



Tutorial



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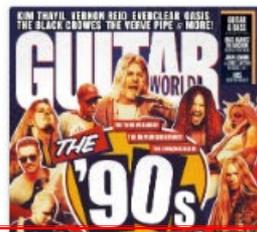
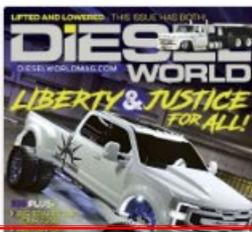
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Keyword



Science news



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Searching for your favorite magazines is easy. Simply enter your search terms in the **Search box** and click **Search**. Search terms can be a specific magazine title or a subject of interest.

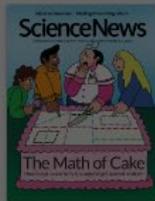
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Keyword

Science news

Results: 37

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Science News

Issue: Sep 9, 2023

Bi-weekly news magazine of science published in the United States.

Categories: Science & technology

Publisher: Society for Science & the Public

ISSN/eISSN: 0036-8423

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Science News Explores

Issue: Sep 2023

Categories: Science & technology

Publisher: Society for Science & the Public

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Issue: Fall 2023

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Science news



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Science News

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Issue: Sep 2023

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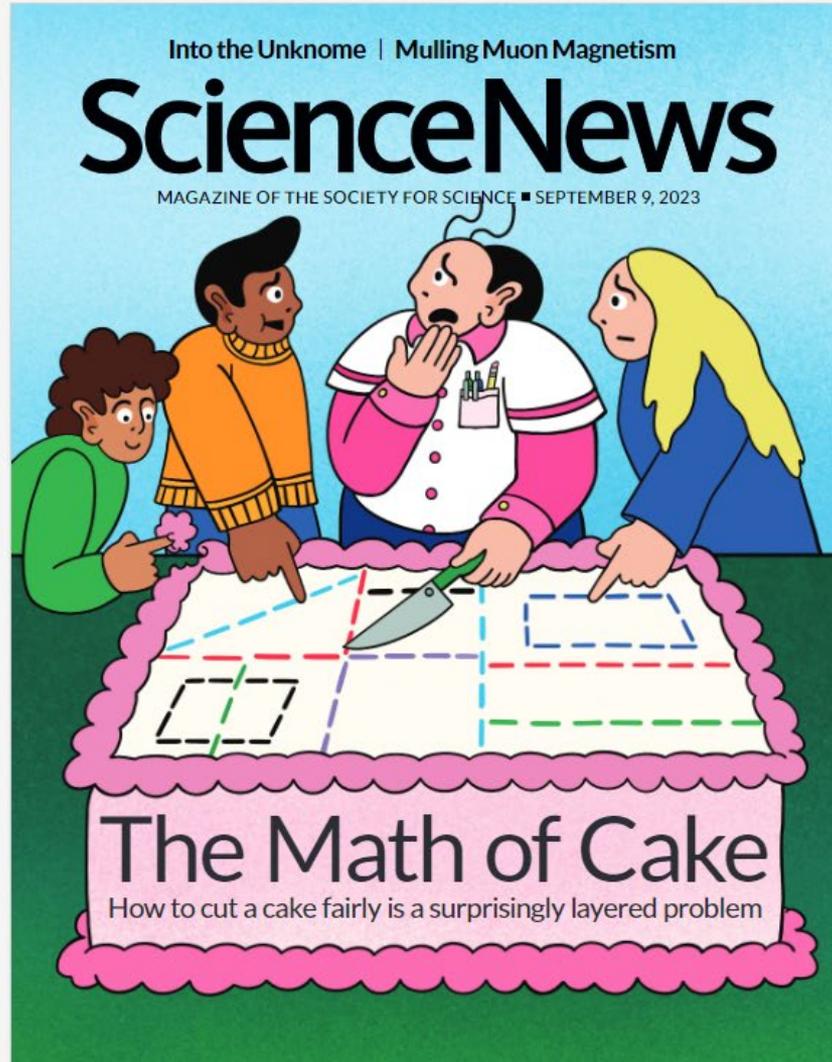
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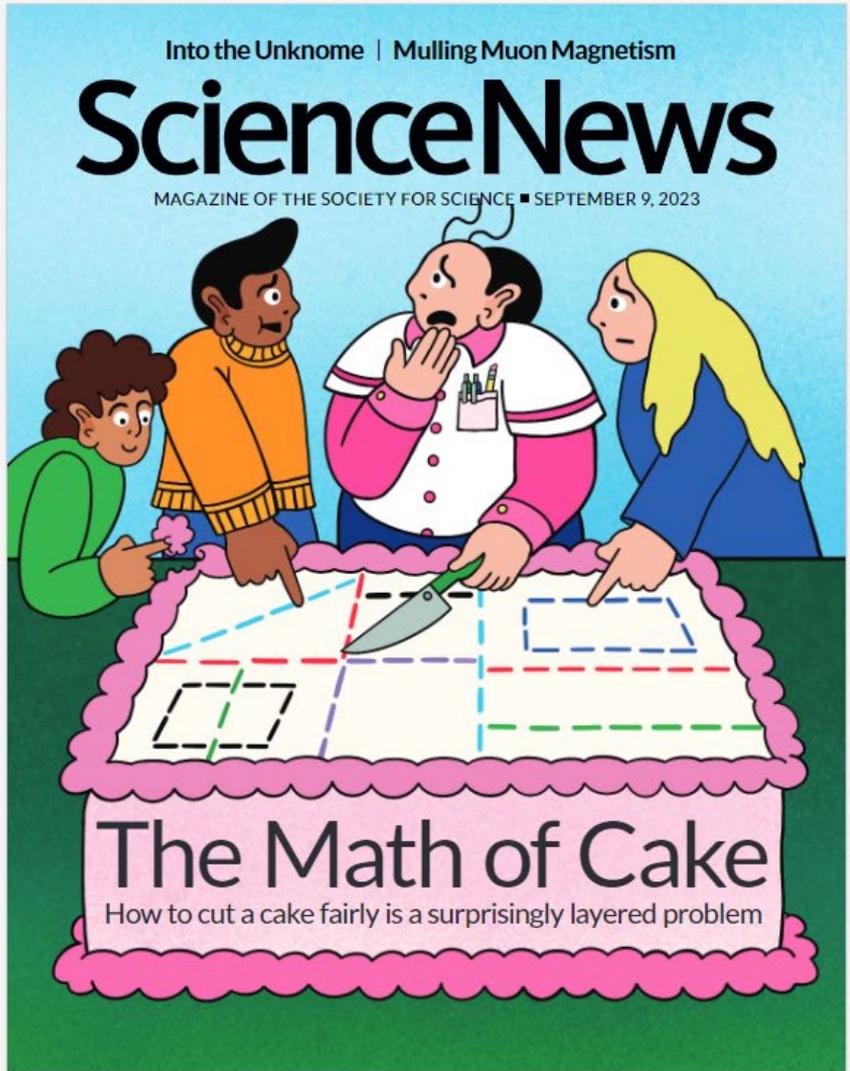
Smore Magazine

