-08-18

The Great Britain Mandatory Classification and Labelling (GB MCL) process includes the consideration of information gathered from public consultations, conducted by HSE or international bodies such as the European Chemicals Agency (ECHA).

ECHA has announced a public consultation on the following proposals for harmonised classification and labelling (CLH):

- formaldehyde (EC: 200-001-8; CAS: 50-00-0). Biocide active substance.
- peracetic acid (EC: 201-186-8; CAS: 79-21-0). Biocide active substance.
- α-methyl-1,3-benzodioxole-5-propionaldehyde (EC: 214-881-6; CAS: 1205-17-0). Chemical registered under REACH.

View the details

HSE, 18 August 2021

https://echa.europa.eu/harmonised-classification-and-labelling-consultation

Consultation on testing proposals under Article 40(2) of UK REACH for the following substances (deadline 30 September 2021)

2021-08-17

2-ethylhexyl 10-ethyl-4,4-dimethyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate

1-(4-(acetyloxy)-3-((acetyloxy)methyl)phenyl)ethenone

Hexyl salicylate

2,2-dimethyl-3-oxopropyl dodecanoate

HSE has received proposals to undertake testing in vertebrates to consider and evaluate.

Article 40(2) of the UK REACH Regulation requires HSE to invite third parties to submit **scientifically valid information and studies**that are relevant to proposed vertebrate tests. These submissions will be considered and evaluated alongside the proposals submitted by the registrants.

The Great Britain Mandatory Classification and Labelling (GB MCL) process includes the consideration of information gathered from public consultations, conducted by HSE or international bodies such as the European Chemicals Agency (ECHA).

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Any interested third parties are invited to provide such information and studies that address the substances and hazard endpoints below for which testing is proposed. Information can be submitted by any member of the public or interested party.

Consultation details for the endpoints for which testing is proposed can be viewed by following the links below:

- **2-ethylhexyl 10-ethyl-4,4-dimethyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate**
  Genetic toxicity in vivo
- **1-(4-(acetyloxy)-3-((acetyloxy)methyl)phenyl)ethenone**
  Genetic toxicity in vivo
- **Hexyl salicylate**
  Sub-chronic toxicity (90-day): oral
  Reproductive toxicity (pre-natal developmental toxicity)
- **2,2-dimethyl-3-oxopropyl dodecanoate**
  Long term toxicity to fish

Scientific and technical information relevant to the testing proposals should be submitted directly to HSE using the commenting webform and templates by **1 October 2021**.

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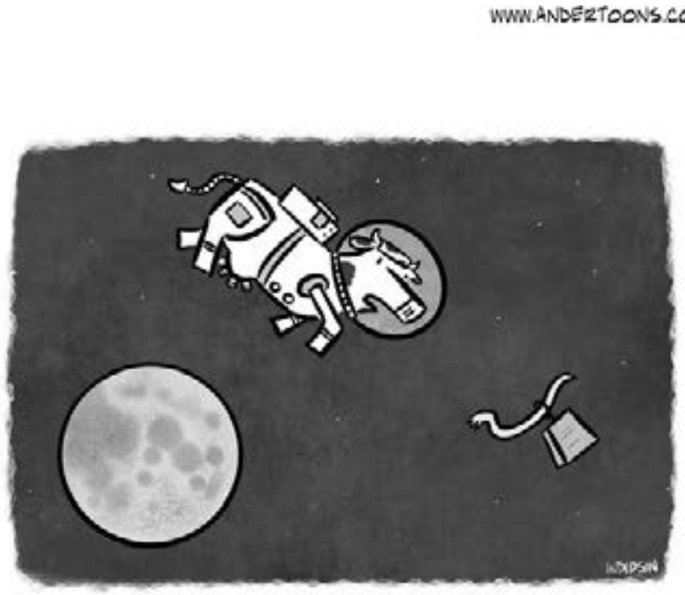
HSE, 17 August 2021

https://www.hse.gov.uk/reach/

Hey Diddle Diddle

2021-02-05



https://andertoons.com/space/cartoon/8876/hey-diddle-diddle-problem

Hexanone

2016-07-04

2-Hexanone is the organic compound with the formula $C_4H_9COCH_3$. This colourless to pale yellow liquid has a sharp odour. It is a ketone and often known either as MBK (methyl butyl ketone) or 2-hexanone. It has moderate water solubility, and can evaporate easily into the air as a vapour. [1]

USES [1]

2-Hexanone was used in the past in paint and paint thinner, to make other chemical substances, and to dissolve oils and waxes. It is no longer made or used in the United States because it has harmful health effects. It is formed as a waste product resulting from industrial activities such as making wood pulp and producing gas from coal, and in oil shale operations.

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [1]

- Breathing contaminated air
- Drinking contaminated water
- Absorbing it through your skin if you touch liquid or soil that contains it
- Eating some foods that naturally contain low levels of 2-hexanone
- Using products manufactured before 1982 that contain 2-hexanone (such as paint thinners)
- Working in coal gasification, oil shale processing, or wood pulping operations
- Living near hazardous waste sites where it is found, or if you breathe the contaminated air.

Routes of Exposure [3]

Inhalation is the primary route of exposure to 2-hexanone; however, dermatologic exposure can lead to skin irritation and this absorption may contribute to chronic exposure and polyneuropathy. Ingestion has rarely been reported.

2-Hexanone is the organic compound with the formula C4H9COCH3.

HEALTH EFFECTS [1,4]

Acute Effects

- Contact with 2-hexanone can irritate the skin and eyes
- Inhalation can cause coughing and wheezing
- Exposure can cause headache, dizziness, light-headedness, and fainting

Chronic Effects

Prolonged inhalation of 2-hexanone can harm the nervous system. Workers who were exposed to 2-hexanone in the air for almost a year felt weakness, numbness, and tingling in the skin of the hands and feet. Similar effects were seen in different animals that ate or breathed high levels of 2-hexanone. Chronic exposure can also cause drying and cracking of the skin with redness and rash.

Reproductive/Development Effects

In animal studies, there was evidence that 2-hexanone damaged the male (testes) reproductive system and pregnant rats inhaled it did not gain as much weight during their pregnancy, had fewer babies, and had babies that were smaller and less active than the rats that were not exposed. It is unknown if breathing 2-hexanone affects human reproduction or causes birth defects.

Carcinogenicity

The Department of Health and Human Services has not classified 2-hexanone as to human carcinogenicity. In addition, the International Agency for Research on Cancer and the Environmental Protection Agency (EPA) have not classified 2-hexanone as to human carcinogenicity. There is no information available on the potential carcinogenic effects of 2-hexanone in people or in experimental animals.

SAFETY [5]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

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- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Exposure Controls & Personal Protection

Engineering Controls

Exhaust ventilation or other engineering controls should be used to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protective Equipment

The following personal protective equipment is recommended when handling 2-hexanone:

- Splash goggles
- Lab coat
- Vapour respirator (be sure to use an approved/certified respirator or equivalent)
- Gloves.

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Vapour respirator

- Boots
- Gloves
- A self contained breathing apparatus should be used to avoid inhalation of the product.
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION [2,6]

United States

- OSHA: The Occupational Safety and Health Administration has set a limit of 5 ppm (5 parts of 2-hexanone in 1 million parts of air) as an average exposure level to this chemical over a 40-hour work week.
- ACGIH: The American Conference of Governmental Industrial Hygienists has made the same recommendation.
- NIOSH: The National Institute for Occupational Safety and Health recommends an even lower limit, 1 ppm, as an average exposure during a 10-hour period.

Australia

- Safe Work Australia: Safe Work Australia has established a time weighted average concentration for 2-hexanone of 5ppm for an 8 hour workday.

REFERENCES

1. http://www.atsdr.cdc.gov/toxfaqs/tfacts44.pdf
2. http://www.atsdr.cdc.gov/ToxProfiles/tp44-c1-b.pdf
3. http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?cid=11583
4. http://nj.gov/health/eoh/rtkweb/documents/fs/1280.pdf
5. http://www.sciencelab.com/msds.php?msdsId=9924258
6. http://www.safeworkaustralia.gov.au/sites/swa/search/results?k=2-hexanone

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Report: 91% of Pennsylvania schools that tested drinking water found lead—only 9% removed it

2021-08-27

PITTSBURGH—Many Pennsylvania school districts have detected lead and other contaminants in their drinking water and documented problems with mold and radon in school buildings—but not all of them removed the hazards, according to a new report.

The report, published this month by the Pittsburgh-based health advocacy nonprofit Women for a Healthy Environment, looked at testing and cleanup practices for environmental health hazards including lead and other contaminants in drinking water; lead in paint and dust; radon; and mold in a randomized sample of 65 public school districts serving about 175,000 students across the state.

That's a small sample size—Pennsylvania's K-12 education system has about 500 school districts, so it represents about 10% of total school districts—but among the schools sampled, the report found that testing and cleanup procedures for environmental hazards are not performed consistently or uniformly as the state still lacks legal requirements.

For example, 89% of the 65 school districts tested drinking water for lead in the last 10 years. Of those, 91% found lead contamination, but only 9% of schools that detected lead took action to remove it. Only 9% of schools had tested for lead in dust or paint, which are the most common sources of lead exposure in children. Of those, 33% found lead contamination in dust or paint—but none took steps to remove it. The report doesn't indicate why schools failed to remediate these toxics, but lack of funds and resources are likely to blame.

For example, 89% of the 65 school districts tested drinking water for lead in the last 10 years.

Lead exposure in children damages the brain and nervous system, slows growth and development, and can lower IQ and cause learning, behavior, hearing, and speech problems. No level of lead exposure is safe for children.

"This report shows that many children in Pennsylvania are exposed to significant environmental hazards in their school buildings," Dr. Deborah Gentile, a pediatric asthma and immunology specialist who was not involved with the study, said in a statement. "It is unacceptable that all school buildings are not screening for and remediating these environmental hazards."

The report does not provide information about testing and cleanup procedures at specific school districts, but it documents troubling patterns:

- Only 20% of schools tested for radon, the leading cause of lung cancer among non-smokers. Of the schools that tested, 33% found hazards. Among those that found hazards, only 40% of those took action to reduce radon exposure.
- Just under half of the schools tested drinking water for non-lead contaminants. 23% of those that tested reported issues, but only 14% of those that reported issues took steps to remove contaminants.
- 72% of public school districts tested for mold. Of those, 78% reported mold in their buildings. Among the schools that found mold, 86% took action to remove it.
- Only 20% of schools have policies in place aimed at ensuring healthy air quality for students.
- 72% of schools contract with a pesticide company to apply chemical pesticides to school grounds. Exposure to pesticides has been shown to impact children's neurological and behavioral development.
- Overall, school districts serving a greater percentage of low income and special education students were less likely to test for environmental hazards. When they did test, they were less likely to remove hazards.

The report notes that Pennsylvania schools are vulnerable to health hazards because the average school building in the state was built in 1964, prior to the passage of the 1976 Toxic Substances Control Act and the 1987 Lead in Paint Rule, two federal laws that reduced toxic substances used in the construction of school buildings.

The report also analyzed results by region. The analyses for southwest Pennsylvania showed similarly troubling patterns:

- In 2019, 24% of school districts in southwestern Pennsylvania conducted radon testing. In 38% of the school districts that tested, radon results were above recommended thresholds.
- In 2019, 96% of districts in southwestern Pennsylvania reported lead in drinking water testing, but only 67% tested water in every school building. Of the schools that tested, 71% reported lead contamination.

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- In 2019, 78% of districts in southwestern Pennsylvania tested for mold in at least one building. Remediation was recommended in 77% of the 59 districts tested. Of those, 52 completed remediation while seven did not have documentation of remediation.
- In 2019, only 8.3% of schools in southwestern Pennsylvania had policies in place aimed at ensuring healthy air quality for students.

The report lays out a series of recommendations aimed at making schools across the Commonwealth safer, including: creating a public statewide database for environmental health data; giving schools access to additional state and federal funds for construction and renovation; implementing safe siting laws to keep schools away from polluting facilities; and creating evidence-based policies aimed at protecting children from environmental hazards at school; among others.

"Schools should be a safe place for children to learn, grow and play," Michelle Naccarati-Chapkis, executive director of Women for a Healthy Environment, said in a statement. "Healthy learning environments lead to greater academic achievement."

ehn.org, 27 August 2021

https://www.ehn.org

Disastrous environmental events are converging like never before

2021-08-26

Northwest, the environmental scientist Robert Rohde posted an unusual observation on Twitter.

Looking through a report that analyzed temperature patterns for the region over the past 70 years, he noted, "the heatwave was statistically 'impossible.'" Obviously, the heat wave wasn't literally impossible, given that, after all, it happened. But the broiling temperature that the Northwest reached—108 degrees Fahrenheit at one point in Seattle, 121 degrees in British Columbia—was so far beyond the observed experience, he explained, that it exceeded even statistical models' outmost potential extremes for the area.

