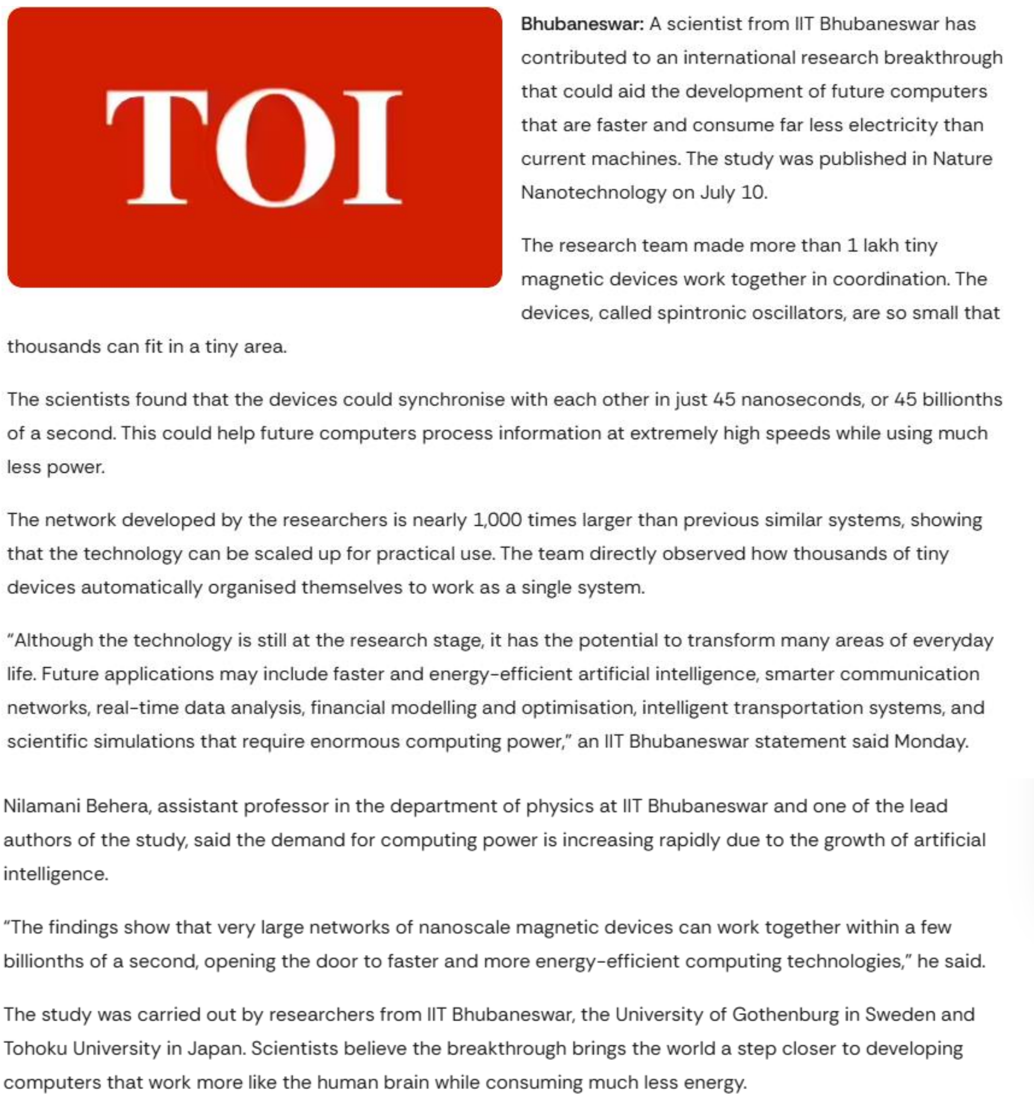
Media/Publication	**The Times of India**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT BBS scientist helps drive breakthrough in faster, low-power computing**		
Link	https://timesofindia.indiatimes.com/city/bhubaneswar/iit-bbs-scientist-helps-drive-breakthrough-in-faster-low-power-computing/articleshow/132367478.cms		



Bhubaneswar: A scientist from IIT Bhubaneswar has contributed to an international research breakthrough that could aid the development of future computers that are faster and consume far less electricity than current machines. The study was published in Nature Nanotechnology on July 10.

The research team made more than 1 lakh tiny magnetic devices work together in coordination. The devices, called spintronic oscillators, are so small that thousands can fit in a tiny area.

