EDITION XVII *3 FEBRUARY 2024*

SPARC WEEKLY

NEW STUDY FINDS DELAYED REM SLEEP COULD BE AN EARLY WARNING FOR ALZHEIMER'S

A recent study highlights the link between delayed REM (rapid eye movement) sleep and an increased risk of developing Alzheimer's disease. REM sleep, essential for memory processing and learning, typically occurs about 90 minutes after falling asleep. However, older adults often take longer to enter this phase.

Researchers found that participants with delayed REM sleep had higher levels of amyloid and tau proteins, which are toxic markers of Alzheimer's. They also exhibited lower brain-derived neurotrophic factor (BDNF), a protective protein crucial for brain health. Those with delayed REM had 16% more amyloid and 29% more tau than those with early REM sleep.

The study followed 128 individuals, aged 70 on average, who underwent sleep monitoring. Participants with Alzheimer's were more likely to have delayed REM sleep, supporting the theory that poor sleep may be an early warning sign of the disease.

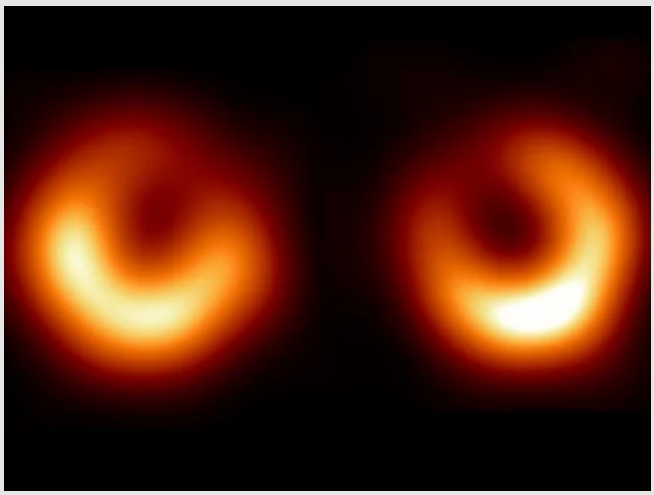
Disruptions in REM sleep can trigger stress hormone imbalances, particularly increased cortisol levels, which impair memory-related brain functions.

Experts recommend improving sleep habits to reduce Alzheimer's risks. Treating sleep apnea, avoiding heavy alcohol consumption, and reconsidering medications that suppress REM sleep, such as some antidepressants, can be helpful. Additionally, melatonin and other insomnia treatments have shown potential in reducing amyloid and tau accumulation.

Future research may explore the role of medications in modifying sleep patterns and potentially slowing Alzheimer's progression. Maintaining healthy sleep routines remains a crucial step in cognitive health and disease prevention.

https://scitechdaily.com/new-study-finds-delayed-rem-sleep-could-be-an-early-warning-for-alzheimers/

THE FIRST MONSTER BLACK HOLE EVER IMAGED IS CHANGING BEFORE OUR EYES



The Event Horizon Telescope (EHT) Collaboration has unveiled new findings about M87*, the supermassive black hole at the center of the M87 galaxy. Building on observations from 2017 and 2018, researchers have gained fresh insights into the turbulent environment surrounding the black hole's event horizon.

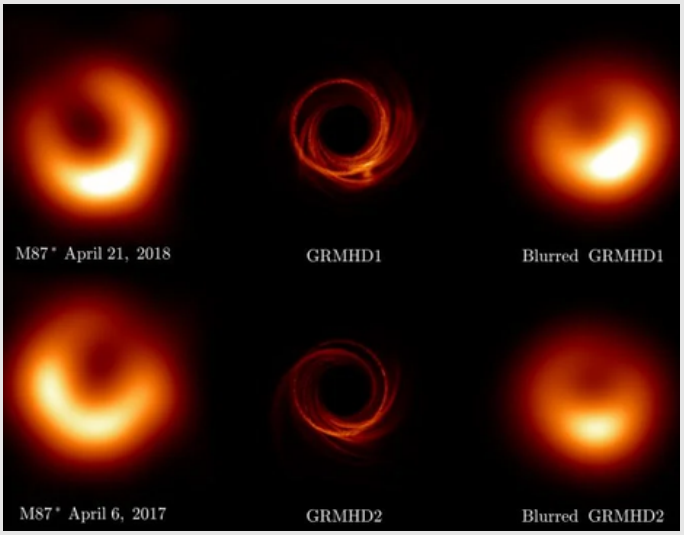
A key discovery is the confirmation of the luminous ring first captured in 2017, with a diameter of 43 microarcseconds, consistent with theoretical predictions for a black hole of 6.5 billion solar masses. Notably, the brightest region of the ring shifted 30 degrees counterclockwise, a predicted consequence of turbulence in the accretion disk.