A few weeks later, I caught up with Rohde, the lead scientist for Berkeley Earth, a nonprofit research group that analyzes current and historical climate data, via Zoom from Zurich, where he's now living. He reiterated

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Rohde allowed that such seemingly impossible events do in fact "sometimes" occur. But, he told me, it's much more common for extreme events to match a rare high point with at least some historic precedent—hence the idea, say, of the thousand-year flood. Truly unprecedented events that shatter any previous experience, he said, have been much rarer. "It is not that common," he said drily, "to find results that look impossible."

Rohde offered two explanations for such a unique event. The heat wave, he suggested, might have represented a meteorological black swan: "a rare dynamical interaction that has always been possible, but so rare that in 70 years of data we never observed a weather pattern that was qualitatively similar." But there was also, he said, a second, "scarier" explanation for the surge, which led to hundreds of excess deaths across Washington and Oregon, as well as mass die-offs for shellfish that were literally baked in their shells: The climate is changing in ways we don't entirely understand. "Once in a while, Mother Nature can throw surprises at us, and what we have experienced in the past is not always a good predictor of the future," he told me. "And climate models are telling us that some things that are coming are not necessarily what we are familiar with."

Across the western United States, 2021 is the year when the unimaginable became the unavoidable. The severity of the threat has been matched only by its breadth. Record heat this summer has battered not just the Northwest, but also the Southwest (where California's Death Valley reached 130 degrees Fahrenheit, or 54.4 Celsius, possibly the highest temperature ever recorded on Earth). Drought conditions have been reached this year in virtually every western state, including Montana, Idaho, Washington, Oregon, California, Nevada, Arizona, New Mexico, Colorado, and Utah, an expanse of at least 1.1 million square miles. The heat and drought have contributed to record wildfires burning across Oregon, California, and other states. (As of Monday, more than 1.6 million acres have burned in California alone, which puts the state clearly on track, with months left in the fire season, to surpass its record of almost 2 million acres in 2018.)

The fires have produced apocalyptic orange skies and emitted harmful particulates to trigger air-quality emergencies. Power systems have teetered under increased demand from the heat and distribution outages caused by the fires (while also, as in previous years, sparking some of the

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fires). Salmon and other fish species throughout the Pacific Coast states have suffered enormous losses because of declining water levels and rising water temperatures. The juniper tree is facing systemic decline in Arizona and Utah, and because of the extreme aridity, previously burned forests across the West appear to be regenerating more slowly. In mid-August, water levels in Lake Mead, the giant reservoir created by the Hoover Dam, fell so low that the Interior Department declared the first official water shortage in the lake's 85-year history and announced cuts in the promised water allocations to Arizona, Nevada, and Mexico.

This has been the West's summer of extremes. In every direction, the consequences of climate change across the region have become more tangible, immediate, inescapable. "It feels like the first inkling of an apocalyptic movie," Jay Inslee, the Washington governor and a longtime leader on climate issues, told me recently. "People can usually deal with one [threat], maybe two, but this comes to you from every direction."

HEAT, DROUGHT, FLOODS, and especially the lengthening and intensifying wildfire season, have compelled the West to reckon with climate change more explicitly than probably any other region in America. But this summer's convergence of extreme events proves that climate change isn't a future threat; it's here. Scientists, political leaders, and environmentalists all broadly recognize that extremes and unpleasant surprises—events that once seemed impossible—will become more commonplace. Even describing climate-related events as unprecedented or unpredictable becomes less meaningful: Is an event that has never happened before really "unpredictable" if such events are now happening virtually every year? Or is it more accurate to say that unpredictable and unprecedented events are now an eminently predictable, even reliable, element of the region's future? To borrow from the late Donald Rumsfeld's famous phrase about the Iraq War, the biggest lesson of this year's severe events may be that the West faces a climate future marked by the certainty of uncertainty, or "known unknowns." (Even more ominous is that climate scientists don't rule out the possibility that we'll experience Rumsfeld's concept of "unknown unknowns": threats so novel that we can't even fully conceptualize them now. Rohde described these as "events that are not just pushing the boundaries a little bit, but are really jumping out at us as something we did not expect based on what we had prepared for in the past.")

The known changes that have already hit the region are daunting enough. Patrick Gonzalez, a forest ecologist and climate scientist at UC Berkeley who also advises the National Park Service on climate, recently

summarized them for me. "Greenhouse-gas pollution from cars, power plants, deforestation … have increased temperature as much as 2 degrees Celsius, 3.6 degrees Fahrenheit, in the Southwest U.S.," he told me. Combined with a period of lower precipitation (a natural cycle that so far scientists have not definitively linked to the changing climate), that excess heat, he said, has "caused a drought across the Southwest since 2000 that has been the most severe since the 1500s." Fueled in turn by the heat and drought, forest fires are now annually burning twice as much acreage as the "natural" level recorded through history. In the Mojave Desert alone—which includes Joshua Tree and Death Valley National Parks, as well as the Mojave National Preserve—"increased aridity has caused four out of 10 bird species to disappear locally since the early 1900s," he said.

To Gonzalez, this pattern of threats is following pretty closely what the climate models warned. But many others I spoke with this summer believe that change is consistently hitting the West at the very high end of what the models considered possible or sometimes beyond it. Mary Nichols, who served as the head of the California Air Resources Board in the 1970s and again from 2007 through last year as the state developed its pathbreaking agenda to reduce carbon emissions, says that although the direction of change isn't surprising, the pace of it is. "I think the multiple assaults on the system from various directions are absolutely consistent with what the models were predicting," she told me. "It's just happening faster than the scientists had been suspecting"—or at least, in their desire to appear cautious, were willing to publicly forecast. Even if scientists had warned of the extreme heat, fire, and drought events the West has experienced this year, "I don't know [that] they would have been believed," she said.

Inslee likewise thinks that he's dealing with climate effects that push at, or through, the outer boundary of forecasts. "Most days, I am reading something about some scientific data points coming in that are outside the projected range: hotter, drier, faster, whatever," he said. He expects climate change in the coming years to present the same kind of unanticipated challenges as COVID-19 is doing now—with the coronavirus's Delta variant powering a massive new outbreak only weeks after the U.S. appeared to be on track to finally contain the pandemic. Like a global pandemic, climate "is a very complex system, and the bad news is it seems like we can't catch a break: Everything that could go bad in climate is going bad in climate. It's hard to find a good data point."

In one sense, experts told me, the convergence of dangerous effects this summer can be seen as coincidental. There will be years that are wetter

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or drier, hotter or cooler, more prone to fires or less. But, as Rohde said, this year's simultaneous extremes are "not random," either. "There are very direct interactions between extremes in heat, extremes in precipitation, and extremes in fire, and so a lot of these extreme events are interacting in such a way that they will tend to pile on top of each other," he told me. Moreover, as carbon continues to accumulate in the atmosphere, years that simultaneously produce record levels of heat, drought, and fire will become more frequent. "Not every year will be an extreme year; there will be normal years along the way," Rohde told me, expressing a view echoed by other scientists. "But we will have an increasing frequency of these extreme years, so there will be times when it just stands out like, Oh my God, what is happening?"

To Vijay Limaye, a climate and health scientist at the Natural Resources Defense Council, the most unnerving aspect of the mounting impacts across the West are the feedback loops. "We are seeing really scary signals in recent weeks about the intersecting effects," he told me. To take one: Long-term, chronic drought means that less of the heat from the sun is consumed to evaporate water from the soil, which "compounds the temperature" rise in the atmosphere. "Then you suddenly expand the possibility of devastating wildfires, and so you have this cascading series of effects."

Katharine Jacobs, the director of the University of Arizona's Center for Climate Adaptation Science and Solutions and an expert in water systems, points to the next consequence in the chain. "When it is hotter and it is drier, obviously you have a much higher chance of wildfire, so the watersheds that are upstream from reservoirs may wind up burning," she told me. "That leads to sediment flows that both reduce the volume of reservoir capacity and increase sediment in the water supply and in some cases actually mean you have to shut down the system. And at the same time, those wildfires are causing air-quality problems that are interfering with virtually everyone who is engaging in outdoor activity."

These complex dynamics test the ability of any institution to plan for what's coming. The governments that obtain water from the Colorado River have painstakingly negotiated the supply cutbacks that the federal government announced this month (first affecting Arizona, Nevada, and Mexico, but potentially reaching California before long). Some experts worry that future water flows will be even lower than the official projections, forcing another round of difficult talks for further reductions.

States across the region are also facing the limits of adaptation in confronting fire risk. Local governments are putting more money and effort into maintaining their forests to clear away the dead trees and plants that provide fuel for the wildfires (a cause that former President Donald Trump highlighted as part of his effort to downplay the consequences of climate change). But "you can't manage your forests out of the problem," Inslee said. "We are putting hundreds of millions of dollars into managing our forest, but that cannot solve this problem when everything is tinder-dry and one spark means a cataclysm."

WHETHER THE ABSOLUTE MAGNITUDE of climate change in the West is more severe than in any other U.S. region is an open question: Some of the experts I talked with said yes, while others said that the heat waves and hurricanes in the Southeast or the heat waves and floods in the Midwest may be at least as damaging.

But even so, there's a general sense among local leaders and scientists that the West remains the U.S. region where life as we know it today will face the greatest disruptions from climate change. The reason is that the West starts with little margin for error. Because it is so arid, development in the West has always been precarious. Since the 19th century, its growth has relied on a sustained triumph over nature, massive engineering projects funded primarily by the federal government to tame its rivers to produce the water and electric power that made possible its growing cities—Las Vegas, Los Angeles, Phoenix (the latter two are the second- and fifth-largest cities in the country). "The modern West is a human construct, dependent on a massive rearrangement of water availability across large areas," Daniel Farber, of the Center for Law, Energy & the Environment at Berkeley Law, wrote recently. "The physical and legal infrastructure of the West is geared toward a certain climate regime. At great expense and effort, dams, canals, and irrigation systems have been carefully engineered for a climate that no longer exists."

The experts I spoke with differed on which of the climate-induced changes under way may reshape life in the West the most. Nichols, of the California Air Resources Board, picked the rising atmospheric temperatures. "I think, realistically, it's the periodic heat waves that just kill people," she said. "We tend not to pay as much attention to them; we don't assume there is a right to air-conditioning in most places, but at a certain point, you are going to see large numbers of excess deaths," along with threats to outdoor work and recreation that will affect "every aspect of how people can live."

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Inslee worries most about the particulates and other air pollutants released in fire seasons that are now both longer and more destructive. "The respiratory issues … are the most, in some sense, immediate because our kids can't go outside because of the particulate pollution," he said. "It's just too unhealthy. We tend to like to breathe, and finding a solution to that is the most challenging. Staying inside right now is the only one, but that is pretty limiting."

Katharine Jacobs pointed to a problem that isn't necessarily the most threatening but may prove the most intractable and tragic: the impact of climate change on plants and animals. Although humans can adapt to hotter temperatures by shifting work patterns or adding air conditioners in areas such as the Northwest where they are rare, animal and plant life can't adapt as quickly or easily. "I am absolutely petrified about the implications for biodiversity and for quality of life, recreation, forest health, all of those things, because you cannot innovate your way into protecting all of that, whereas people have lots of options if they are willing to make adaptive choices," she said. Mass die-offs of salmon and other freshwater fish in multiple states from rising water temperatures and declining water levels, and the reports of at least 1 billion shellfish (and probably more) boiling in their shells during the Northwest heat wave, underline her point.

But without discounting any of these dangers, most of the experts I spoke with pointed to drought and reduced water supplies as the biggest long-term threat from climate change to the West. Climate change is putting pressure on western water supplies from almost every direction. Because the air is hotter, it draws more moisture from plants; parched soil in turn absorbs more water before allowing runoff to rivers. Snowpack in the mountains, which operates as an essential source of natural storage for the water system, accumulates less (because more precipitation is falling as rain) and then also melts more (because of rising temperatures). One study estimated that each Celsius degree of warming would reduce the water flow in the Colorado River, the principal water source for most of the West, by nearly 10 percent. Even heavier precipitation, the scientists concluded, "will not suffice to fully counter" the robust drying driven by the changing climate. When it comes to water supplies, "every year in the West is a roll of the dice," Felicia Marcus, the former chair of the California State Water Resources Control Board, told me. "But with climate change, the dice are loaded."

The squeeze on water supplies from the changing climate isn't a surprise; scientists have been tracking it for years (which is why states across the region have been compelled to negotiate cutbacks in their allocations

from the Colorado River). But, as on many fronts, the shortfalls are developing at the far end of the most pessimistic projections, if not past them. Even people who "have been looking at water-supply issues for several decades and anticipating climate change … have been surprised by how quickly the impacts have escalated," said Jacobs, who has studied water policy for decades as both an Arizona state official and a senior climate adviser in President Barack Obama's White House. "The physics of this pretty much were known a long time ago, but as a water manager, I have to say I don't know of any water managers who understood the dramatic relationship between increase in heat of a few degrees and a reduction in flow of surface water. It goes beyond what seems to be predictable, just thinking about it from a physical perspective."