The scientists found that the devices could synchronise with each other in just 45 nanoseconds, or 45 billionths of a second. This could help future computers process information at extremely high speeds while using much less power.

The network developed by the researchers is nearly 1,000 times larger than previous similar systems, showing that the technology can be scaled up for practical use. The team directly observed how thousands of tiny devices automatically organised themselves to work as a single system.

"Although the technology is still at the research stage, it has the potential to transform many areas of everyday life. Future applications may include faster and energy-efficient artificial intelligence, smarter communication networks, real-time data analysis, financial modelling and optimisation, intelligent transportation systems, and scientific simulations that require enormous computing power," an IIT Bhubaneswar statement said Monday.

Nilamani Behera, assistant professor in the department of physics at IIT Bhubaneswar and one of the lead authors of the study, said the demand for computing power is increasing rapidly due to the growth of artificial intelligence.

"The findings show that very large networks of nanoscale magnetic devices can work together within a few billionths of a second, opening the door to faster and more energy-efficient computing technologies," he said.

The study was carried out by researchers from IIT Bhubaneswar, the University of Gothenburg in Sweden and Tohoku University in Japan. Scientists believe the breakthrough brings the world a step closer to developing computers that work more like the human brain while consuming much less energy.

Media/Publication	**The New Indian Express**		
Date	**14th July 2026**	**Language**	**English**
Headline	**IIT-Bhubaneswar researchers come up with technology to build faster computers**		
Link	https://www.newindianexpress.com/cities/bhubaneswar/2026/Jul/14/iit-bhubaneswar-researchers-come-up-with-technology-to-build-faster-computers		

Nilamani Behera, assistant professor in the department of physics at IIT-Bhubaneswar said the demand for computing power is growing rapidly, especially with the rise of artificial intelligence.

In a major breakthrough, a team of scientists and researchers from IIT-Bhubaneswar and other international institutions have come up with a technology that could help build future computers capable of solving difficult problems much faster while consuming only a fraction of energy used by today’s computing machines.

The team from IIT-Bhubaneswar, University of Gothenburg (Sweden) and Tohoku University (Japan), in the discovery published in the Nature Nanotechnology journal, have demonstrated the world’s largest synchronised network of more than 1,00,000 nanoscale spintronic oscillators, which are tiny magnetic devices that can work together like a perfectly coordinated orchestra.

The synchronised network is said to be nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications and development of next-generation computing hardware.

The researchers said it has the potential to transform many areas of everyday life and the future applications may include faster and energy-efficient artificial intelligence (AI), smarter communication networks, real-time data analysis, financial modelling and optimisation, intelligent transportation systems and scientific simulations that require enormous computing power.

According to the researchers, unlike conventional computer chips that process information sequentially, these miniature devices naturally synchronise with one another within only 45 billionths of a second (45 nanoseconds). Working together, they can process information extremely quickly while consuming far less energy than today’s electronic technologies.

Nilamani Behera, assistant professor in the department of physics at IIT-Bhubaneswar and one of the lead authors of the study, said the demand for computing power is growing rapidly, especially with the rise of artificial intelligence. “This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient,” Behera said.

Media/Publication	**The Business Standard**		
Date	**14th July 2026**	**Language**	**English**
Headline	**Scientists synchronise 105,000 nano-oscillators in computing breakthrough**		
Link	https://www.business-standard.com/india-news/iit-bhubaneswar-largest-synchronised-nano-oscillator-network-126071400161_1.html		

The network of more than 105,000 magnetic nano-oscillators synchronised within 45 nanoseconds, opening a path towards faster, low-power computing and AI hardware

In a breakthrough that could redefine the future of supercomputing and energy-efficient electronics, a team of scientists and researchers has experimentally demonstrated the world’s largest synchronised network of nanoscale magnetic oscillators, paving the way for a new generation of ultra-fast, low-power computing systems.

Scientists from the University of Gothenburg in Sweden, the Indian Institute of Technology (IIT) Bhubaneswar and Tohoku University in Japan have established that more than 105,000 nanoscale spin Hall nano-oscillators, with widths of 10–20 nm, can spontaneously synchronise within just 45 nanoseconds. They proved that such ultra-large spintronic networks can operate coherently and scale efficiently for future unconventional computing.

The landmark research, published recently in the prestigious journal Nature Nanotechnology, overcomes one of the biggest challenges in unconventional computing by proving that massive networks of tiny magnetic devices can work together in perfect synchronisation within billionths of a second — a feat scientists believe could eventually transform how computers process information.