Issue: Fall 2023

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This issue

Enter keyword

To search for articles that include your keywords, click the **Search** icon to display the search box. Select to search the current issue or all issues and enter your terms in the search box. Click the **Magnifying glass** to run your search.

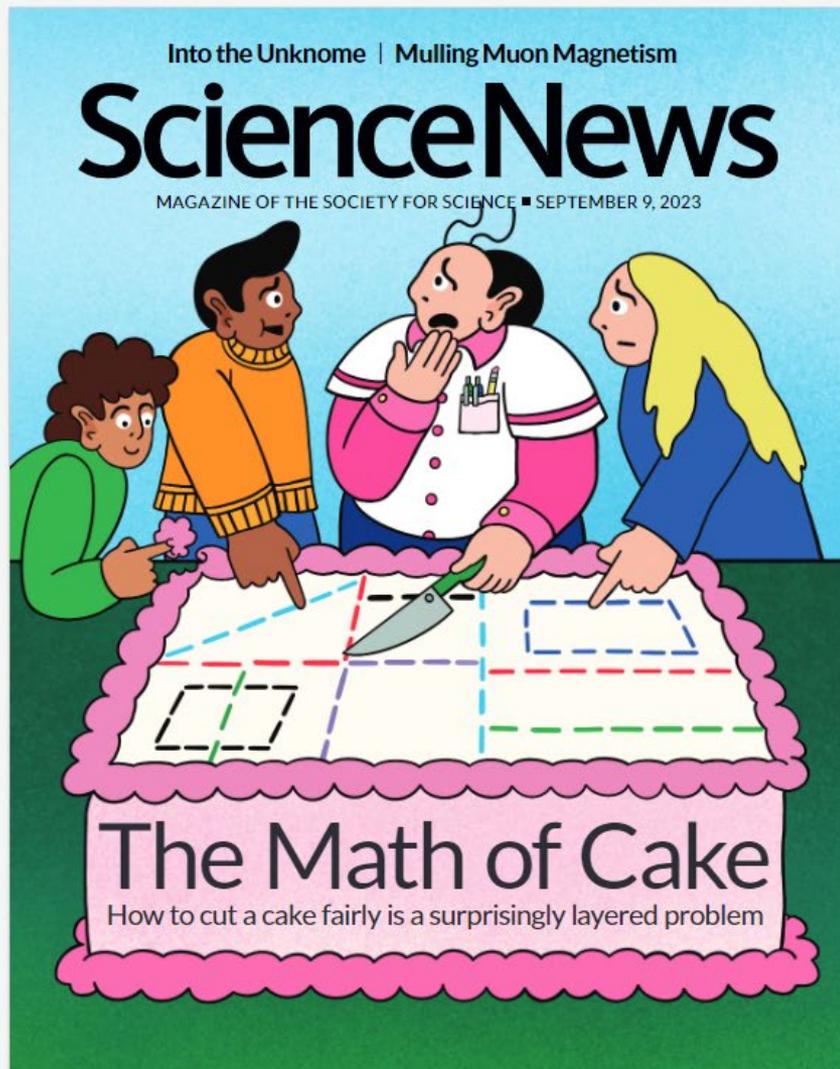
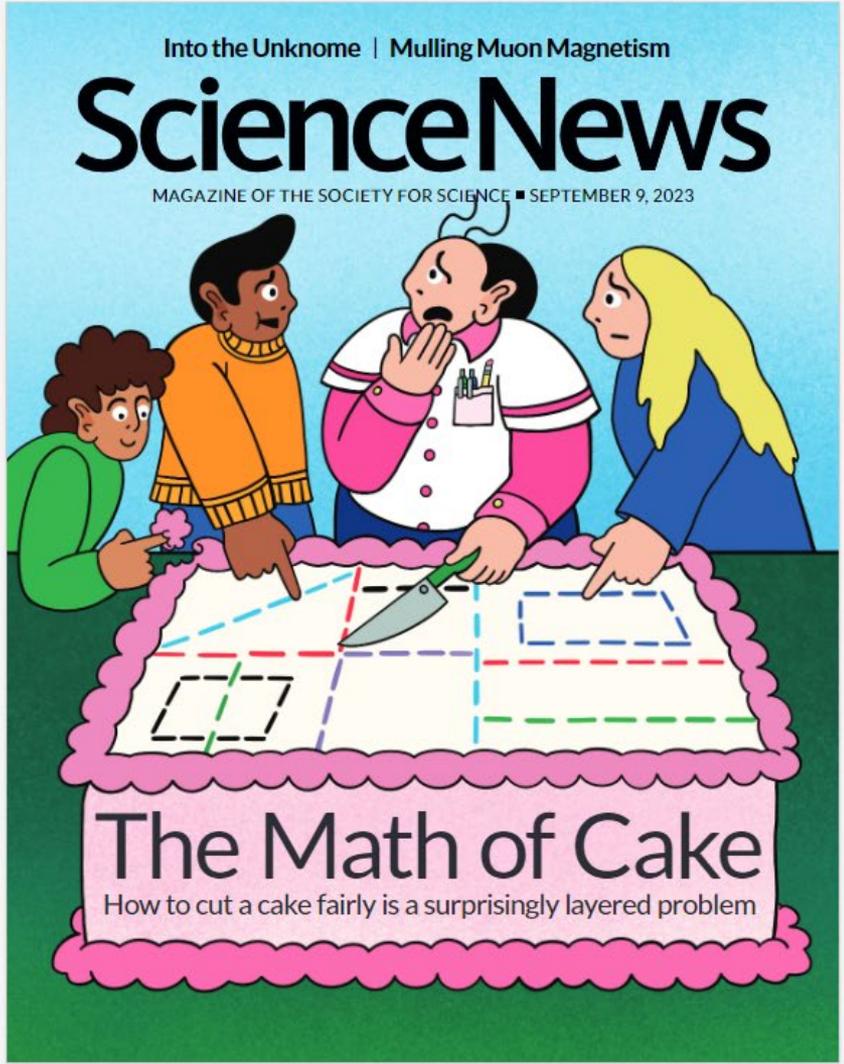


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Science News

MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC

Science News

Sep 9, 2023

Aug 26, 2023

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Jul 15, 2023

Click the **All Issues** icon to view the available back issues of the title. Click on an issue to read it in the viewer.