The western states, as a group, have actually performed quite well over the past generation in conserving water: Through pricing incentives and mandatory installation of water-saving technologies, California now uses less water than it did in 1980, though its population is far greater. Phoenix and Tucson likewise use no more water than they did in 1985 despite huge population growth, Jacobs said.

Marcus, now a senior fellow at Stanford University's Water in the West program, said that climate-driven constraints will require further significant tightening. California Governor Gavin Newsom's request in July that Californians voluntarily reduce their water consumption by 15 percent is likely only the beginning. The good news, Marcus said, is that there are many opportunities for savings. "Urban areas can adapt because we are so wasteful now," she told me. "We use over 50 percent of our water on outdoor ornamental landscaping, which is mostly keeping a lawn as green as a Scottish golf course … You could get rid of the lawns and plant more trees." More recycling and recapture of rain runoff (the L.A. area is expanding its water-recycling efforts through two massive projects that are each larger than any now operating in the world, as well as a huge stormwater-capture program funded under a fee measure passed in 2018) can also offset the continuing squeeze on water supplies. Agriculture across the West, Marcus said, will also need to live with "bigger limitations" on its water supplies and learn to grow more with less. On the other side of the water challenge—managing rising sea levels and more dangerous floods—San Francisco has been leading the way with a bond initiative that provides hundreds of millions of dollars to nurture wetlands and tidal marshes that can serve as a natural buffer against floods and capture carbon as well. "We have to integrate the natural world into our thinking," Marcus said.

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Through measures like the Los Angeles and San Francisco Bay Area initiatives, Marcus believes, the West can reconfigure its water system to cope with the reduced supply, even as its population continues to rise. But the pace of change must rapidly increase. And none of it will be painless. Reduced supply to agriculture will affect consumers because California produces such a large share of the country's fruits and vegetables. (California, for instance, is the source of all of the nation's commercially grown almonds, a highly water-intensive crop, and less water could mean lower production and higher prices at a time when demand is soaring, partly because almond milk has proved a hit with so many consumers.) And, after restrictions imposed during the last drought expired in 2017, both local and statewide California officials have not shown much appetite for confronting homeowners with limits on water usage for maintaining lawns or hosing down driveways (though the pressure of the new shortfalls could soon change that). Water law will need to adjust as well, Farber said, because the current rules prioritize agriculture and even with conservation, population growth will demand a shift of limited water resources from farms to cities. "We are going to have a lot of political conflict over what to do with an increasingly scarce resource," he said.

In the end, Marcus believes, adapting to the drier future will be a task comparable in magnitude and difficulty to the original test of building the enormous network of dams and water systems that made the West's settlement possible in the first place. "It really is going to be the test of our civilization," she said, "as to whether we can retrofit ourselves to live within our means with the vision and audacity of that original expansion."

THE DISRUPTIVE CLIMATE-CHANGE EVENTS unfolding now reflect the impact of carbon that was released into the atmosphere years ago. As Nichols noted, the carbon already emitted guarantees that the extreme events happening across the West this year will become more common, and even more severe, "no matter what" we do to reduce emissions going forward. The main question is whether we can slow the rate of emissions to a point that holds those future changes in the climate to a range the West can plausibly adapt to.

The West, as I noted, may be threatened by the changes already baked into the climate more than any other U.S. region, because its aridity means it starts with so little margin for error. It also faces the pressure of growing demands on its natural resources from a steadily rising population: All but one of the 12 counties that added the most people from 2010 through 2020 (including those centered on Phoenix, Seattle, Las Vegas, Houston, and Dallas) are located from Texas to the Pacific Coast.

Should the most environmentally stressed region add people that quickly? Generally, the experts I spoke with said that although adjustment won't be easy, with sufficient planning and adaptation (things like more water conservation, more air conditioners in the Northwest, more concentrated development to limit expansion into fire-prone areas), the region should be capable of sustaining a continually growing population, albeit not without heavy burdens, such as more punishing heat waves or smoky days that force the residents of big cities to huddle indoors.

But even that conditional optimism rests on a profoundly uncertain foundation. All of the scientists and government officials I spoke with agreed that any hope of adaptation depends on rapidly reducing, and eventually eliminating, the addition of more carbon into the atmosphere. If emissions are not controlled, our adaptations will continually be running behind further deterioration in the climate beyond what planners anticipated. "Ultimately, to have our adaptation responses be manageable, we have to stay committed to very ambitious emission reductions, because if we do not reduce emissions, the effects are going to be that much worse," says Nuin-Tara Key, the deputy director for climate resilience at the California Governor's Office of Planning and Research. Gonzalez, of UC Berkeley, likewise said that if emissions are controlled, the West can likely adapt to the changes already locked into the system, but if the world fails to hold the global temperature increase below the international goal of 1.5 to 2 degrees Celsius, the future effects will be extremely difficult to contain—like wildfires at five times the historical average.

On the ground, the future already seems ominously unstable to the activists and officials I spoke with this summer in Sebastopol, a hippie-flavored, now-gentrifying small town in the Russian River Valley northeast of San Francisco. On the western edge of Sonoma County's wine country, the town is thriving with Bay Area transplants seeking more affordable housing; it's developed a stylish shopping and eating complex downtown, in a former apple cannery called the Barlow. On the day I was there, families descended with lawn chairs for free afternoon concerts on stages set up in between the craft breweries, wine bars, and boutiques.

In the past few years, the Russian River Valley has experienced almost every danger climate change can offer: flood, drought, wildfires. The fires haven't yet broken through to downtown Sebastopol, but hardly anyone in the area feels immune after the most intense blaze, in 2017, burned through affluent residential neighborhoods nearby. Then in 2019, severe flooding from the Russian River submerged much of the region, including the Barlow. Fires raged again in 2020. Now drought has left the Russian

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River (the central attraction for the region's tourism industry) at a low ebb and forced cutbacks in water supplies. Water shortages have added a new challenge for the area's many wineries, which already saw nearly one-third of their grapes last year ruined by smoke from the persistent wildfires. (Smoke can leave the grapes tasting, in the evocative if unappetizing analogy many wine growers use, like a wet ashtray.) Kari Svanstrom, Sebastopol's planning director, told me that she and her counterparts across Sonoma County are all being forced to wrestle with the likelihood that these extreme events will hit more often. "We are looking at increased frequency as well as new impacts that weren't necessarily planned for in the past," she said.

Sonoma County, perhaps not surprisingly as an upscale Democratic-leaning place, takes climate change very seriously. The county already generates 97 percent of its power from carbon-free sources, and the county commission earlier this year endorsed the goal of reaching carbon neutrality by 2030—fully two decades ahead of President Joe Biden's national goal.

Kenna Lee, a home hospice nurse, is participating in all these efforts as the chair of the citizens' climate advisory committee that Sebastopol's city council established earlier this year. With its relatively affluent population, she says, the city should become a model for strategies to cut carbon emissions, through ideas such as building community storage facilities for solar energy and constructing renewably powered "resilience centers" that can serve as cooling spaces during heat waves or evacuation points during fires. "This is a wealthy place that should be an incubator for ideas," she told me when we met in the Barlow. After 20 years living in the area, she's excited about those possibilities, yet she says that if not for her family situation, she would have moved away already because of the accumulating threats from flood and especially fire. The fires have become so persistent that her company has been forced to develop evacuation plans for all its patients; Lee was worried enough about her own fire risk that she recently moved from her house about two miles outside of town to a new home inside Sebastopol close to the fire department.

Lee is determined to do everything possible to control the risks of a changing climate, through both adaptation and reducing future emissions, but she's also keenly aware that even if she achieves all the goals she's working toward, she cannot prevent the risk from increasing. In that way, she personifies the equation facing the West in a warming world. "We tell ourselves" that it is safe to keep living as we have been, Lee told me, "but

looking at it from any rational perspective, no one can believe that. We tell ourselves that because, otherwise, we can't go on living our lives."

theatlantic.com, 26 August 2021

https://www.theatlantic.com

Toxic algal blooms are growing out of control

2021-08-26

On the Fourth of July last year, an hour after playing in the North Fork of the Virgin River in Utah's Zion National Park, a healthy five-month-old husky puppy started seizing and then died. Local health officials determined that the dog, named Keanna, had swallowed toxic algae from the river.

The Park Service warned against all forms of recreation on the North Fork for the rest of the summer because of the danger, effectively closing one of the most popular attractions in one of the country's most visited national parks. Zion is just one of hundreds of popular places across the U.S. to have been impacted by toxic algae, which thrive in hot weather. This year, rivers and reservoirs across Utah are seeing unprecedented algal growth once again (the North Fork of the Virgin River is still under a warning advisory), while algal blooms continue to close bodies of water from Washington to Florida (a total of 278 were deemed off-limits in 2020). Officials in California are even investigating algae as a cause of a family's respiratory death near Yosemite.

A report from the nonprofit Environmental Working Group, which tracked outbreaks between May and October of 2020, found documented cases of toxic algae in every state except Alaska. Last year more than 400 cases were reported, up from fewer than 100 cases in 2010, when the EWG first started keeping track. By July of 2021, the organization had seen a 46 percent increase in reports of blooms compared to the same period last year.

So what is toxic or blue-green alga? It's a kind of naturally occurring microscopic cyanobacteria. If there are nutrients in water, particularly phosphorus and nitrogen, when that water warms up, the bacteria begin multiplying like crazy, creating algal blooms. And that's when things can get really complicated.

When the bacteria blooms, it can emit thousands of different kinds of toxins, including saxitoxin, which causes paralysis, and the liver toxin and carcinogen microcystin. For humans, reactions can range from rashes,

Officials in California are even investigating algae as a cause of a family's respiratory death near Yosemite

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diarrhea, and sore throats to cardiac arrhythmia. Researchers are just starting to dig into the long-term health effects—it's been linked to cancer, Alzheimer's disease, and other neurodegenerative conditions. "The scariest part is that it's really hard to predict toxins—you can't tell if they're toxic by looking at them, so you can't just avoid them, and we don't understand what triggers a bloom to be toxic," says Anne Schechinger, senior economic analyst at the EWG. "We're really at the beginning of the science."

While we don't know exactly what triggers the alga to release specific toxins, we do know what causes it to bloom and why it's getting worse. "These blooms wouldn't occur without phosphorus and nitrogen, which are mainly caused by fertilizer and animal-manure runoff, along with an urban area's stormwater runoff and septic," says Schechinger.

Commercial agriculture—both animal ag, which releases phosphorus in the form of manure, and crops, which use nitrogen as fertilizer—has increased the amount of those nutrients in the ecosystem to the degree that the Environmental Protection Agency called it "one of America's most widespread, costly, and challenging environmental problems."

Toxic algal blooms have also been exacerbated by climate change. Algae need heat and light to bloom, and rising water and air temperatures caused by a warming climate provide fuel. Heavy precipitation often makes things worse, and because of climate change, intense weather events are happening more often. According to a report from the EPA's Office of Water, "Recent research suggests that the impacts of climate change may promote the growth and dominance of harmful algal blooms through a variety of mechanisms including: warmer water temperatures, changes in salinity, increases in atmospheric carbon dioxide concentrations, changes in rainfall patterns, intensifying of coastal upwelling, and sea level rise."

That's not good news for waterside communities, where an outbreak can affect people's health and crush their livelihoods. This summer in Florida, both coastal and lakeside towns have had to close their water access after blooms caused huge fish die-offs and sickened beachgoers. "For a lot of towns that rely on bodies of water for their economy, this can be really really harmful," Schechinger says. "The Mississippi Gulf Coast had a big bloom last year that shut down most of the beaches, and that had a huge impact on tourism."

But despite these impacts, there's no national oversight for outbreaks, and according to Schechinger, monitoring and management at the state level

is highly variable. (The EWG uses local news reports to identify outbreaks, which means they're probably undercounting.) The 1998 Harmful Algal Bloom and Hypoxia Research and Control Act split the responsibility on the federal level between the EPA, which monitors fresh water, and NOAA, which has started to track blooms in marine ecosystems, but no one is looking at the whole picture.

Plus, it's not easy to track and regulate diffuse pollution that becomes dangerous as it accumulates. In the U.S., we address water pollution through laws like the Clean Water Act, which only covers pollution that comes from a single source, such as wastewater or industrial dumping. The impacts of toxic algal blooms are far removed from the source. For instance, the headwaters of the Virgin River in Utah aren't particularly close to concentrated agriculture, and they're far from urban septic systems, but nitrogen and phosphorus still build up in water as they wash downstream.