“Unlike conventional semiconductor chips that process data sequentially using billions of transistors, these oscillators interact through spin waves and naturally synchronise with one another. This collective behaviour allows them to perform complex computational tasks at extremely high speeds while consuming substantially less energy,” said Nilamani Behera, assistant professor in the Department of Physics at IIT Bhubaneswar.

Researchers used advanced microwave and optical microscopy techniques to directly observe how thousands of these tiny devices spontaneously organised themselves into a single synchronised state. The synchronised network is nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications. Demonstrations conducted so far had been limited to arrays of up to 64 oscillators.

“This achievement is a giant leap in the development of next-generation computing hardware. Our study confirms that even extremely large networks can coordinate remarkably fast, opening exciting possibilities for future computing systems,” said Behera, one of the lead authors of the study.

The researchers employed sophisticated microwave spectroscopy and time-resolved Brillouin light-scattering microscopy, enabling them to directly observe how tens of thousands of nanoscale devices synchronised in real time. Their measurements revealed that synchronisation time increased only marginally even as the network size expanded dramatically — from about 10 nanoseconds for arrays of 100 oscillators to around 45 nanoseconds for networks containing more than 100,000 oscillators.

The findings also established several performance records. The synchronised arrays exhibited microwave output power that increased proportionally with the number of oscillators, while the signal linewidth decreased inversely with network size, producing exceptionally stable microwave signals with quality factors exceeding one million. Such highly coherent signals are valuable not only for unconventional computing but also for advanced wireless communication technologies and ultra-fast spectrum analysis.

According to Behera, the rapid growth of artificial intelligence is placing unprecedented demands on computing hardware, making conventional silicon-based technologies increasingly constrained by power consumption and heat generation.

“The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronise in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient,” he said.

The research further demonstrates that these ultra-large oscillator arrays could serve as physical platforms for emerging computing paradigms such as Ising machines and reservoir computing architectures operating at tens of gigahertz. Ising machines are specialised processors capable of solving highly complex optimisation problems encountered in logistics, financial modelling, industrial planning and scientific simulations, while reservoir computing offers a hardware-efficient approach to processing time-dependent data and AI workloads.

Beyond computing, the researchers said, the technology could eventually find applications in intelligent transportation systems, high-speed communication networks, real-time data analytics, scientific modelling and advanced AI accelerators. Although commercial deployment remains years away, the successful scaling of synchronised spintronic networks marks an important milestone in the global search for alternatives to CMOS-based electronics.

“The rich non-linear transient response, intrinsic short-term memory and high dimensionality of the SHNO lattice make it a promising medium for physical reservoir computing. The nanosecond-scale dynamics and gigahertz operating frequencies imply an exceptionally large processing bandwidth, while the tunable non-linearity and coupling strength provide natural knobs for task adaptation. Future work could harness these properties by encoding time-dependent inputs in the drive current or magnetic field,” they added.

Media/Publication	**Orissadiary.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar Scientist Achieves Major Breakthrough Towards Faster, Smarter and Energy-Efficient Computing**		
Link	https://orissadiary.com/iit-bhubaneswar-scientist-achieves-major-breakthrough-towards-faster-smarter-and-energy-efficient-computing/		

Imagine computers that can solve difficult problems much faster while consuming only a fraction of the energy used by today's machines. A major step toward that future has now been achieved by an international team of scientists, including researchers from the **Indian Institute of Technology (IIT) Bhubaneswar**.

The team has reported a landmark discovery in the prestigious journal Nature Nanotechnology, demonstrating the world's largest synchronized network of more than 100,000 nanoscale spintronic oscillators—tiny magnetic devices that can work together like a perfectly coordinated orchestra.

Unlike conventional computer chips that process information sequentially, these miniature devices naturally synchronize with one another within only 45 billionths of a second (45 nanoseconds). Working together, they can process information extremely quickly while consuming far less energy than today's electronic technologies.

This achievement represents a giant leap in the development of next-generation computing hardware. The synchronized network is nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications.

Researchers used advanced microwave and optical microscopy techniques to directly observe how thousands of these tiny devices spontaneously organized into a single synchronized state. The study confirms that even extremely large networks can coordinate remarkably fast, opening exciting possibilities for future computing systems.

Although the technology is still at the research stage, it has the potential to transform many areas of everyday life. Future applications may include (i) Faster and energy-efficient artificial intelligence (AI), (ii) Smarter communication networks, (iii) Real-time data analysis, (iv) Financial modelling and optimization, (v) Intelligent transportation systems, and (vi) Scientific simulations that require enormous computing power.