PALEONTOLOGY

Fires may have doomed ancient beasts

A drying climate and humans transformed Southern California



BY JAKE BUEHLER

By about 11,700 years ago, most large land mammals outside of Africa had gone extinct. Scientists have long debated whether these extinctions were primarily driven by human activities or a changing climate as the last ice age came to a close (SN: 3/22/14, p. 13).

A new study of the remains of animals trapped long ago in the La Brea tar pits, in what's now Los Angeles, suggests both factors worked in concert to bring about the demise of the region's megafauna. A warming, drying climate plus humans' hunting and burning of the landscape led to large fires that precipitated die-offs there around 13,000 years ago and forever changed the ecosystem, researchers report in the Aug. 18 Science.

The findings "reflect the reality of nature, which is that phenomena are rarely, if ever, driven by a single factor," says paleoecologist Danielle Fraser of the Canadian Museum of Nature in Ottawa.

The type of climate-human synergy implicated in the demise of some of California's biggest ancient mammals may warn of dramatic upheaval in modern ecosystems that are subjected to human-caused climate change, the scientists say. Over the last century, Southern California has warmed more than 2 degrees Celsius on average. That's a far more rapid change than the area faced during the end of the last ice age.

Paleontologist and evolutionary biologist F. Robin O'Keefe and colleagues had been studying the remains of ancient carnivores preserved in La Brea's asphalt seeps to see how the animals had physically changed over thousands of years. Then the researchers found evidence of an extinction event in the tar pit fossil record.

"We had lots and lots of megafauna, and then suddenly they were gone," says O'Keefe, of Marshall University in Huntington, WV.

The researchers dated the remains of 172 individuals representing eight megafauna species that lived from about 10,000 to 15,600 years ago. The sample included extinct species like saber-toothed cats (*Smilodon fatalis*), dire wolves (*Aenocyon dirus*) and ground sloths (*Parmorydon harrisi*), and a single still-living species, the coyote (*Canis latrans*).

Sure enough, about 13,000 years ago, seven of the eight species vanished from the tar pit fossil record, the team found.

To understand what was going on in the environment back then, the team turned to a sediment core from nearby Lake Elsinore. The core records regional vegetation, fire frequency and climate changes over tens of thousands of years. O'Keefe and colleagues also compared the extinction timing with a computer model of human population growth in North America.

Over the millennium preceding the

Fossils from the La Brea tar pits, including of saber-toothed cats (left) and dire wolves (right), record an extinction event 13,000 years ago.

extinction, the region warmed by nearly 6 degrees, the core revealed. The area dried out, with juniper and oak woodlands giving way to more drought- and fire-tolerant plants. Soon after this shift started, Southern California experienced a 300-year stretch of intense fires, evidenced by a spike in charcoal in the core.

Right before the burning started, human populations rapidly grew, according to the computer model, suggesting the two events are linked.

What's more, the changing climate and human activities transformed the region's woodlands into chaparral scrubland. It's a vicious feedback loop, O'Keefe says. Hunting herbivores makes the ecosystem more fire-prone as plants go uncut. "You add more people and it gets hotter and drier, and you're killing more herbivores. So there's more fuel [to burn]," he says.

The seven extinct megafauna species vanished from Southern California about 1,000 years before they did elsewhere in North America. Those other populations may have met a similar end, the scientists say. "There is evidence for a continent-wide event, not just in Southern California but across the continent right about at the same time," O'Keefe says.

Paleoecologist Sandra Brügger of the University of Basel in Switzerland notes that similarly rapid ecological transformations have been documented in the Mediterranean and a broader swath of the U.S. West at the end of the last ice age.

The new findings, O'Keefe says, are a cautionary tale relevant to the survival of modern biodiversity. He points to recent intense fires in Hawaii, the U.S. West and Canada (SN: 8/12/23, p. 6). "The parallels are certainly there. The one thing that's different about today is that we know what happened before, and if we can learn something from that, maybe we can change our trajectory." ■

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PARTICLE PHYSICS

Data confirm muons' weird wobbles

Experiment highlights confusion over theoretical predictions

BY EMILY CONOVER

Muons might not behave as expected. But scientists can't agree on what to expect.

By taking stock of how the subatomic particles wobble in a magnetic field, physicists have pinned down a property of the muon's internal magnet to greater precision than ever before, researchers from the Muon $g-2$ experiment reported August 10 in a seminar hosted by Fermilab in Batavia, Ill.