According to Schechinger, the only recourse is to rely on voluntary conservation to curb non-point-source pollution, which isn't a very powerful tool. She says it would be much more effective to deal with it where it's created, because it's expensive and incredibly hard to clean up once it's released. The economic cost of algal blooms amounts to an estimated $2.2 billion each year, and that number will grow as the blooms do.

For now, dogs are dying and you can't go swimming or canyoneering in a growing number of places. And (welcome to 2021) the people bearing the brunt of the problem are not the ones responsible for its spread, and it's only going to get worse.

One silver lining is that more people are starting to pay attention—NOAA, for example, just began making harmful-algal-bloom forecasts for the Gulf Coast of Florida and the Gulf of Maine, and it's planning to expand into more places, including the Pacific Northwest, soon. Schechinger also points out that satellite mapping is getting better, so it's becoming easier to trace pollution plumes to their source. And some regulation is getting passed on the local level: in Minnesota, where Schechinger lives, a new law just went into effect that mandates barriers between farms and major waterways.

The best thing for individuals to do is to start local and be loud. If you see something that looks like alga at your local beach or creek, report it to your health or water department. The more data points there are, the

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fewer people are inadvertently impacted, and the more powerful the argument for regulation becomes.

outsideonline.com, 26 August 2021

https://www.outsideonline.com

Italian shark has 'virgin birth' after 10 years in all-female shark tank

2021-08-26

A shark's rare "virgin birth" in an Italian aquarium may be the first of its kind, scientists say.

The female baby smoothhound shark (Mustelus mustelus) — known as Ispera, or "hope" in Maltese — was recently born at the Cala Gonone Aquarium in Sardinia to a mother that has spent the past decade sharing a tank with one other female and no males, Newsweek reported.

This rare phenomenon, known as parthenogenesis, is the result of females' ability to self-fertilize their own eggs in extreme scenarios. Parthenogenesis has been observed in more than 80 vertebrate species — including sharks, fish and reptiles — but this may be the first documented occurrence in a smoothhound shark, according to Newsweek.

"It has been documented in quite a few species of sharks and rays now," Demian Chapman, director of the sharks and rays conservation program at Mote Marine Laboratory & Aquarium in Florida, told Live Science. "But it is difficult to detect in the wild, so we really only know about it from captive animals," said Chapman, who has led several studies on shark parthenogenesis.

Virgin birth

Parthenogenesis may occur infrequently, but it happens in many types of sharks.

"About 15 species of sharks and rays are known to do this," Chapman said. But it is likely that most species can probably do it, he added.

Scientists notice parthenogenesis occurring most often in carpet sharks, particularly white-spotted bamboo sharks (Chiloscyllium plagiosum) and zebra sharks (Stegostoma tigrinum), because they are common aquarium species. However, parthenogenesis occurs in both oviparous (egg-laying)

This rare phenomenon, known as parthenogenesis, is the result of females' ability to self-fertilize their own eggs in extreme scenarios.

sharks, like carpet sharks, and viviparous (live-birthing) sharks, like smoothhound sharks, Chapman said.

In the wild, parthenogenesis may be a last resort for females that cannot find a mate, either because they have been separated from others in their species or because human impacts, such as climate change and overfishing, or natural selection pressures, such as predation and disease, have wiped out all the available males. In aquariums, separation from males or long periods of isolation can trigger this natural response in females, Chapman said.

Some individual sharks have been observed repeatedly giving birth via parthenogenesis over a period of years, and others may switch between parthenogenesis and sexual reproduction when introduced to a mate, Chapman said.

Imperfect cloning

There are two types of parthenogenesis: apomixis, a form of cloning common among plants, and automixis, a form of self-fertilization that more closely resembles sexual reproduction, according to National Geographic.

"Rather than combining with a sperm cell to make an embryo, [the egg cell] combines with a polar body, which is essentially another cell that is produced at the same time that the egg cell is produced and has the complementary DNA," Christine Dudgeon, a biosciences researcher at the University of Queensland in Australia who has studied shark parthenogenesis, told Live Science. In this scenario, the polar body acts as a pseudo-sperm cell with a single strand of DNA.

The resulting offspring get 100% of their their DNA from their mother but are not exact clones of them, Dudgeon said.

This is because sex cells, also known as gametes, have a unique combination of genes that are randomly selected from each parent as they are created — so each shark egg (or polar body) has a different genetic makeup. When the polar body and egg combine, they produce a baby shark that is genetically different from the mother. But because they are only made from one gamete , not two, parthenogenetic offspring are more closely related to their mother than normal babies are, Dudgeon said.

Because parthenogenesis in sharks happens only in females and females cannot pass on a Y chromosome, it also means the resulting offspring

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are always female. "The mother is XX, and so she will only pass on X chromosomes to the offspring," Dudgeon said.

Health issues

"Parthenogenesis is essentially a form of inbreeding, as the genetic diversity of the offspring is greatly reduced," Dudgeon said.

As such, offspring produced by parthenogenesis may have a reduced chance of survival, Dudgeon added.

"There is a high rate of embryonic failure among parthenogenetic offspring," Chapman said. "But when they do survive, many have normal lives, and some can even reproduce."

However, it is hard to pin down exactly why baby sharks die, whether they are parthenogenetic or not.

"Mortality in young sharks in aquaria, and the wild, is common, so it's hard to say what is causing it," Dudgeon said. "The [normal] offspring that are born have already won the lottery," she added.

Baby Ispera appears to be in good health and is expected to live a relatively normal life in captivity, according to Newsweek.

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https://www.livescience.com

Invasive earthworms are remaking our forests, and climate scientists are worried

2021-08-29

For the past 300 years, a slow-motion invasion has been unfolding under our feet.

Year by year, a plethora of invasive earthworms have been quietly burrowing their way through our forests' leaf litter, grasslands and backyard gardens.

Although earthworms are beneficial for growing food, research shows they are harming our forests, and could potentially be contributing to climate change.

Year by year, a plethora of invasive earthworms have been quietly burrowing their way through our forests' leaf litter, grasslands and backyard gardens.

Earthworms are not native to most of North America. Until about 10,000 years ago, a vast ice sheet covered the northern third of the North American continent. Scientists think it killed off the earthworms that may have inhabited the area before the last glaciation.

Earthworms were reintroduced to North America with the arrival of European settlers in the 18th century. There are now more than 30 species of non-native earthworms in Canada, according to Michael McTavish, a postdoctoral research fellow at the University of Toronto specializing in the ecology of non-native earthworms.

"By physically changing the soil environment, earthworms affect everything from decomposition of organic matter, to nutrient cycling, carbon storage...how water moves through [the soil]," said McTavish.

"They just kind of affect everything across the board."

Although they're usually perceived as friendly helpers in the garden, elsewhere, they can be a surprisingly destructive force.

Threatening forest diversity

Earthworms are ecosystem engineers, meaning they play a huge role in shaping their environment.

Normally, microbes and other soil-dwelling organisms such as mites, nematodes, millipedes and fungi break down organic matter in Canadian forests. They turn leaves and wood bits into soil and free up the nutrients that were once bound in organic matter. In the absence of earthworms, the litter layer, which is composed of old leaves and detritus that has built up on the soil floor, breaks down very slowly.

When earthworms move into our forests, they have the potential to rapidly change these ecosystems by devouring the leaf litter. They break down plant matter in much the same way as other invertebrates, but they do it much faster. In essence, worms speed up decomposition, which can be a bad thing for ecosystems used to taking it slow.

"When earthworms move in, you have a fundamentally different soil environment," said McTavish.

"So you can get changes in pH, in the texture and density, and nutrient enrichment. The problem is that the species that we have present in our forests are not used to those kinds of conditions."

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According to McTavish, the soil environment becomes inhospitable to native plants, allowing non-native plants to thrive.

Erin Cameron, an environmental science professor at St. Mary's University in Halifax who studies invasive earthworms, found that earthworms cause a 50 per cent decrease in abundance in native soil invertebrates.

Now, to the great concern of climate scientists, invasive earthworms are expanding their range northwards, in boreal forests that have lacked native earthworms since the last ice age.

The boreal forest is losing carbon

Justine Lejoly, a soil scientist with the University of Alberta in Edmonton researching the effects of earthworms on soil carbon dynamics, says the earthworms' voracious appetite has serious implications for the boreal forest's capacity to store carbon.

The boreal is special. In warmer climates, the floor of a typical forest is a mix of mineral soil and organic soil. In a boreal forest, those components are distinct, with a thick layer of rotting leaves, mosses and fallen wood on top of the mineral soil.

This spongy layer of leaf litter contains most of the carbon stored in the boreal soil. Dendrobaena octaedra, the small earthworm responsible for invading most of the North American boreal, is the type that loves to devour leaf litter and stay above ground, releasing carbon.

"Boreal forests are known to be a very important terrestrial reservoir of carbon," said Lejoly. "If we lose that organic matter, it means that there is a lot of carbon that's not going to be stored in those forests anymore."

Lejoly estimates that only around 10 per cent of the boreal forest currently has earthworms, but she projects that by 2050, most of the boreal forest will be invaded — which means the boreal forest soil could potentially lose most of its carbon stock.

Cameron modelled the potential effects of earthworms on carbon stored in the forest floor. Her models found that when earthworms were present, the forest floor's carbon stock was reduced by around 50 to 94 per cent after 125 years, but most of that reduction occurred in the first 35 to 40 years.

This means that boreal forests may potentially be emitting a lot more carbon, in the form of carbon dioxide, into the Earth's atmosphere, than

they are absorbing. Already, rising temperatures are releasing carbon from forests, by thawing permafrost and increasing the number of forest fires.

Second wave of invasion

More recently, several species of Asian earthworms have made their way to the continent, and they have soil scientists particularly concerned. Originally from Korea and Japan, they are known as "jumping worms," "snake worms," or "crazy worms" — named for their distinctive thrashing when disturbed. They are ravaging soils throughout the U.S., and have crossed the border into Canada.

McTavish fears that jumping worms pose an even greater threat than their European predecessors. Jumping worms have many of the same effects, except that they grow larger, recycle nutrients even faster and exist in dense colonies, sometimes numbering more than 100 individuals per square metre of ground.

Jumping worms are known to quickly churn the top layer of soil, turning it into something that resembles coffee grounds from all the worm droppings.

Managing the invasion

Invasive earthworms have been found everywhere from Ontario to Alaska. Their rapid spread across the continent is largely due to human activity. Earthworms, left to their own devices, can only spread around 10 metres per year. But invasive earthworms can easily travel a couple hundred kilometres in one day by roads, anglers, tire treads, boats and even gardeners.

McTavish says this means it's key to educate the public about invasive earthworms, and limit the transfer of soil and earthworms between different areas.

For example, David Legros, the chief naturalist at Ontario's Algonquin Provincial Park, says the park has begun asking visitors going fishing to stop dumping their leftover bait.

"The problem is there's no way of removing them from an area once they invade," said Cameron. "So, any action or management really has to be done in terms of restricting introduction."

cbc.ca, 29 August 2021

https://www.cbc.ca

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Quantum crystal could reveal the identity of dark matter

2021-08-30

Using a quirk of quantum mechanics, researchers have created a beryllium crystal capable of detecting incredibly weak electromagnetic fields. The work could one day be used to detect hypothetical dark matter particles called axions.

The researchers created their quantum crystal by trapping 150 charged beryllium particles or ions using a system of electrodes and magnetic fields that helped overcome their natural repulsion for each other, Ana Maria Rey, an atomic physicist at JILA, a joint institute between the National Institute of Standards and Technology and the University of Colorado Boulder, told Live Science.

When Rey and her colleagues trapped the ions with their system of fields and electrodes, the atoms self-assembled into a flat sheet twice as thick as a human hair. This organized collective resembled a crystal that would vibrate when disturbed by some outside force.

"When you excite the atoms, they don't move individually," Rey said. "They move as a whole."

When that beryllium "crystal" encountered an electromagnetic field, it moved in response, and that movement could be translated into a measurement of the field strength.

But measurements of any quantum mechanical system are subject to limits set by the Heisenberg uncertainty principle, which states that certain properties of a particle, such as its position and momentum, can't simultaneously be known with high precision.

The team figured out a way to get around this limit with entanglement, where quantum particles' attributes are inherently linked together.

"By using entanglement, we can sense things that aren't possible otherwise," Rey said.

In this case, she and her colleagues entangled the motions of the beryllium ions with their spins. Quantum systems resemble tiny tops and spin describes the direction, say up or down, that those tops are pointing.

When the crystal vibrated, it would move a certain amount. But because of the uncertainty principle, any measurement of that displacement, or the

The work could one day be used to detect hypothetical dark matter particles called axions.

amount the ions moved, would be subject to precision limits and contain a lot of what's known as quantum noise, Rey said.

To measure the displacement, "we need a displacement larger than the quantum noise," she said.