Dr. **Nilamani Behera**, Assistant Professor in the Department of Physics at IIT Bhubaneswar and one of the lead authors of the study, said: *“The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronize in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient.”*

The research was carried out through an international collaboration involving the **University of Gothenburg (Sweden), IIT Bhubaneswar (India), and Tohoku University (Japan)**.

The findings not only advance the fundamental understanding of how large networks of interacting nanoscale devices behave but also provide an important foundation for developing future computing technologies inspired by the human brain. Such hardware could help overcome the growing energy and performance limitations of conventional computers, paving the way for the next generation of intelligent computing systems.

The research paper, titled **“Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing,”** has been published in **Nature Nanotechnology**, one of the world’s leading journals in nanoscience and nanotechnology.

भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

Indian Institute of Technology Bhubaneswar

Media/Publication	**IBGNews.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar Scientist Joins Global Breakthrough in Next-Generation Computing**		
Link	https://ibgnews.com/2026/07/13/iit-bhubaneswar-scientist-joins-global-breakthrough-in-next-generation-computing/		

Landmark Nature Nanotechnology Study Demonstrates World’s Largest Synchronized Spintronic Network, Paving the Way for Faster, Smarter and Ultra-Energy-Efficient Computers

In a breakthrough that could redefine the future of artificial intelligence (AI) and high-performance computing, an international team of scientists—including researchers from the **Indian Institute of Technology (IIT) Bhubaneswar**—has achieved a major milestone toward building computers that are significantly faster, smarter, and dramatically more energy-efficient than today’s conventional systems.

The research, published in the globally renowned journal **Nature Nanotechnology**, demonstrates the world’s largest synchronized network of **more than 100,000 nanoscale spintronic oscillators**—microscopic magnetic devices capable of working together in perfect harmony. The achievement represents a significant advance in the development of unconventional computing architectures inspired by the remarkable efficiency of the human brain.

A New Paradigm Beyond Conventional Computing

Traditional computers rely on billions of transistors that process information sequentially. While this architecture has powered decades of technological advancement, it is increasingly facing physical and energy limitations as artificial intelligence, big data analytics, and scientific computing demand exponentially greater processing power.

The new research explores an alternative computing approach based on **spintronics—**a cutting-edge field that utilizes not only the electrical charge of electrons but also their intrinsic magnetic property, known as “spin,” to process information. Spintronic devices have long been viewed as one of the most promising candidates for next-generation computing because of their potential to deliver exceptional computational performance while consuming only a fraction of the energy required by conventional semiconductor technologies.

World’s Largest Synchronized Spintronic Network

One of the greatest challenges in spintronic computing has been synchronizing large numbers of nanoscale oscillators so they function as a single coherent system.

The international research team has now overcome that challenge by successfully synchronizing **over 100,000 spin Hall nano-oscillators**, making it the largest coherent spintronic network ever demonstrated.

Even more remarkable is the speed at which synchronization occurs.

The devices naturally organize themselves into a unified operating state in just **45 nanoseconds**—approximately **45 billionths of a second**—allowing massive numbers of computing elements to process information simultaneously with extraordinary efficiency.

According to the researchers, the synchronized system is nearly **1,000 times larger** than previously demonstrated coherent spintronic networks, proving that this technology can be scaled for practical real-world applications.

Seeing Synchronization in Real Time

To validate the breakthrough, scientists employed sophisticated microwave characterization techniques along with advanced optical microscopy capable of directly observing the behaviour of tens of thousands of nanoscale magnetic devices.

The observations revealed that the oscillators spontaneously synchronized into a single coherent state within an extremely short period of time without requiring complex external control mechanisms.

This finding significantly strengthens confidence that ultra-large spintronic computing systems could become practical components of future computing hardware.

Why This Discovery Matters

As artificial intelligence becomes increasingly integrated into everyday life—from autonomous vehicles and robotics to healthcare diagnostics, financial modelling and scientific simulations—the global demand for computing power continues to grow rapidly.

Today’s data centres already consume enormous amounts of electricity, making energy efficiency one of the defining technological challenges of the coming decades.

The IIT Bhubaneswar-led collaboration addresses precisely this challenge.

If successfully translated into commercial hardware, synchronized spintronic processors could offer:

- Faster Artificial Intelligence computation
- Ultra-low power data centres
- High-speed scientific simulations
- Real-time optimisation systems
- Intelligent transportation infrastructure
- Advanced communication networks

- Brain-inspired neuromorphic computing
- Edge AI devices with significantly lower energy consumption

The technology could eventually complement—or in specific applications even replace—certain conventional silicon-based computing architectures.