Previous measurements of muon magnetism haven't aligned with predictions from the standard model of particle physics, which describes subatomic particles and the forces that bind them.

Many physicists have hoped that the muon discrepancy might be hinting at a flaw in the stalwart theory that could lead to a better understanding of the universe. But recent scientific surprises have muddled the theoretical prediction of the strength of the muon's magnet, making it harder to know how the new and old measurements, which agree with one another, compare with theory.

Muons are short-lived particles that behave like miniature magnets, each with their own magnetic field. The strength of that magnet is adjusted by a strange effect of quantum physics. Empty space is filled with a constant flurry of particles that appear temporarily before flitting out of existence. Known as "virtual" particles,

they have very real effects. These transient particles alter the strength of the muon's magnet by an amount that can be calculated according to the standard model.

The precise value of this tweak—the anomalous magnetic moment, or " $g-2$ "—is what has befuddled physicists. Tantalizingly, particles unknown to science could shift $g-2$'s measured value. So hints of a disagreement with predictions have generated a hubbub. "The muons' behavior that we're measuring is affected by all of the forces and particles in the universe," says Muon $g-2$ researcher Brynn MacCoy of the University of Washington in Seattle. "It's basically giving us this direct window into how the universe works."

The first indication of a mismatch between prediction and measurements came from an experiment completed more than two decades ago. Then in 2021, the Muon $g-2$ experiment, based at Fermilab, reported results confirming the discrepancy.

Now, Muon $g-2$ has doubted its precision in an updated measurement. "To reach that level of precision is really unprecedented," says physicist Carlos Wagner of the University of Chicago. "I am simply in awe." The measurement incorporates four times as much data as the previous one, among other improvements.

Scientists aim to compare the measured value with the standard model prediction.

But determining what, exactly, the standard model predicts is complicated.

In 2020, a group of theoretical physicists, the Muon $g-2$ Theory Initiative, came to a consensus prediction. But since then, contradictory information has come out from other experiments and theoretical calculations, leaving the prediction uncertain.

The confusion hinges on a bit of the $g-2$ calculation known as the hadronic vacuum polarization, which refers to the adjustment resulting from a virtual photon emitted by the muon that splits into a quark and its antimatter partner, an antiquark. Quarks make up particles called hadrons, including protons and neutrons. The quark and antiquark interact before annihilating back into a virtual photon.

The conventional way of calculating this hadronic vacuum polarization term involves using experimental data measuring how electrons and their antimatter partners, positrons, collide and produce hadrons. The results of such experiments are thought to be well understood.

But an experiment at the VEPP-2000 particle collider in Russia disagrees with those other experiments, researchers reported in February at arXiv.org. If this outlier is correct, the hints of disagreement between muon measurements and prediction might be weaker than thought.

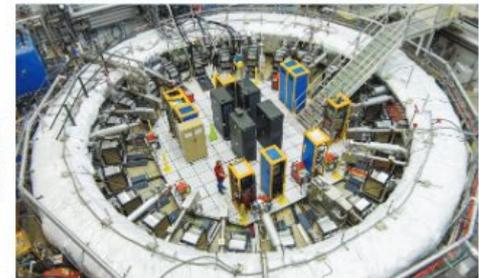
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So the focus has now shifted from scrutinizing the experimental measurements to analyzing the disagreement among theoretical techniques.

"The experiment has delivered," says theoretical physicist Thomas Teubner of the University of Liverpool in England, a member of the Muon $g-2$ collaboration. To figure out if muons are keeping with the standard model or cracking it, it's up to the theoretical physicists, he says. "We have to get our house in order." ■

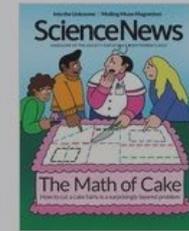
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Physicists have made the most precise measurement of a magnetic property of muons by studying how the particles wobbled as they circled within this doughnut-shaped magnet at Fermilab.



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News

PALEONTOLOGY

Fires may have doomed a

A drying climate and humans transforme



BY JAKE BUEHLER

Paleontologist and evolutionary biologist E. Robin O'Keefe and colleagues had been studying the remains of ancient carnivores preserved in La Brea's asphalt traps to see how the animals had physically changed over thousands of years. Then the researchers found evidence of an extinction event in the tar pit fossil record. "The last lions and lots of megafauna, and then suddenly they were gone," says O'Keefe, of Marshall University in Huntington, W.Va.