Entanglement between the ions' motions and their spins spreads this noise out, reducing it and allowing the researchers to measure ultra-tiny fluctuations in the crystal. They tested the system by sending a weak electromagnetic wave through it and seeing it vibrate. The work is described Aug. 6 in the journal Science.

The crystal is already 10 times more sensitive at detecting teensy electromagnetic signals than previous quantum sensors. But the team thinks that with more beryllium ions, they could create an even more sensitive detector capable of searching for axions.

Axions are a proposed ultralight dark matter particle with a millionth or a billionth the mass of an electron. Some models of the axion suggest that it may be able to sometimes convert into a photon, in which case it would no longer be dark and would produce a weak electromagnetic field. Were any axions to fly through a lab containing this beryllium crystal, the crystal might pick up their presence.

"I think it's a beautiful result and an impressive experiment," Daniel Carney, a theoretical physicist at Lawrence Berkeley National Laboratory in Berkeley, California, who was not involved in the research, told Live Science.

Along with helping in the hunt for dark matter, Carney believes the work could find many applications, such as looking for stray electromagnetic fields from wires in a lab or searching for defects in a material.

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…found that 30% of 557 raptor species worldwide are considered near threatened, vulnerable or endangered or critically endangered.

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Birds of prey face global decline from habitat loss, poisons

2021-08-31

WASHINGTON (AP) — Despite a few high-profile conservation success stories – like the dramatic comeback of bald eagle populations in North America – birds of prey are in decline worldwide.

A new analysis of data from the International Union for the Conservation of Nature and BirdLife International found that 30% of 557 raptor species worldwide are considered near threatened, vulnerable or endangered or critically endangered. Eighteen species are critically endangered, including the Philippine eagle, the hooded vulture and the Annobon scops owl, the researchers found.

Other species are in danger of becoming locally extinct in specific regions, meaning they may no longer play critical roles as top predators in those ecosystems, said Gerardo Ceballos, a bird scientist at the National Autonomous University of Mexico and co-author of the study published Monday in the journal Proceedings of the National Academy of Sciences.

"The golden eagle is the national bird of Mexico, but we have very few golden eagles left in Mexico," he said. A 2016 census estimated only about 100 breeding pairs remain in the country.

Harpy eagles were once widespread throughout southern Mexico and Central and South America, but tree cutting and burning has dramatically shrunk their range.

Of threatened birds of prey that are active mostly during the day — including most hawks, eagles and vultures — 54% were falling in population, the study found. The same was true for 47% of threatened nocturnal raptors, such as owls.

That means "the factors causing the decline have not been remedied" and those species need immediate attention, said Jeff Johnson, a biologist at the University of North Texas, who was not involved in the study.

Globally, the biggest threats to these birds are habitat loss, climate change and toxic substances, said Evan Buechley, a research associate at the Smithsonian Migratory Bird Center and a scientist at nonprofit HawkWatch International who was not involved in the study.

The insecticide DDT thinned egg shells and decimated bald eagle populations in North America, leading to its ban in the U.S. in 1972. But

Buechley said other threats remain, including rodent pesticides and the lead in hunters' bullets and shot pellets. Many raptors feed on rodents and dead animals.

The Andean condor is declining due to exposure to pesticides, lead and other toxic substances, said Sergio Lambertucci, a biologist at the National University of Comahue in Argentina.

Widespread use of an anti-inflammatory drug in livestock led to the rapid decline of vultures in South Asia. The birds died after eating carcasses, shrinking the population of some species by 95% in recent decades.

In East Asia, many raptor species are long-distance migrants: They breed in northern China, Mongolia or Russia and travel down the eastern coast of China to spend summers in Southeast Asia or India.

"Certain areas of the coast will see 30 to 40 species during peak migration," said Yang Liu, an ecologist at Sun Yat-Sen University in Guangzhou, who was not involved in the study.

But eastern China is also the most populous and urban part of the country, with steep development pressures. "Sites that are bottlenecks for migration, with thousands of birds passing through, are important to protect," he said.

Of 4,200 sites identified by conservation groups as critical for raptor species globally, most "are unprotected or only partly covered by protected areas," said Stuart Butchart, chief scientist at BirdLife International in the United Kingdom.

A 2018 study in the journal Biological Conservation found that 52% of all raptor species worldwide are decreasing in population.

apnews.com, 31 August 2021

https://www.apnews.com

Man can change his pupil size on command, once thought to be an impossible feat

2021-08-01

A 23-year-old student in Germany can shrink and enlarge his pupils on demand, according to a new case report — a feat that was previously thought to be impossible.

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Two tiny opposing muscles in the eye act as puppeteers of each pupil (the dark center of the eye), dilating or enlarging them in a dark environment to let in more light and constricting them in a bright environment to limit the amount of light that flows in. This process was thought to be completely automatic; when you step into a dark room, you don't have to consciously tell your pupils to change size. Pupils can also change size in response to other factors, such as increases in arousal.

It was previously known that some people can change their pupil size at will, but by using indirect methods.

For example, researchers already knew that just thinking about the sun could constrict the pupils and that thinking of a dark room or mentally calculating something could dilate them, said Christoph Strauch, senior author of the new case report and an assistant professor in the experimental psychology department at Utrecht University in the Netherlands.

This process was thought to be completely automatic; when you step into a dark room, you don't have to consciously tell your pupils to change size.

But no one thought it was possible to change pupil size by directly controlling it like a muscle — that is, until a student of psychology at Ulm University in Germany contacted Strauch after taking one of his courses. (Strauch was previously a doctoral student at Ulm University).

When he was about 15 or 16 years old, the young man — identified in the case report by his initials, D.W. — realized that he could change the size of his pupils. "I showed a friend that I can 'tremble' with my eyeballs, and he noticed that my pupils became small," D.W. told Strauch and his colleagues at Ulm University. But D.W. didn't notice that he had this ability until he played computer games for long periods of time.

"Constricting the pupil feels like gripping, tensing something; making it larger feels like fully releasing, relaxing the eye," D.W. told the researchers. At first, he would change his pupil size by focusing in front of or behind an object, but with practice, he learned how to do it without focusing on objects. He told the researchers that, to change his pupil size, all he has to do is concentrate on the eye; he doesn't have to imagine a bright or dark environment.

That makes D.W. different from other people who have demonstrated the ability to change their pupil size, Strauch told Live Science. What's more, that he can feel the muscles in the pupils directly "is astonishing, as it was thought to be impossible."

How rare is this?

Through a series of tests, the researchers confirmed that D.W. indeed had this ability — and they found no indication that he was changing the size of his pupils indirectly. In one test, the researchers measured the electrical properties of the skin by applying voltage to test whether he was aroused by increased mental effort, which also might have increased his pupil size indirectly. (He wasn't.)

Without using any indirect method, D.W. could dilate his pupils up to 0.09 inches (2.4 millimeters) in diameter and constrict them to 0.03 inches (0.88 mm) in diameter. What's more, even at the closest point an object can be for the eye to still see it in focus, in which the pupil is already "maximally" constricted (imagine holding up a pencil in front of the eyes and moving it closer to the face and stopping at the point before it becomes blurry), D.W. could voluntarily constrict his pupil even more. By doing this, D.W. improved his focus and could see objects clearly nearly two times closer to his face than he could if he wasn't controlling his pupil size.

Using a type of brain scan known as functional magnetic resonance imaging (fMRI), the researchers found increased activation of certain parts of the brain involved in volition, or the ability to decide and do something out of free will.

The researchers can't say for sure that D.W. was directly controlling his pupils, but from their many tests, they did not find any evidence that he was using indirect strategies.

Can other people learn to do this? Possibly, Strauch said. Finding and researching more people who have this ability might help the team understand whether there's a strategy for training people to control their pupil size at will. (Readers who think they may have this ability can reach out to the researchers at pupilcontrol@gmail.com.)

Studies of more people who might have this ability may help researchers describe and understand the phenomenon, such as where it came from, Strauch added. "Quite some people have reached out who believe that they might be able to do the same thing — this is really cool," he said.

The findings were published online Aug. 12 in the International Journal of Psychophysiology.

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https://www.livescience.com

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Maine ban on 'forever chemicals' marks a big win for some scientists

2021-08-27

Last month, a group of scientists scored an unexpected win in chemical regulation: The state of Maine became the world's first jurisdiction to ban the sale of products containing per- and polyfluoroalkyl substances (PFASs). The controversial chemicals are common in consumer goods such as nonstick cookware. By 2030, Maine will forbid selling products that use PFASs unless regulators determine their use is "currently unavoidable."

The law, adopted 15 July, targets a family of chemicals that includes some 5000 compounds, including several banned under the international Stockholm Convention because they threaten human health. Because PFASs have a similar basic structure that can persist in the environment for long periods, some researchers have argued governments should drop the traditional approach of regulating them one by one. Instead, they want regulators to restrict the entire class, requiring manufacturers who want to use a PFAS in a product to prove the chemical's use is "essential" for health, safety, or the functioning of society, and that there are no alternatives.

The essential-use approach "is really about trying to find more efficient regulatory means to control something that has been identified as hazardous," says Kathleen Garnett, an environmental law scholar at Wageningen University & Research's Law Group and a proponent of the idea.

Industry groups, however, have pushed back, saying the approach is not rooted in science and could put useful chemicals off limits. "A one-size-fits-all approach to chemical regulation is neither scientifically accurate, nor appropriate," said the American Chemistry Council in a recent statement on the Maine law.

For decades, manufacturers used PFASs to create materials that repel water and stains and make fire-fighting products. The compounds' basic structure—a string of carbon atoms swathed in fluorine—resists degradation, earning them the nickname "forever chemicals." After two PFASs were linked to health problems in the 1990s, major manufacturers—including 3M and DuPont—voluntarily replaced them with related compounds they said were safer. Since then, many communities in the United States and elsewhere have discovered PFASs in their water supplies, sparking extensive legal and political battles over cleanups.

By 2030, Maine will forbid selling products that use PFASs unless regulators determine their use is "currently unavoidable."

In the meantime, regulators and researchers have struggled to determine the risks posed by PFASs that are now in use. One challenge has been that companies are often unwilling to share information with outside scientists, notes analytical chemist Xenia Trier of the European Environment Agency, who says she could not properly measure PFASs in food packaging in Denmark because companies did not cooperate. Another challenge has been that manufacturers change the specific PFASs they use, making it difficult for scientists and regulators conducting risk assessments to keep up.

In 2013, PFAS researchers discussed such frustrations at a meeting that Trier and environmental scientist Ian Cousins of Stockholm University organized in Helsingør, Denmark. "There was a clear bubbling [of] a certain sense of urgency and concern," recalls Martin Scheringer, an environmental chemist at ETH Zurich. The discussions resulted in a document, known as the Helsingør Statement, that summarized key concerns about PFASs and research needs. It also urged that PFASs "only be used in applications where they are truly needed and proven indispensable."

That idea wasn't new. In the late 1970s, the U.S. government pioneered the essential-use approach in restricting chemicals that harm Earth's protective ozone layer. It allowed the use of ozone-destroying chemicals that were important for health and safety—such as propellants in asthma inhalers—but banned uses in products such as hairsprays. Several international pacts to control pollutants adopted similar ideas.

After the Helsingør meeting, Trier, Cousins, and their collaborators fine-tuned their ideas about how to apply the essential-use concept to PFASs and, in 2017, founded the Global PFAS Science Panel to focus on the issue. "We kind of had this mission that we wanted to phase [PFASs] out of society," Cousins says. In May 2019, Cousins and other scientists provided examples of how the policy might work in Environmental Science: Processes & Impacts. They noted, for example, that using PFASs to make highly water- and oil-repellant surgical gowns and firefighting gear could be considered an essential use, but using the compounds in rain jackets or surfing gear would not.

The idea has made some headway. In October 2020, the European Union announced a Chemicals Strategy for Sustainability, which includes a proposal to ban PFASs except for essential uses. In China, a January update to a key chemical law asks manufacturers to explain why use of a hazardous substance is necessary.

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The new Maine law, however, is one of the strongest embraces yet of essential use. In 2019, officials discovered PFAS pollution is widespread in the state, even though the chemicals are not manufactured there. Legislators wanted "an approach to PFASs that gets to the root of the problem," says Patrick MacRoy of the nonprofit Defend Our Health, which helped shape the law. "That was a very deliberate decision."

Maine and other governments that adopt essential-use policies are likely to face fierce disputes over which chemicals should be included in the PFAS family—and which uses will be defined as essential. PFAS manufacturers, for example, want large molecules known as fluoropolymers excluded, arguing they should not affect health because the molecules are too big to be absorbed by humans and other animals. (Some scientists, however, point out that manufacturing fluoropolymers often involves smaller PFASs, and historically PFAS pollution originated at facilities that made fluoropolymers.)