Indian Scientist Contributes to Global Innovation

Among the lead contributors is **Dr. Nilamani Behera**, Assistant Professor in the Department of Physics at **IIT Bhubaneswar**.

Commenting on the achievement, Dr. Behera said:

“The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronize in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient.”

His contribution highlights India’s growing role in frontier research areas that are expected to shape the next generation of global computing technologies.

International Scientific Collaboration

The breakthrough is the outcome of a collaborative research effort involving:

- **University of Gothenburg, Sweden**
- **Indian Institute of Technology Bhubaneswar, India**
- **Tohoku University, Japan**

The study illustrates the increasing importance of international scientific partnerships in addressing some of the world’s most complex technological challenges.

Implications for the Future of Computing

Beyond immediate technological advances, the research deepens scientific understanding of how extremely large networks of interacting nanoscale magnetic devices behave collectively.

Such systems closely resemble certain information-processing principles found in biological neural networks, making them particularly attractive for future **neuromorphic computing**—computer architectures designed to emulate the efficiency of the human brain.

Experts believe that as Moore’s Law approaches its practical limits, unconventional computing platforms such as spintronics, quantum computing, photonics, and neuromorphic systems will increasingly define the next era of digital innovation.

The successful demonstration of ultra-large synchronized spintronic networks therefore represents not merely an incremental improvement, but a potential paradigm shift in computing architecture.

IBG NEWS Analysis

This achievement reinforces India’s growing presence in high-impact scientific research and underscores the strategic importance of investing in advanced materials science, nanotechnology, semiconductor research, and artificial intelligence.

As nations worldwide compete to develop the next generation of computing infrastructure, breakthroughs such as this position Indian researchers as important contributors to technologies that could influence future AI systems, supercomputers, intelligent communication networks, and energy-efficient digital infrastructure.

While commercial deployment remains several years away, the findings provide compelling evidence that brain-inspired spintronic hardware could help overcome the growing performance and energy limitations of today’s semiconductor technologies.

The research paper, **“Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing,”** has been published in **Nature Nanotechnology**, one of the world’s leading peer-reviewed journals in nanoscience and nanotechnology, marking a significant milestone in the global pursuit of sustainable, intelligent computing.

Media/Publication	**PrameyaNews.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar scientist achieves major breakthrough towards faster, smarter and energy-efficient computing**		
Link	https://www.prameyanews.com/iit-bhubaneswar-scientist-achieves-major-breakthrough-towards-faster-smarter-and-energy-efficient-computing		

Imagine computers that can solve difficult problems much faster while consuming only a fraction of the energy used by today's machines. A major step toward that future has now been achieved by an international team of scientists, including researchers from the Indian Institute of Technology (IIT) Bhubaneswar.

The team has reported a landmark discovery in the prestigious journal Nature Nanotechnology, demonstrating the world's largest synchronized network of more than 100,000 nanoscale spintronic oscillators—tiny magnetic devices that can work together like a perfectly coordinated orchestra.

Unlike conventional computer chips that process information sequentially, these miniature devices naturally synchronize with one another within only 45 billionths of a second (45 nanoseconds). Working together, they can process information extremely quickly while consuming far less energy than today's electronic technologies.

This achievement represents a giant leap in the development of next-generation computing hardware. The synchronized network is nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications.

Researchers used advanced microwave and optical microscopy techniques to directly observe how thousands of these tiny devices spontaneously organized into a single synchronized state. The study confirms that even extremely large networks can coordinate remarkably fast, opening exciting possibilities for future computing systems.

Although the technology is still at the research stage, it has the potential to transform many areas of everyday life. Future applications may include (i) Faster and energy-efficient artificial intelligence (AI), (ii) Smarter communication networks, (iii) Real-time data analysis, (iv) Financial modelling and optimization, (v) Intelligent transportation systems, and (vi) Scientific simulations that require enormous computing power.

Dr. Nilamani Behera, Assistant Professor in the Department of Physics at IIT Bhubaneswar and one of the lead authors of the study, said:"The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronize in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient."

The research was carried out through an international collaboration involving the University of Gothenburg (Sweden), IIT Bhubaneswar (India), and Tohoku University (Japan).