The researchers dated the remains of 122 individuals representing eight megafauna species that lived from about 10,000 to 15,000 years ago. The sample included extinct species like saber-toothed cats (*Smilodon fatalis*), dire wolves (*Canis dirus*) and ground sloths (*Mylodon darwini*), and a single still-living species, the coyote (*Canis latrans*). Some straight, about 15,000 years ago, several of the eight species vanished from the tar pit fossil record, the team found.

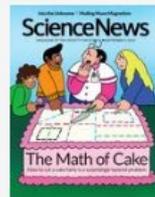
To understand what was going on in the environment back then, the team turned to a sediment core from nearby Lake Elmore. The core records regional vegetation, fire frequency and climate changes over tens of thousands of years. O'Keefe and colleagues also compared the extinction timing with a computer model of human population growth in North America.

Over the millennium preceding the demise of the region's megafauna, a warming, drying climate plus human hunting and burning of the landscape led to large fires that precipitated die-offs here around 15,000 years ago and far over changed the ecosystem, researchers report in the Aug. 18 *Science*.

The findings "reflect the reality of nature, which is that phenomena are rarely, if ever, driven by a single factor," says paleontologist Danielle Frazer of the Canadian Museum of Nature in Ottawa.

The topic of climate-human synergy implicated in the demise of some of California's biggest ancient mammals may seem of dramatic import to modern ecosystems that are subjected to human-caused climate change, the scientists say. Over the last century, Southern California has warmed more than 2 degrees Celsius on average. That's a far more rapid change than the area faced during the end of the last ice age.

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News

PALEONTOLOGY

Fires may have doomed ancient beasts A drying climate and humans transformed Southern California



BY JAKE BUEHLER

By about 11,000 years ago, most large land mammals outside of Africa had gone extinct. Scientists have long debated whether these extinctions were primarily driven by human activities or a changing climate as the last ice age came to a close (SN: 5/22/24 p. 13).

A new study of the remains of animals trapped long ago in the La Brea tar pits, in what's now Los Angeles, suggests both factors worked in concert to bring about the demise of the region's megafauna. A warning, drying climate plus humans' hunting and burning of the landscape led to large fires that precipitated the extinctions around 13,000 years ago and later over changed the ecosystem, researchers report in the Aug. 18 *Science*.

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Trunks from the La Brea tar pits, including of water buffaloes (left) and fire weasels (right), record an extinction event 13,000 years ago.

extinction, the region warmed by nearly 6 degrees, the core revealed. The area dried out, with juniper and oak woodlands giving way to more drought- and fire-tolerant plants. Soon after this shift started, Southern California experienced a 300-year stretch of intense fires, culminated by a spike in charcoal in the core. Right before the burning started, human populations rapidly grew, according to the computer model, suggesting the two events are linked.

What's more, the changing climate and human activities transformed the region's woodlands into chaparral scrubland. As a vicious feedback loop, OKeefe says. Hunting herbivores makes the ecosystem more fire prone as plants germinate. "You add more people and it gets hotter and drier, and you're killing more herbivores. So there's more fuel [to burn]," he says.

The seven extant megafauna species consisted from Southern California about 13,000 years before they did elsewhere in North America. These other populations may have met a similar end, the scientists say. "There is evidence for a continent-wide event, not just in Southern California but across the continent right about at the same time," OKeefe says.

Paleoecologist Sandra Bragdon of the University of Basel in Switzerland notes that similarly rapid ecological transformations have been documented in the Mediterranean and a broader swath of the U.S. West at the end of the last ice age.

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BY EMILY CONOVER

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Many physicists have hoped that the muon discrepancy might be hinting at a flaw in the standard theory that could lead to a better understanding of the universe. But recent scientific surprises have muddled the theoretical predictions of the strength of the muon's magnet, making it harder to know how the new and old measurements, which agree with one another, compare with theory.

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But determining what, exactly, the standard model predicts is complicated.

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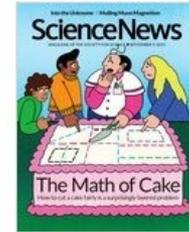
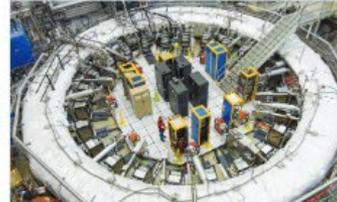
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News

PALEONTOLOGY

Fires may have doomed ancient beasts

A drying climate and humans transformed Southern California



BY JAKE BUEHLER

About 11,000 years ago, most large land mammals outside of Africa had gone extinct. Scientists have long debated whether these extinctions were primarily driven by human activities or a changing climate as the last ice age came to a close (SN 3/22/24, p. 29).