Even as these debates heat up, some companies are removing PFASs from their products. An Oregon-based company, KEEN Footwear, recently eliminated PFASs from shoes. Large cosmetics brands, such as Sephora, have pledged to follow suit.

In the meantime, researchers pushing the essential-use concept are thrilled by the recent policy developments. Cousins, for example, is "superexcited" about the Maine law. "I just hope it holds."

science.org, 27 August 2021

https://www.sciencemag.org

Amazing Hubble telescope photo shows space 'sword' piercing huge celestial 'heart'

2021-09-01

A flaming blue sword seems to pierce a giant cosmic heart in a gorgeous new photo captured by the Hubble Space Telescope.

The "sword" is composed of twin jets of superheated, ionized gas that are rocketing into space from opposite poles of a newborn star called IRAS 05491+0247. The "heart" is the cloud of leftover dust and gas surrounding the protostar, according to Hubble team members.

This dramatic interaction between jets and cloud creates an uncommon celestial sight known as a Herbig-Haro object. The one photographed here

This dramatic interaction between jets and cloud creates an uncommon celestial sight known as a Herbig-Haro object

by Hubble is named HH111, and it lies about 1,300 light-years from Earth, in the constellation Orion.PLAY SOUND

Hubble captured the image using its Wide Field Camera 3 (WFC3) instrument, which observes in both optical and infrared (heat) wavelengths of light.

"Herbig-Haro objects actually release a lot of light at optical wavelengths, but they are difficult to observe because their surrounding dust and gas absorb much of the visible light," European Space Agency (ESA) officials wrote in a description of the image, which was released Monday (Aug. 30).

"Therefore, the WFC3's ability to observe at infrared wavelengths — where observations are not as affected by gas and dust — is crucial to observing [Herbig]-Haro objects successfully," they added.

Hubble, a joint mission of NASA and ESA, launched to low Earth orbit aboard the space shuttle Discovery in April 1990. The first images the iconic observatory captured were fuzzy, a problem that team members soon determined was caused by a flaw in Hubble's 7.9-foot-wide (2.4 meters) primary mirror.

Spacewalking astronauts fixed that issue in December 1993, and Hubble was further upgraded and maintained over the course of four more servicing missions. The WFC3 instrument was installed during the last of these Hubble-bound space shuttle flights, which took place in May 2009.

Hubble continues to provide amazing views of the cosmos, but it has begun to show its age, and, without the shuttle, astronauts can no longer feasibly access the observatory. (It's technically possible that a crewed vehicle such as SpaceX's Crew Dragon capsule could reach Hubble, but that idea apparently has not been seriously investigated.) The telescope has overcome a number of glitches recently, including a computer problem that closed its supersharp eye for more than a month this summer.

livescience.com, 1 September 2021

https://www.livescience.com

Inflammation gene may be possible drug target for endometriosis

2021-08-25

Researchers have discovered a potential new way to fight endometriosis—a prevalent, mysterious, and hard-to-treat disease that causes pain and infertility in women. The approach—which came to light after more than 2 decades of intensive genetic research—blocks a particular gene, reducing discomfort and inflammation, at least in mice.

"It's a really magnificent piece of sleuthing," says Linda Griffith, a biological engineer who studies endometriosis at the Massachusetts Institute of Technology. However, she cautions that because the condition is complex, the theoretical treatment will probably relieve symptoms in only a subset of patients. "It pulls together so many pieces of the puzzle, but it's not the final piece."

Endometriosis affects an estimated one in 10 women. In the disease, tissue that lines the inside of the uterus—and is shed each menstrual cycle—also grows outside the uterus. The condition causes severe pain, especially during periods, when the rogue lining attempts to shed, creating scar tissue that can essentially glue internal organs together. Only invasive surgery can remove this scarring.

Hormonal treatments such as estrogen suppressors can alter or disrupt the menstrual cycle, but finding the right one can involve months of trial and error. Hormones can also cause a range of side effects, including weight gain, mood changes, and headaches. For some people, these treatments don't help at all.

The new study is a "labor of love" building on research stretching back to the 1990s, says team leader Krina Zondervan, an endometriosis researcher at the University of Oxford. At the time, scientists knew genetics explained some of the risk of getting endometriosis, but they didn't know which genes were responsible. Then, studies tracking families with multiple cases of endometriosis helped researchers zero in on a particular region of chromosome 7.

However, there are hundreds of genes in that region, Zondervan says. Narrowing the stretch of the chromosome down to a single gene took years of detective work. First, her team sequenced the DNA of women in 32 families in which three or more women had been diagnosed with endometriosis, focusing on that specific chromosome region. The group found that many of the women with more severe cases had variants

"It's a really magnificent piece of sleuthing," says Linda Griffith, a biological engineer who studies endometriosis at the Massachusetts Institute of Technology.

of a gene called NPSR1. This gene had not previously been linked to endometriosis, but it has been tied to other inflammatory diseases such as asthma and rheumatoid arthritis.

Zondervan and her colleagues then turned to rhesus macaques, monkeys that also develop endometriosis. When the researchers sequenced the DNA of a group of 850 animals in which 135 had the disease, they saw the same variants. A similar search in more than 3000 endometriosis patients and roughly 7000 people who do not have the disease further confirmed the results, the researchers report in Science Translational Medicine today.

The next step was to try to prevent the gene from turning on. In mice, the researchers blocked the protein that NPSR1 encodes by injecting a solution containing a molecule called SHA 68R, which is known to inhibit the gene's expression. Mice don't menstruate, but researchers could simulate the pain and inflammation of endometriosis by injecting little pieces of bacteria or uterine lining into their abdomens. The rodents that received SHA 68R experienced less inflammation and abdominal pain. (Mice experiencing abdominal pain shift their weight toward their front paws to compensate, and researchers can measure that weight shift.)

"This was a heroic effort," says Stacy McAllister, an endometriosis researcher at Emory University who was not involved in the study. However, she'd like to see more evidence that targeting NPSR1 would help with chronic pain rather than only alleviating pain in the short term.

A complicating factor is that not every endometriosis patient had an NPSR1 variant, the researchers found. "That's why this disease is so darn hard to make progress on," Griffith says. "Endometriosis very likely isn't one disease." Studies like this help researchers understand the complex disease and how to treat it, she says.

The researchers next want to target the gene in monkeys to see whether it has the same benefits. "It's been a big project and a long effort," says Thomas Tapmeier, an endometriosis researcher at Monash University and lead author of the study. "This is just the end of the beginning."

science.org, 25 August 2021

https://www.science.org

"This is the first time we have the full skull and the full [body]," says Victor Beccari, a paleontologist at the NOVA School of Science & Technology in Caparica, Portugal.

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This big-headed pterosaur may have preferred walking over flying

2021-08-25

In 2013, a police raid at Santos Harbor in Brazil recovered about 30,000 smuggled fossils, including the most intact specimen of a type of big-headed pterosaur ever found. A new analysis of the fossil provides insight into the flying reptile's foraging style, flight capability and anatomy, researchers report August 25 in PLOS ONE.

Identified as Tupandactylus navigans, the fossil is a member of a group of pterosaurs called tapejarids. These pterosaurs are known for their oversize, crested skulls, and hail from the early Cretaceous Period, which lasted from about 145 million to 100 million years ago.

Some well-preserved tapejarid fossils have been found in China, but they aren't as complete as the newly analyzed fossil, and the pterosaur's anatomy hadn't been fully described. "This is the first time we have the full skull and the full [body]," says Victor Beccari, a paleontologist at the NOVA School of Science & Technology in Caparica, Portugal.

When Beccari's team received the fossil in 2016, it had already been cut into six blocks. "It's a shame," Beccari says, "but we used it to our advantage." The researchers fit the sliced pieces inside a CT scanner, and then used the scans to produce a 3-D model of the pterosaur's skeleton that revealed parts still buried inside rock.

Previous studies suggested that tapejarids had a short, stout neck to support their large head during flight. But Beccari's team showed that the neck accounted for over half of the spine's length, which could have made sustained flight difficult. The fossil's long hind legs and relatively short arms hint that tapejarids could have been comfortable walking.

These observations suggest that T. navigans may have behaved similarly to peacocks, Beccari says. The tapejarid's crest probably attracted mates, and the pterosaur may have flown to treetops to look for food or escape from predators, he says. "But it spent most of its time walking on the ground."

sciencenews.org, 25 August 2021

https://www.sciencenews.org

"It didn't look nice to me – the coloured bits of plastic all along the shore," he says.

How to fight microplastic pollution with magnets

2021-08-26

As a child, Fionn Ferreira spent hours exploring the coastline near his hometown of Ballydehob in south-west Ireland. But the more time he spent on the sheltered, shingle-strewn coves nearby, he grew increasingly shocked by the large amounts of plastic litter he found strewn across the beach and in the sea.

"It didn't look nice to me – the coloured bits of plastic all along the shore," he says.

Around the world, humans produce an estimated 300 million tonnes of plastic waste every year, and at least 10 million tonnes end up in our oceans – the equivalent of a rubbish truck load every minute.

But it was the plastic that Ferreira couldn't see which really concerned him. Microplastics are fragments smaller than five millimetres and either come directly from the products we use or are created as larger plastic objects break down in the environment. They are ubiquitous – they have been found at the bottom of the world's deepest ocean trench and lodged in Arctic sea ice.

"I got really anxious when I found out about microplastics," says Ferreira, who is now aged 20 and a chemistry student at Groningen University in the Netherlands. "These plastics are going to be in our environment for thousands of years. We are going to be dealing with them long after we stop using plastic."

As he learned more about the environmental impact of microplastics in the environment, Ferreira began to look for ways to combat them. And it was a serendipitous discovery on his local beach that gave him the idea for a new way to remove these tiny, omnipresent plastics from the oceans.

Microplastics are found in our clothes, cosmetics and cleaning products. One load of laundry can release an average of 700,000 microplastic fibres. Less than a millimetre in length, these fibres make their way into rivers and oceans, where they are eaten by fish and even corals. Because of their tiny size, microplastics are able to pass through filtration systems, making it very difficult to avoid them.

One 2018 study, plastic contamination can also be found in bottled water, with 93% of 259 bottled water samples the scientists examined containing microplastics.

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According to recent research, we constantly inhale and ingest microplastics during our daily lives. One study in 2019 by researchers at the University of Newcastle found that globally people ingest an average of 5g of plastic every week – the equivalent of a credit card. The impact that this diet of microplastics has on our health, however, is still poorly understood.

Chemicals used in plastic have, however, been linked to a range of health problems including cancer, heart disease and poor foetal development. Studies have found that human exposure to microplastics could cause oxidative stress, inflammation and respiratory problems.

"The urgency of the plastic problem has not yet hit people," says Ferreira. "Plastic pollution is a public health issue. You are not just drinking the plastic, but also the chemicals that are added to it. Plastic attracts heavy metals and brings these into our system."

Another concern is that plastics could help transport pathogens which bind themselves to the material. A 2016 study found the pathogen Vibrio cholerae, which causes cholera in humans, attached to microplastics sampled from the North and Baltic Seas.

"It is not just a problem of the health of our environment, but really a problem that concerns all of us and our health," says Ferreira.

And the amount of plastic in the environment is projected to get much worse. Plastic production is expected to increase by 60% by 2030 and triple by 2050. By then, there could be more plastic than fish in the ocean, according to the Ellen MacArthur Foundation, a UK non-profit that promotes the circular economy where materials are reused rather than thrown away.

At the age of 12 years old, Ferreira became determined to find a solution to remove microplastics from water. He started by designing his own spectrometer, a scientific instrument that uses ultraviolet light to measure the density of microplastics in solutions.

"I could see there were a lot of microplastics in the water and they weren't just coming from big plastic breaking down in the sea," he says. "There needed to be a way to combat this."

It was on his local beach that Ferreira came up with a solution that could extract microplastics from water. "I found some oil spill residue with loads of plastic attached to it," he says. "I realised that oil could be used to attract plastic."

Ferreira mixed vegetable oil with iron oxide powder to create a magnetic liquid, also known as ferrofluid. He then blended in microplastics from a wide range of everyday items, including plastic bottles, paint and car tyres, and water from the washing machine.

After the microplastics attached themselves to the ferrofluid, Ferreira used a magnet to remove the solution and leave behind only water.

Following 5,000 tests, Ferreira's method was 87% effective at extracting microplastics from water.

Ferreira is currently in the process of designing a device which uses the magnetic extraction method to capture microplastics as water flows past it. The device will be small enough to fit inside waterpipes to continuously extract plastic fragments as water flows through them. He has also been working on a system that could be fitted to ships so they can extract plastics on the oceans.

"There is no current effective solution to remove microplastics in natural waterways," says Anne-Marieke Eveleens, who created another device known as the Bubble Barrier, a tube device that can be installed on canals and rivers to trap larger plastic waste with a stream of bubbles that guides it to a catchment area, preventing it from entering the ocean. "Our Bubble Barrier is very effective at catching macroplastics and can catch microparticles of plastic as small as 1 mm. Fionn's innovation has the capacity to remove all types of microplastics."