This shift provides crucial information about the black hole's spin orientation, with the brightest region reinforcing earlier interpretations that M87*'s rotational axis points away from Earth. The observations highlight the evolving nature of the black hole environment, despite M87* itself changing on much longer timescales.

Luciano Rezzolla from Goethe University compared the findings to observing shifting clouds near a stable mountain peak, offering new insights into the black hole's dynamic surroundings.

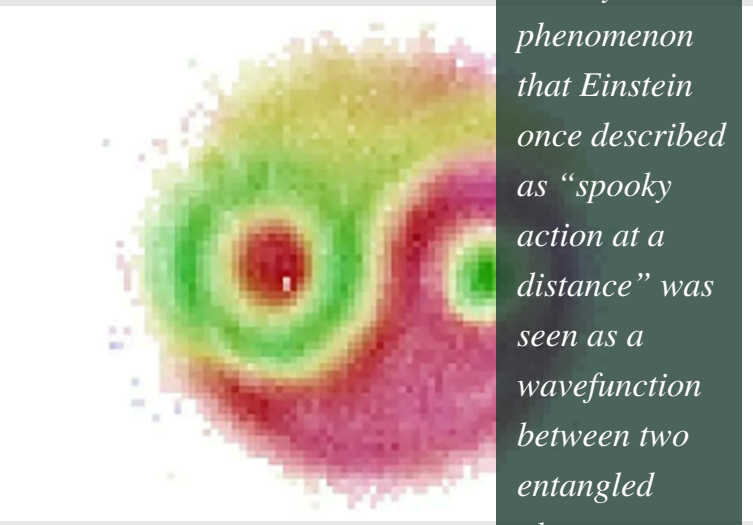
Using an expanded library of supercomputer-generated models, researchers evaluated different accretion scenarios. They found that gas spiraling in the opposite direction of the black hole's rotation aligns better with observations, suggesting greater turbulence.

Future analyses of data from 2021 and 2022 are underway, aiming to provide more precise constraints and a potential "movie" of M87*'s activity. These studies promise to deepen our understanding of black holes and their surrounding environments.



https://scitechdaily.com/the-first-monster-black-hole-ever-imaged-is-changing-before-our-eyes/

QUANTUM ENTANGLEMENT VISUALIZED FOR THE FIRST TIME EVER



The mysterious phenomenon that Einstein once described as "spooky action at a distance" was seen as a wavefunction between two entangled photons.

Quantum entanglement, a counter-intuitive phenomenon in quantum physics, involves two particles being interconnected such that a change in one instantly affects the other, even if separated by vast distances. This "spooky action at a distance" puzzled Einstein, as it seemingly defies the speed limit of information transfer established by the speed of light.

In a groundbreaking study published in Nature Photonics, researchers from the University of Ottawa and Sapienza University of Rome have visualized the wavefunction of an entangled photon pair. The wavefunction provides a complete description of a quantum system, predicting the likelihood of measurement outcomes for the photons' positions.

To achieve this, the team extended digital holography—a method typically used for 3D imaging—to reconstruct the quantum state of entangled photons. By superimposing a reference photon state with the entangled state, they deciphered crucial information not from the intensity of light but from the distribution of photon pair coincidences.