A new study of the remains of animals trapped long ago in the La Brea tar pits, in what's now Los Angeles, suggests both factors worked in concert to bring about the demise of the region's megafauna. A warming, drying climate plus human hunting and burning of the landscape led to large fires that precipitated the extinctions about 11,000 years ago and later over changed the ecosystem, researchers report in the Aug. 18 Science.

The findings "reflect the reality of nature, which is that phenomena are rarely, if ever, driven by a single factor," says paleontologist Danielle Fraser of the Canadian Museum of Nature in Ottawa.

The type of climate-human synergy implicated in the demise of some of California's biggest ancient mammals may seem of dramatic import to modern ecosystems that are subjected to human-caused climate change, the scientists say. Over the last century, Southern California has warmed more than 2 degrees Celsius on average. That's far more rapid change than the area faced during the end of the last ice age.

Fossil from the La Brea tar pits, including a saber-toothed cat (left) and the western hog, record an extinction event 11,000 years ago.

Paleontologist and evolutionary biologist E. Robin O'Keefe and colleagues had been studying the remains of ancient carnivores preserved in La Brea's asphalt seeps to see how the animals had physically changed over thousands of years. Then the researchers found evidence of an extinction event in the tar pit's fossil record.

"We had lots and lots of megafauna, and then suddenly they were gone," says O'Keefe, of Marshall University in Huntington, W.Va.

The researchers dated the remains of 172 individuals representing eight megafauna species that lived from about 10,000 to 15,000 years ago. The sample included extinct species like saber-toothed cats (*Homotherium*), dire wolves (*Acanonyx*) and ground sloths (*Megamelas*) during a and a single living species, the coyote (*Canis latrans*). Since enough, about 11,000 years ago, seven of the eight species vanished from the tar pit's fossil record, the team found.

To understand what was going on in the environment back then, the team turned to a sediment core from nearby Lake El Estero. The core records regional vegetation, fire frequency and climate changes over tens of thousands of years. O'Keefe and colleagues also compared the extinction timing with a computer model of human population growth in North America.

Over the millennium preceding the

extinction, the region warmed by nearly 6 degrees, the core revealed. The area dried out, with juniper and oak woodlands giving way to more drought- and fire-tolerant plants. Soon after this shift started, Southern California experienced a 300-year stretch of intense fires, evidenced by a spike in charcoal in the core.

Right before the burning started, human populations rapidly grew, according to the computer model, suggesting the two events are linked.

"What's more, the changing climate and human activities transformed the region's woodlands into chaparral scrubland. It's a vicious feedback loop, O'Keefe says, that, along with herbivores making the ecosystem more fire-prone as plants grow taller, "You add more people and it gets hotter and drier, and you're killing more herbivores. So there's more fuel [to burn]," he says.

The seven extinct megafauna species vanished from Southern California about 10,000 years before they did elsewhere in North America. These other populations may have met a similar end, the scientists say. "There is evidence for a continental-wide event, not just in Southern California but across the continent right about the same time," O'Keefe says.

Paleoecologist Sandra Brigger of the University of Texas at San Antonio notes that similarly rapid ecological transformations have been documented in the Mediterranean and a broader swath of the U.S. West at the end of the last ice age.

The new findings, O'Keefe says, are a cautionary tale relevant to the survival of modern biodiversity. He points to recent intense fires in Hawaii, the U.S. West and Canada (SN 8/12/23, p. 6). "The parallels are certainly there. The one thing that's different about today is that we know what happened before, and if we can learn something from that, maybe we can change our trajectory."

PARTICLE PHYSICS

Data confirm muons' weird wobbles

Experiment highlights confusion over theoretical predictions

BY EMILY CONOVER

Muons might not behave as expected. But scientists can't agree on what to expect.

By taking stock of how the subatomic particles wobble in a magnetic field, physicists have pinned down a property of the muon's internal magnet to greater precision than ever before, researchers from the Muon $g-2$ experiment reported August 10 in a seminar hosted by Fermilab in Batavia, Ill.

Previous measurements of muon magnetism haven't aligned with predictions from the standard model of particle physics, which describes subatomic particles and the forces that bind them.

Many physicists have hoped that the muon discrepancy might be hinting at a flaw in the standard theory that could lead to a better understanding of the universe. But recent scientific surprises have muddled the theoretical predictions of the strength of the muon's magnet, making it harder to know how the new and old measurements, which agree with one another, compare with theory.

