Saturday Citations: Corn sweat! Nanoplastics! Plus: Massive objects in your area are dragging spacetime

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A closed carbonized papyrus scroll from Herculaneum being scanned. Credit: EduceLab/University of Kentucky

It's the last day of August, which means that in the Northern Hemisphere, tomorrow will be 50 degrees and cloudy; conditions are expected to be hot and humid south of the equator. In science news this week, we reported on nanoplastic contamination, spacetime dragging, corn sweat and an AI technique to read ancient papyrus scrolls

nondestructively. Take your pick:

Contaminant worrisome

How much nanoplastic are you chugging? A lot, probably—nanoplastics are suspended in drinking water, food and the air, and none of us can just stop eating, drinking and breathing, except for noted superhuman Simone Biles. The ratio of plastic to human cell content will continue growing until we're all basically walking plastic golems that can only be de-animated by a sorcerer.

Researchers at the University of British Columbia were morbidly curious about the (likely) innumerable microplastic deposits in human cells and developed a portable tool to measure nanoplastics released from sources including disposable cups and water bottles. Consisting of a wireless digital microscope, a green LED light and an excitation filter, it uses fluorescent labeling to detect plastic particles from 50 nanometers to 10 microns. It connects wirelessly to a smartphone app to reveal the number of nanoplastic particles in a water sample.

In one test, they poured boiling water into a polystyrene cup, let it cool for 30 minutes and detected hundreds of millions of nanoscale plastic particles. The health effects of nanoplastics are still poorly understood but, according to scientists, are likely to be profound.

Spacetime deformable

Frame dragging is the phenomenon in which a rapidly spinning black hole twists spacetime around itself in the direction of rotation, like the skirt of a magnificent dancer. Scientists with Beijing Computational Research Center recently reported a technique to determine how fast frame dragging occurs around a rotating, massive gravitational object

like a black hole or a neutron star. To be clear, all rotating gravitational objects, including the Earth, drag spacetime around them, but the effect is too small to measure. In the case of massive objects, the effect is more apparent.

The researchers in Beijing were considering the phenomenon of atoms jumping from a lower to a higher energy level in weak gravity, caused by such things as an electron absorbing a photon or a nucleus absorbing a gamma ray, and hit on the idea that the amount of excitation depends on how fast local spacetime is spinning; therefore, measuring the changes in a set of excitations could be used to determine the speed of frame dragging.

After determining that an atom near a rotating black hole would become excited, they established mathematically that the excitation energies for atoms rotating at different speeds and at different distances from the massive object were all between zero and an upper bound for all values of the frame dragging rotational frequency. The upper bound is measurable and can be used to measure the rate of frame dragging.

Corn sweaty

Here in the U.S., we have a corn monoculture. We use corn to make everything from sweeteners and beer to biofuel, and the demand for corn is still growing, particularly in the energy industry. A phenomenon familiar to residents of corn-producing regions is "corn sweat"—the spike in summer humidity caused by corn plants cooling themselves in a process called evapotranspiration: In high heat conditions, corn plants draw water from the soil, use it for normal, biological corn-based processes and then release it into the air as vapor, which cools the plant.

This used to happen during the dog days of August, but according to the U.S. Department of Agriculture, and Nebraskans who already have pit-

stained shirts before noon, corn is getting sweatier much earlier in the summer. Experts say the phenomenon is definitely driven by climate change, and researchers are studying it to determine how climate change will affect evapotranspiration and its downstream effects in the future.

Book read

In AD 79, Mount Vesuvius erupted and buried the city Herculanium under a massive amount of ash. In the 18th century, researchers excavated a luxurious Roman villa containing preserved paintings, busts and statues, as well as the only preserved library from antiquity, housing 1,000 papyrus scrolls. Over the years, attempts to unroll the scrolls mechanically had the predictable effect of destroying them.

Recently, a Silicon Valley entrepreneur teamed up with computer scientist Brent Seales to establish a research challenge to read the text of the scrolls nondestructively using imaging techniques and artificial intelligence; over 1,000 teams have entered the contest since 2023. In February 2024, the challenge awarded the prize to the first winners, who developed an AI model that revealed parts of 15 columns from the innermost part of one of the scrolls—it's a text on ethics, likely by Philodemus.

The team scanned the carbonized scroll in a particle accelerator at high resolution. The physical structure of the scroll was analyzed and virtually flattened. Then the team trained their AI ink detection model on patterns in the papyrus itself, and visualized the writing on the scrolls. The Vesuvius Challenge organizers believe that once they've overcome a number of technical challenges, the remaining scrolls can be analyzed using a refined version of this approach.