In 2019, Ferreira presented his invention to a panel of expert judges at the Google Science Fair, which led to him winning the competition and receiving an educational scholarship of $50,000 (£36,400).

"He observed and tackled a problem he saw locally which has vast global significance," says Larissa Kelly, Ferreira's former science teacher at Schull Community College and his mentor for the Google Science Fair entry. "His invention, based on very simple components, is groundbreaking. It has powerful potential to provide solutions that will contribute to the worldwide effort to remove microplastics from the environment."

"I started out as a lonely inventor," says Ferreira. "After the Google Science Fair, I could all of a sudden speak to scientists – they gave me credit for what I had done. My idea was no longer a toy invented by a child."

After receiving funding from the Footprint Coalition, which was founded by actor Robert Downey Jr, Ferreira started scaling up the technology so it

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could be used at wastewater treatment facilities and prevent microplastics from escaping into the ocean.

He is currently working with US company Stress Engineering to fine-tune his invention and design a device out of stainless steel, glass or recycled plastic. "We're trying to make something where we are not creating more plastic pollution," he says.

The technology is "very quick, cheap and low energy," he says, adding that it can easily be integrated into existing facilities and is able to handle normal flow rates of water.

Ferreira is also developing a consumer-focused device which can be installed inside pipes in homes, cleaning the water as it enters and leaves the house. The aim is to provide people with water that is both safe to drink and sustainable.

"I don't want to be drinking plastic every day," he says. "By building this device in our homes, we are not only protecting our health, but also raising awareness."

He is testing the devices in different water bodies around the world and hopes to commercialise both within the next two years.

But Ferreira says he has encountered scepticism throughout his journey as a young inventor and hopes that inventions such as his will help change that attitude. And as his generation inherits problems created by those that came before them, the world is likely to need more imaginative solutions.

"A lot of people don't trust young inventors," he says. "That needs to change. Youth have the power to come up with new creative ideas, they aren't trained to look down just one tunnel."

bb.com, 26 August 2021

https://www.bbccom

Fully recyclable paper cups? They exist, but you won't find them at Starbucks

2021-08-26

When you order your Venti-sized espresso macchiato at Starbucks, it will arrive in what looks and feels like a cardboard cup topped with a plastic lid. After you finish your drink, you might think about dumping your cup

Starbucks cups are actually lined with polyethylene plastic coating that makes it nearly impossible to recycle, experts say.

into a paper recycling bin. But you shouldn't. Starbucks cups are actually lined with polyethylene plastic coating that makes it nearly impossible to recycle, experts say.

"Paper recycling is designed for recycling paper — not plastic," Will Lorenzi, president of packaging engineering company Smart Planet Technologies, told Mongabay in an interview. "There's a whole variety of products that have plastic coatings on it … and when those products hit the pulper [in a recycling plant] they block it up. It's almost like a storm drain. If there's a few leaves, a branch maybe, the storm drain is going to be fine. But if you get too many leaves and too many branches, all of a sudden the whole drain clogs up."

It's estimated that 1.6 million trees are logged each year to produce Starbucks cups, and that 4 million of these cups end up in landfills, according to Stand.Earth, a group that started

in 2016. Starbucks itself actually pledged to create a fully recyclable paper cup back in 2008, but nothing resulted from this commitment.

"So many people have confessed to us that they feel at least a little bit guilty about ordering a single-use coffee in a paper cup that came from critical forests," Jim Ace, a senior campaigner and actions manager at Stand.Earth, told Mongabay in an email. "Many feel even worse when they learn it's lined with polyethylene plastic, whether they are concerned for their own health or the health of the planet. Most consumers don't realize Starbucks cups have been uneconomical to recycle, in part because they are lined with plastic, so they've ended up in landfills."

According to a recent survey conducted in the U.S. by the SEAL Awards, which recognizes companies for their sustainability and environmental leadership, 83% of Starbucks customers actually believe that Starbucks cups can be recycled.

"At heart, the cup problem is a moral and leadership issue," Matt Harney, founder of SEAL, said in a statement. "Like the 83% of consumers we surveyed, I recently thought that paper cups were, in fact, recyclable."

Stand.Earth ended its campaign in 2019 when Starbucks partnered with other industry giants to support the NextGen Cup Challenge, which called on innovators to create a recyclable and compostable cup. Twelve winners were chosen, but two years later, the problem has still not been solved.

"Starbucks committed itself to solving its cup problem and have taken steps to develop solutions, but the majority of its customers still leave the

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store with single-use, disposable paper cups that are lined with plastic, which end up in the landfill," Ace said. "Until that is solved, Starbucks still has a responsibility to address the problem."

A commercially viable solution is already here, Lorenzi said. In 2016, his company, Smart Planet Technologies, developed EarthCoating, a film for paperboard barrier packaging that uses 40-51% less plastic than conventional plastic coating barriers.

"We came up with something that would basically be recyclable, and at the same time, work just as well as the current packaging we have," Lorenzi said. The coating uses a special mix of minerals and resin so that the coating can easily be separated from the cardboard during the recycling process, and sink to the bottom of the pulper along with dirt and other residue, he added.

Several big companies, including United Airlines and Taco Bell in Australia, already use recyclable products with EarthCoating, Lorenzi said. Yet Starbucks has not adopted this technology, despite Smart Planet Technologies reaching out to Starbucks on several occasions.

"They pretend we don't exist," Lorenzi said. "They pretend it's not happening. They continue to do their own thing."

On Starbucks' website, the company pledges to "double the recycled content, recyclability and compostability, and reusability" of its cups and packaging by 2022.

Yet Lorenzi said he is not convinced this is a definitive goal. "It's about the fifth date they set," he said. "They started in 2008 — they were going to do it by 2012. And in 2010, they said they'd do it by 2015. In 2015, they said they'd do it by 2020. They're now with the next one, which is 2022."

Starbucks did not respond to Mongabay's request for comment.

This month, the SEAL Awards Impact Team launched a campaign called #UpTheCup to call on Starbucks to truly adopt a recyclable cup. An accompanying petition has already garnered more than 60,000 signatures.

"In reality, as a society, we entrust leaders to make decisions — like the type of cup used — in a truly responsible way, even if that issue has gone

undetected by the general public," Harney said. "To quote C.S. Lewis, 'Integrity is doing the right thing, even when no one is watching.'"

news.mongabay.com, 26 August 2021

https://www.news.mongabay.com

EPA: Bee-killing pesticide harms most endangered species

2021-08-27

Most endangered species are likely to be harmed by three pesticides already known to impair bees, EPA said.

In a draft biological evaluation of three so-called neonicotinoids used on a wide variety of crops, the environmental agency said hundreds of plants and animals are likely to be adversely affected by exposure. The conclusion doesn't necessarily mean EPA is headed toward new restrictions but informs decisions by other agencies about which species might be in enough jeopardy to warrant such measures.

The pesticides in question are imidacloprid, thiamethoxam and clothianidin. Growers use them on crops ranging from potatoes to orchard fruit to leafy vegetables.

Imidacloprid, for instance, is one of the most widely used pesticides in the U.S., with farmers applying 891,400 pounds on orchard fruit, cereal grains and other crops from 2014 to 2018, EPA said. It also poses one of the more potent threats to wildlife, likely to have adverse effects on 1,444 species, or 79% of those considered in the EPA review.

Imidacloprid is also likely to adversely affect 83% of critical habitats, EPA said.

EPA scientists reached similar results for the other two neonicotinoids examined. The agency's review is part of the regular registration review EPA conducts for pesticides and herbicides under the Federal Insecticide, Fungicide and Rodenticide Act.

The "likely to adversely affect" determination doesn't necessarily mean a farm chemical puts a species in jeopardy. And because effects on even one animal can trigger such a finding, the agency said, the LAA determinations can be misleadingly high.

The pesticides in question are imidacloprid, thiamethoxam and clothianidin.

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EPA has endorsed continued use of neonicotinoids, proposing or adding various label restrictions to limit exposure to pollinators (E&E News PM, Jan. 30, 2020).

Still, the Center for Biological Diversity, an environmental group critical of widespread pesticide use, said the report bolsters its argument for the federal government to ban neonicotinoids. All 38 of the nation's endangered amphibians were found likely to be harmed, the group said.

"Now the EPA can't ignore the fact that these popular insecticides are wiping out our country's most endangered plants and animals," said Lori Ann Burd, the CBD's environmental health director. "Neonicotinoids are used so widely, and in such large quantities, that even the EPA's industry-friendly pesticide office had to conclude that few endangered species can escape their toxic effects."

"The EPA doesn't need any more proof. It should ban neonicotinoids right now," Burd said.

Other Biden admin actions on pesticides

The Biden administration has already shown a willingness to bypass some of the usual regulatory framework to scale back pesticides deemed dangerous to human health. Last week, EPA said it would essentially end the use of the insecticide chlorpyrifos on food crops due to concerns about brain damage in children exposed to residue (Greenwire, Aug. 18).

That decision was prompted by a court ruling that EPA had ignored compelling evidence about the pesticide's risks to workers and children, although the Obama administration previously had moved toward banning it. EPA said it would issue a new regulation for chlorpyrifos without taking public comment.

Farm groups and pesticide manufacturers say they worry that EPA may sidestep some of the regulatory hurdles that typically surround pesticides. The chlorpyrifos decision seemed to abandon scientific analysis as the top priority, said Chris Novak, president of CropLife America, a trade group for pesticide manufacturers.

President Biden last year adopted the "mantra of science over fiction," Novak said, adding that the agency's science advisory panel hadn't reached such a conclusion.

The American Farm Bureau Federation expressed concern, too, about EPA abandoning its usual process to put new restrictions on farm chemicals.

In addition to the neonicotinoids, cousins of chlorpyrifos called organophosphates are all on the target list for environmental groups. Used since the middle of the last century, they pose similar risks to chlorpyrifos, said Miriam Rotkin-Ellman, a senior scientist in the health and environment program at the Natural Resources Defense Council.

"These are the old clunkers," Rotman-Ellman said.

"The science around the whole class is the same," she added. "We want to see them out of contact with kids."

Farm groups say growers have limited alternatives against insects, some of which may have expanded ranges with the warming climate, and against weeds like Palmer amaranth, which have become tolerant of chemical herbicides. In California — where state officials already banned chlorpyrifos — growers' choices to treat cotton are especially limited, Novak said.

CropLife likens pesticide use to a farmer who wants to fix a broken implement and needs more than just a hammer from the toolbox, Novak said. "Our job is to continue to advocate for those chemistries," he said.

Alternatives include the range of organophosphates and neonicotinoids, as well as biopesticides that have a shorter regulatory path, Novak said.

A total of 14 organophosphates are used in the U.S. totaling more than 16 million pounds a year, according to the environmental group Earthjustice. Foods such as snap peas, frozen spinach, basil and cilantro have shown relatively high residues, the group said, citing Department of Agriculture data from 2018 and 2019.

Farmers looking for alternatives can consider switching to organic production, Rotkin-Ellman said. Crops being treated with chlorpyrifos can all be grown organically, she said.

eenews.net, 27 August 2021

https://www.eenews.net

An incredibly resilient coral in the Great Barrier Reef offers hope for the future

2021-08-27

A coral the size of a carousel is the widest known in the Great Barrier Reef.

…this reef-building Porites measures 10.4 meters in diameter — earning it the nick-name Muga dhambi, or "big coral,"…

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Found just off the coast of Goolboodi Island in Northeast Australia, this reef-building Porites measures 10.4 meters in diameter — earning it the nickname Muga dhambi, or "big coral," from the Indigenous custodians of the island, the Manbarra people.

In addition to its record-setting width, Muga dhambi stands a little over 5 meters tall, making it the sixth tallest coral in the Great Barrier Reef, researchers report August 19 in Scientific Reports.

"It's a stand-alone coral … and we don't see many that size," says marine scientist Nathan Cook of Reef Ecologic, a climate and environmental consulting firm in Townsville, Australia.

Based on Muga dhambi's height and estimated growth rate, Cook and colleagues calculate that the creamy brown, boulderlike coral is about 421 to 438 years old. It predates European colonization of Australia and has survived as many as 80 cyclones (SN: 5/28/20) and 99 coral bleaching events (SN: 7/4/21), the team says.

Many of the recent stories about corals in the Great Barrier Reef read like obituaries, Cook says. "Knowing that these things [like Muga dhambi] exist, and have persisted for a long time, helps to provide a renewed sense of hope for the future."

sciencenews.org, 27 August 2021

https://www.sciencenews.org

See Hurricane Ida from 1 million miles away in this NOAA satellite view

2021-09-01

When Hurricane Ida slammed into Louisiana as huge Category 4 storm on Sunday (Aug. 29), the tempest's sheer size was evident from nearly a million miles away.