Muons are short-lived particles that behave like miniature magnets, each with their own magnetic field. The strength of that magnet is adjusted by a strange effect of quantum physics: Empty space is filled with a constant flurry of particles that appear temporarily before fitting out of existence. Known as "virtual" particles,

they have very real effects. These transient particles alter the strength of the muon's magnet by an amount that can be calculated according to the standard model.

The precise value of this tweak—the muon's magnetic moment, or " $g-2$," is what has befuddled physicists. Interestingly, particles unknown to science could shift $g-2$'s measured value. So hints of a disagreement with predictions have generated a hubbub. "The muon's behavior that we're measuring is affected by all of the forces and particles in the universe," says Muon $g-2$ researcher Bryan Maier of the University of Washington in Seattle. "It's basically giving us this direct window into how the universe works."

The first indication of a mismatch between prediction and measurement came from an experiment completed more than two decades ago. Then in 2020, the Muon $g-2$ experiment, based at Fermilab, reported results confirming the discrepancy.

Now, Muon $g-2$ has doubled its precision in an updated measurement. "To reach that level of precision is really unprecedented," says physicist Carlos Wagner of the University of Chicago. "I am simply in awe." The measurement incorporates four times as much data as the previous one, among other improvements.

Scientists aim to compare the measured value with the standard model prediction.

But determining what, exactly, the standard model predicts is complicated.

In 2021, a group of theoretical physicists, the Muon $g-2$ Theory Initiative, came to a consensus prediction. But since then, consistency information has come out from other experiments and theoretical calculations, leaving the prediction uncertain.

The confusion hinges on a bit of the $g-2$ calculation known as the hadronic vacuum polarization, which refers to the adjustment resulting from a virtual photon emitted by the muon that splits into a quark and its antimatter partner, an antiquark. Quarks make up particles called hadrons, including protons and neutrons. The quark and antiquark interact before annihilating back into a virtual photon.

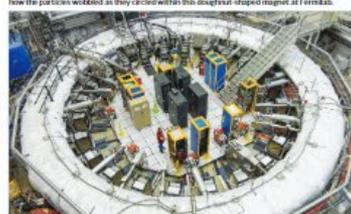
The conventional way of calculating this hadronic vacuum polarization term involves using experimental data measuring how electrons and their antimatter particles, positrons, collide and produce hadrons. The results of such experiments are thought to be well understood.

But an experiment at the SLAC-PEP-II particle collider in Russia disagreed with those other experiments, researchers reported in February at arXiv.org. If this outlier is correct, the hints of disagreement between muon measurements and prediction might be weaker than thought.

In 2021, a research group in Europe published in *Nature* an estimate of the hadronic vacuum polarization using a different method, called lattice quantum chromodynamics. That technique involves mathematically splitting up spacetime into a grid to make calculations more tractable. The estimate pointed to a closer harmony between the prediction and measurements of $g-2$.

So the focus has now shifted from scrutinizing the experimental measurements to analyzing the disagreement among theoretical techniques. "The experiment has delivered," says theoretical physicist Thomas Leutner of the University of Liverpool in England, a member of the Muon $g-2$ collaboration. To figure out if muons are keeping with the standard model or cracking it, it's up to the theoretical physicists, he says. "We have to get our house in order."

Physicists have made the most precise measurement of a magnetic property of muons by studying how the particles wobble as they circled within this doughnut-shaped magnet at Fermilab.



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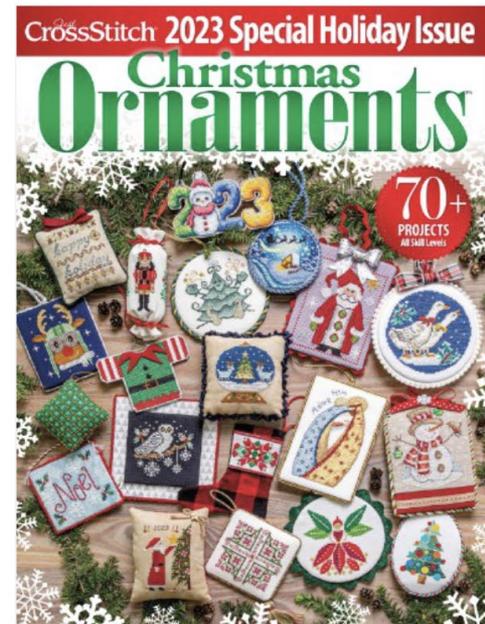
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