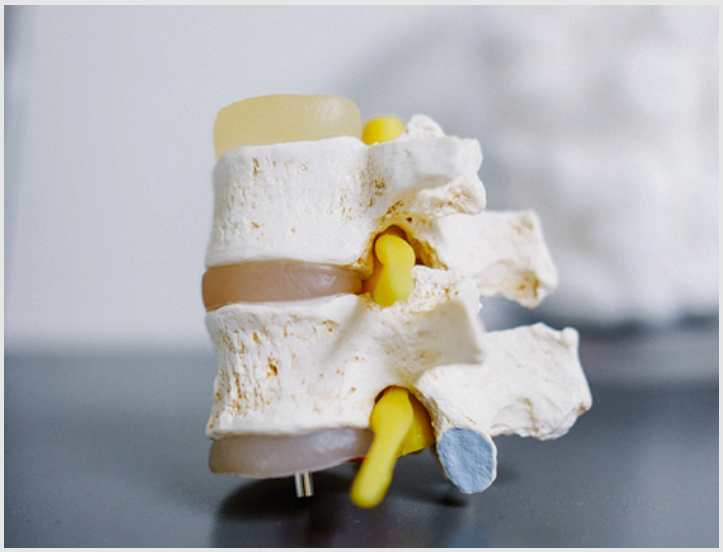
A significant technological advance enabled this breakthrough: a new camera capable of tracking photon arrival times down to nanoseconds. The resulting image of the photon wavefunction intriguingly resembles a Yin-Yang symbol, symbolizing interconnected forces.

This development has profound implications for quantum technology, particularly quantum computing, which relies on the manipulation of entangled states. The technique could also inspire next-generation imaging technologies surpassing classical optical limits.

By visualizing the elusive wavefunction, the research marks a pivotal step in cementing the "realness" of quantum entanglement and advancing our understanding of the quantum realm.

https://www.advancedsciencenews.com/quantum-entanglement-visualized-for-the-first-time-ever/

AN ANTI-INFLAMMATORY PEPTIDE MAY HOLD THE KEY TO LOW-BACK PAIN RELIEF



Chronic low-back pain is often caused by the degeneration of intervertebral discs, but its underlying mechanisms remain unclear. A recent study led by researchers from Changzheng Hospital's Department of Orthopedic Surgery has identified a promising biological pathway that may not only slow this degeneration but potentially reverse it. This discovery could pave the way for novel therapeutic approaches.

Current treatments for disc degeneration are limited to anti-inflammatory drugs with side effects or invasive surgeries that pose risks and require extensive recovery. Recognizing the need for better alternatives, the research team focused on the role of neurotransmitters, chemical messengers in the spine that influence both pain signaling and disc health.

The study examined the vasoactive intestinal peptide (VIP), known for its anti-inflammatory properties. Researchers found that in degenerated disc tissue, the receptors for this peptide were significantly reduced. When they inhibited receptor expression, the production of essential structural components like type II collagen and aggrecan also decreased.

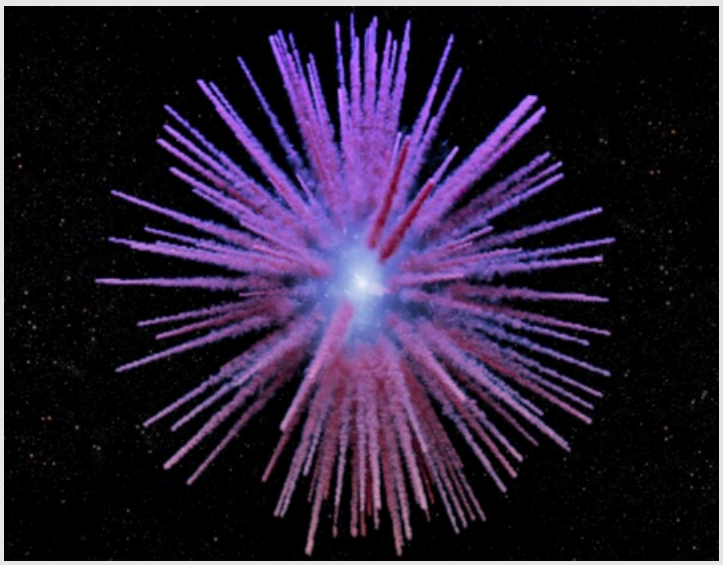
To explore VIP's therapeutic potential, the team treated mice with the peptide for four weeks. Imaging techniques revealed that the treatment slowed disc degeneration and improved aggrecan levels. These findings suggest that VIP may protect disc tissue from deterioration.