A new photo from NASA's Epic camera on the NOAA Deep Space Climate Observatory (DSCOVR) shows Hurricane Ida as it appeared from Lagrange point 1, a a point between the sun and Earth that's about 1 million miles (1.5 million kilometers) from our planet, just as it hit the U.S. Gulf Coast.

"From about 1 million miles away, NASA's EPIC camera on NOAA's Deep Space Climate Observatory saw Hurricane Ida as it was approaching landfall in Louisiana yesterday," NOAA officials wrote in a Twitter update Monday (Aug. 30).

It made landfall in the state 16 years to the day of the devastating Hurricane Katrina in 2005.

PLAY SOUND

Hurricane Ida made landfall near Port Fourchon, Louisiana as a terrifying Category 4 hurricane, with wind speeds of up to 150 mph (240 kph) and torrential rain. It made landfall in the state 16 years to the day of the devastating Hurricane Katrina in 2005. The storm knocked out power an estimated 1 million customers and at least two deaths have been attributed to the storm, according to the New York Times. Ida was also expected to cause flooding from storm surge and wind damage.

By 4 p.m. EDT (20:00 GMT) Monday, Ida was downgraded to a tropical depression located about 20 miles (35 km) north-northwest Jackson, Mississippi and dropping heavy rainfall across parts of southeast Louisiana, Mississippi and western Alabama, according to the National Hurricane Center.

Two NASA centers, the Michoud Assembly Facility in New Orleans and Stennis Space Center in Mississippi were placed on emergency lockdown during the storm, with only essential personnel on hand to ride out the hurricane.

"Initial assessments from the rideout crew at NASA's Michoud Assembly Facility report all personnel onsite are accounted for and there are no injuries. Michoud remains closed and is operating on generator power," Michoud officials wrote in an update this morning. "There is no significant flooding at the facility. At this time, no damage to flight hardware has been observed and NASA personnel will be conducting detailed damage assessments today."

NASA's Michoud Assembly Facility is the manufacturing hub for the space agency's new Space Launch System megarocket designed to launch astronauts to the moon as part the Artemis program.

livescience.com, 1 September 2021

https://www.livescience.com

Flu season will be bad this year, research predicts

2021-09-01

Flu activity has been virtually nonexistent during the COVID-19 pandemic, but that could change soon: Two new studies predict that the flu will come roaring back this fall and winter.

One study predicted that there could be 100,000 to 400,000 more flu hospitalizations in the 2021-2022 flu season compared with a typical season.

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One study predicted that there could be 100,000 to 400,000 more flu hospitalizations in the 2021-2022 flu season compared with a typical season.

The findings, posted this week to the preprint database medrXiv and not yet peer-reviewed, underscore the importance of flu shots this year — both studies suggested that a bad flu season could be avoided if flu vaccination rates increased by 20% to 50% compared with a typical year. "Vaccinating as many people against flu as possible will be key to avoiding this scenario," Dr. Mark Roberts, director of the Public Health Dynamics Laboratory at the University of Pittsburgh Graduate School of Public Health, and senior author of both studies, said in a statement.

Last year had historically low levels of flu activity, likely due to measures for preventing COVID-19, such as social distancing, school closures, mask wearing and reduced travel. During the 2020-2021 flu season, the overall flu hospitalization rate in the U.S. was only about 4 hospitalizations per 100,000 people; compared with the usual rate of 70 hospitalizations per 100,000 people. Flu-related deaths dropped by 95%, the researchers said.

This means that the U.S. population "missed the opportunity to establish or boost their immunity [to the flu] for the future influenza season," which raises the concern that the flu could make a comeback when preventive measures for COVID-19 are lifted, the researchers said. They note that the U.S. is already seeing a rise in cases of other respiratory infections, such as respiratory syncytial virus (RSV), "which does not bode well for the coming flu season," Roberts said.

In one of the new studies, led by Kyueun Lee, a postdoctoral researcher at Pitt Public Health, the researchers used a mathematical model called the Susceptible-Exposed-Infected-Recovered (SEIR) model. They simulated influenza epidemics, and levels of population immunity to flu, over multiple seasons, using data from 2009 through 2020.

They predicted that, with the low flu activity seen in the 2020-2021 season, flu hospitalizations would surge to 610,000 in 2021-2022, which is 102,000 more hospitalizations that would be expected to occur if the 2020-2021 season had seen normal levels of flu activity. In a worst-case scenario with a highly transmissible flu strain and low levels of flu vaccination, the model predicted there would be 409,000 more hospitalizations than expected (or more than 900,000 hospitalizations overall.)

But the study found that the predicted increase in flu hospitalizations could be avoided if the percentage of Americans vaccinated against flu increased from the typical 50% to 75%.

The second study, led by Mary Krauland, who studies mathematical modeling at Pitt Public Health, used a different model, called the Framework for Reconstructing Epidemiologic Dynamics, to simulate flu cases and hospitalizations over two sequential flu seasons, and found similar results. The findings suggested that the 2021-2022 flu season could see a 20% increase in flu cases compared with a typical season. Young children (younger than age two) would be particularly at risk for flu in the 2021-2022 season because they are unlikely to have any previous exposure to the disease, the authors said.

But increasing flu vaccination rates by just 10% could reduce hospitalizations by 6% to 46%, depending on the transmissibility of the flu this season, the study found.

"The 'twindemic' — a coinciding flu and COVID-19 epidemic — overwhelming our hospitals was thankfully avoided last year. But that does not mean it is no longer possible," Roberts said. "If anything, our models show that we should be more concerned this year about the possibility of a surge in COVID-19 hitting at the same time as a massive flu outbreak in areas of the country with low vaccination rates against both diseases."

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One-third of Sun-like stars may have eaten their planets

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Like the Greek god Chronos, a good number of stars devour their children. As many as one-third of them have swallowed one or more of their own planets, a new study suggests. The findings could help astronomers rule out stellar systems unlikely to contain Earth-like worlds.

"This will probably end up being one of the classic papers on this subject," says Eric Mamajek, an astronomer at NASA's Jet Propulsion Laboratory who was not involved in the work.

Researchers have known for decades that stars could, on occasion, engulf their progeny. Rocky planets are rich in heavy elements such as

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iron, silicon, and titanium, whereas stars contain mostly lighter material like hydrogen, helium, oxygen, and carbon. When a planet is swallowed, its heavy elements spread out in the star's outer layers, leaving telltale absorption signatures in its light.

"If a star is anomalously rich in iron but not in other elements such as carbon and oxygen, this can be interpreted as a signature of planetary engulfment," says Lorenzo Spina, an astrophysicist at the Astronomical Observatory of Padua who led the study.

He and his colleagues investigated how often this happens by looking at 107 binary systems containing two Sun-like stars—akin to the fictional two-sunned world Tatooine in Star Wars. Binary stars are born from the same cloud of gas and dust, so their chemical compositions should be nearly identical. The team also chose partners that were extremely close in mass and temperature to one another—essentially twins.

In 33 of these pairs, one of the companions showed elevated levels of iron compared with the other, a sign of planetary cannibalism. These same partners were also rich in lithium, giving further credence to the world-munching hypothesis. Although Sun-like stars are born with substantial amounts of lithium, they burn it away within the first 100 million years of their lives, so seeing it in the older stars in the study sample indicated it likely came from a planet.

The team also found that abnormal chemical signatures showed up more often in the hottest stars. That makes sense, Spina says, because hot stars have thin outer layers—and a planet's material would be concentrated in a smaller volume, leaving a starker signature.

Using these different lines of evidence, the team was able to model that between 20% and 35% of Sun-like stars consume a few Earths' worth of their offspring. Such events could happen in systems where gravitational interactions among the planets would either fling one into the central star or bring it close enough for the star to slowly vaporize and devour it. The results appear today in Nature Astronomy.

"This is clearly a strong trend," Mamajek says. Planetary ingestion has been studied before, he says, but the new paper provides a much larger sample size and clear statistical evidence for the phenomenon.

Spina thinks it is unlikely our Sun ever swallowed any planets, because it's depleted in heavy elements compared with others in its class. Though that fact could help astronomers find Earth 2.0: If they spot an alien sun that

The theory could explain why dark matter came to dominate the universe.

appears to have eaten its offspring, they'll probably want to point their telescopes elsewhere.

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Is dark matter made of 'Fermi balls' forged in the Big Bang?

2021-09-01

Dark matter — the mysterious substance that exerts gravity but doesn't interact with light — might be made of tiny black holes permeating the universe. And according to a new theory, those black holes might have been made from Fermi balls, or quantum "bags" of subatomic particles known as fermions that got smooshed together in dense pockets during the universe's infancy.

The theory could explain why dark matter came to dominate the universe.

"We find that in some cases, the Fermi balls are so dense that the fermions are too close to each other, triggering the collapse of a Fermi ball [in]to a black hole," Ke-Pan Xie, a researcher at the Center for Theoretical Physics at Seoul National University in South Korea, told Live Science.

Xie and collaborator Kiyoharu Kawana, also of the Center for Theoretical Physics, have devised a new scenario to explain how dark matter came to dominate the universe: In the midst of an incredible transformation when the cosmos was less than a second old, a new kind of particle got trapped, collapsing to such a small point that they transformed into black holes. Those black holes then flooded the universe, providing the heft required to explain dark matter.PLAY SOUND

The case for primordial black holes

Astronomers and physicists cannot explain dark matter, the mysterious substance that makes up more than 80% of the mass of every large structure, from galaxies to the cosmic web itself, in the universe.

One intriguing possibility is that dark matter originated from black holes. After all, black holes, like dark matter, emit no light. "As a kind of nonluminous and compact object, black holes are a natural explanation for the dark matter," Xie said.

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But astronomers have known for a long time that normal, stellar-mass black holes can't explain the universe's dark matter. That's because not nearly enough stars have formed in the history of the universe to create enough black holes to account for the known dark matter.

But the earliest moments of the universe featured some pretty mind-boggling physics. Perhaps whatever was going on back then spawned trillions of smaller black holes. Those black holes could persist to the present day, potentially solving the dark matter riddle.

But to explain dark matter, the theory would have to make enough black holes.

A frothy universe

Xie and Kawana added several ingredients to their model, which is described in a paper published in June to the preprint database arXiv. (The paper has not yet been peer-reviewed.) They started with a very young, very hot, very dense universe. These extreme conditions allow some physical processes that do not happen in the normal conditions of the present-day universe.

The first ingredient is something called a scalar field, which is a quantum mechanical entity that encompasses all of space. (The well-known Higgs field, which gives matter its mass, is an example of one.) As the universe expanded and cooled, that scalar field underwent a phase transition, transforming from one quantum mechanical state to another.

That phase transition didn't happen all at once throughout the entire universe. Instead, there were a few points where the transition began from and then spread — just as a few bubbles in a pot of boiling water merge to form bigger bubbles, Xie said.

"This process is called a first-order phase transition: Water transfers from 'liquid phase' into 'gas phase,' and the latter first exists as growing bubbles," Xie said.

The new scalar field state, called the "ground state," spreads out from these points like a bunch of fizzing bubbles. Eventually, the bubbles merge completely, and the scalar field finishes its transition.

How to make a Fermi ball

To make primordial black holes that seed dark matter, however, Xie and Kawana needed another ingredient. So they added a new kind of fermion to their model. Fermions are a category of particles that make up the

building blocks of the universe. For instance, the electrons, protons and neutrons that make up the atoms in your body are all fermions.

In the very early universe, these fermions moved freely within the scalar field. But according to the recipe that Xie and Kawana have cooked up, these fermions couldn't penetrate the little foaming bubbles of the new ground state of the cosmos as the phase transition proceeded.

As the bubbles grew, the fermions crowded into the remaining pockets, becoming Fermi balls. And that's when things went really haywire for them.

That's because there was an additional force, known as a Yukawa interaction, between the fermions, caused by that very same scalar field, Xie and Kawana proposed in the paper. Normally, fermions don't like to be crammed into small volumes together, but the scalar field added an attractive force that could overwhelm that natural repulsion, they theorized.

As an example, protons and neutrons are made of even tinier particles, called quarks. Quarks are fermions and normally hate each other, but an extra force, the strong force, glues them together. That force can be modeled as a Yukawa interaction, similar to the early-universe physics at play in Xie and Kawana's model.

Once the Yukawa attraction took hold, it was game over for the little Fermi balls, according to Xie and Kawana's theory. Wedged into little pockets of a rapidly changing universe, the clumps of fermions catastrophically collapsed, forming huge numbers of black holes.

Those black holes then survived through the end of the phase transition, going on to flood the universe as dark matter.

At least, that's the idea. It's a radical suggestion, but when it comes to the physics of the early universe — and the mystery surrounding dark matter — we need some radical suggestions, along with a healthy dose of observations, to make progress.

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