However, significant challenges remain in developing a practical treatment. Peptides are unstable and difficult to deliver effectively when taken orally. Local injections, while effective in the study, risk damaging the fragile disc structure. Despite these obstacles, the researchers remain optimistic, emphasizing the need to investigate additional neurotransmitters that could offer more viable solutions.

This study represents a step forward in understanding disc degeneration and highlights a potential new avenue for treating chronic back pain without relying on invasive surgeries or high-risk drug therapies.

https://www.advancedsciencenews.com/an-anti-inflammatory-peptide-may-hold-the-key-to-low-back-pain-relief/

THIS ZOMBIE STAR'S SPIKY FILAMENTS ARE BAFFLING ASTRONOMERS



About 6,500 light-years from Earth lies a mysterious "zombie star" surrounded by spiky tendrils of hot sulfur. First observed as a "guest star" in the sky by Chinese and Japanese astronomers in 1181, the remains of this stellar explosion, now called the Pa 30 nebula, were rediscovered in 2013. Despite being classified as a Type 1a supernova, in which a white dwarf star typically destroys itself, part of this star inexplicably survived.

What makes Pa 30 even more unusual is the structure of its debris. Stretching roughly three light-years in every direction, the star is surrounded by unique filament-like tendrils. No other known supernova nebula exhibits this formation. Tim Cunningham, an astronomer at the Harvard & Smithsonian Center for Astrophysics, describes it as "really unique."

Using the W.M. Keck Observatory in Hawaii, Cunningham and his team mapped the motion of these filaments and developed a 3-D model of the nebula. The system resembles a "three-layered onion." At the core is the zombie star, followed by a gap of one to two light-years, a spherical dust shell, and finally, the spiky tendrils emerging from the shell.

"It's unknown how those filaments formed, nor how they've held their shape for so long"

The origins of these filaments and how they remain perfectly straight for centuries remain puzzling. One hypothesis suggests that a shockwave from the explosion may have bounced off nearby interstellar material and sculpted the filaments. However, further studies are needed to confirm or challenge this theory.

The recent findings offer insight into the complex aftermath of supernova explosions and raise new questions about how stellar remnants like Pa 30 can form such intricate and enduring structures in space.

https://www.snexplores.org/article/zombie-star-spiky-filaments-supernova

WHO ARE WE?

SPARC Robotics Team's mission and vision is to make our environment the best it can be. On a volunteer basis, we look at the problems that are happening around us and make them our problems, both as SPARC and individually, and help as much as we can with appropriate projects. NASA ACCP (Astro Camp Community Partners) was only in the US until four years ago. This year they came to Turkey with us after four years of traveling to many countries. ACCP educates school-age children from kindergarten to high school on science-related topics of interest with practical knowledge and application, while also supporting children's craft development, general culture and questioning skills. As SPARC, we have brought this training provided by NASA to our country in the most comprehensive way and our continuous communication with NASA not only enables us to improve our trainings day by day, but also gives us the opportunity to learn about the innovations in the field of STEM instantly, from the most accurate source and to spread the knowledge we have around us.

EDITOR

Dear reader,

Greetings from SPARC Weekly, in which we gather latest scientific news.

We would be delighted to hear your comments or suggestions and we encourage you to write to us if you have any views or opinions on the stories in SPARC Weekly. We look forward to hearing from you.
Have a nice week and enjoy the magazine.

Defne Şehidoğlu and Reyhan Doğanca