The findings not only advance the fundamental understanding of how large networks of interacting nanoscale devices behave but also provide an important foundation for developing future computing technologies inspired by the human brain. Such hardware could help overcome the growing energy and performance limitations of conventional computers, paving the way for the next generation of intelligent computing systems.

The research paper, titled "Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing," has been published in Nature Nanotechnology, one of the world's leading journals in nanoscience and nanotechnology.

Media/Publication	**OdishaBytes.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar Scientist Among Team Of Researchers To Achieve Major Breakthrough Towards Faster Computing**		
Link	https://odishabytes.com/iit-bhubaneswar-scientist-among-team-of-researchers-to-achieve-major-breakthrough-towards-faster-computing/		

Bhubaneswar: An international team of scientists, including researchers from Indian Institute of Technology (IIT) Bhubaneswar, has achieved a landmark breakthrough demonstrating the world’s largest synchronised network of more than 100,000 nanoscale spintronic oscillators — tiny magnetic devices that can work together like a perfectly coordinated orchestra.

The research paper, titled ‘Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing’, has been published in Nature Nanotechnology, a leading journal in nanoscience and nanotechnology.

The research was carried out through a collaboration involving IIT Bhubaneswar, University of Gothenburg (Sweden) and Tohoku University (Japan).

Dr Nilamani Behera, Assistant Professor in Department of Physics at IIT Bhubaneswar, is one of the lead authors of the study.

“The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronise in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient,” said Dr Behera.

Unlike conventional computer chips that process information sequentially, these miniature devices synchronise naturally with one another within only 45 billionths of a second (45 nanoseconds). They can process information extremely quickly while consuming far less energy than today’s electronic technologies.

It marks a giant leap in the development of next-generation computing hardware, with the synchronised network being nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications.

The technology is at the research stage, but it has the potential to transform many areas of everyday life. Future applications may include — (i) Faster and energy-efficient artificial intelligence (AI); (ii) Smarter communication networks; (iii) Real-time data analysis; (iv) Financial modelling and optimisation; (v) Intelligent transportation systems; (vi) Scientific simulations that require enormous computing power.

Media/Publication	**Pragativadi.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar Scientist Achieves Breakthrough in Energy-Efficient Computing**		
Link	https://pragativadi.com/iit-bhubaneswar-scientist-achieves-breakthrough-in-energy-efficient-computing/		

International research team, including IIT Bhubaneswar scientist, publishes landmark study in Nature Nanotechnology

Imagine computers that can solve difficult problems much faster while consuming only a fraction of the energy used by today's machines. A major step toward that future has now been achieved by an international team of scientists, including researchers from the Indian Institute of Technology (IIT) Bhubaneswar.

The team has reported a landmark discovery in the prestigious journal Nature Nanotechnology, demonstrating the world's largest synchronised network of more than 100,000 nanoscale spintronic oscillators—tiny magnetic devices that can work together like a perfectly coordinated orchestra.

Unlike conventional computer chips that process information sequentially, these miniature devices naturally synchronise with one another within only 45 billionths of a second (45 nanoseconds). Working together, they can process information extremely quickly while consuming far less energy than today's electronic technologies.

This achievement represents a giant leap in the development of next-generation computing hardware. The synchronised network is nearly 1,000 times larger than previously demonstrated coherent spintronic systems, proving that such technology can be scaled up for practical applications.

Researchers used advanced microwave and optical microscopy techniques to directly observe how thousands of these tiny devices spontaneously organised into a single synchronised state. The study confirms that even extremely large networks can coordinate remarkably fast, opening exciting possibilities for future computing systems.

Although the technology is still at the research stage, it has the potential to transform many areas of everyday life. Future applications may include (i) Faster and energy-efficient artificial intelligence (AI), (ii) Smarter communication networks, (iii) Real-time data analysis, (iv) Financial modelling and optimisation, (v) Intelligent transportation systems, and (vi) Scientific simulations that require enormous computing power.

Dr Nilamani Behera, Assistant Professor in the Department of Physics at IIT Bhubaneswar and one of the lead authors of the study, said: *“The demand for computing power is growing rapidly, especially with the rise of artificial intelligence. Our work demonstrates that very large networks of nanoscale magnetic devices can naturally synchronise in just a few billionths of a second. This opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient.”*

The research was carried out through an international collaboration involving the University of Gothenburg (Sweden), IIT Bhubaneswar (India), and Tohoku University (Japan).

The findings not only advance the fundamental understanding of how large networks of interacting nanoscale devices behave but also provide an important foundation for developing future computing technologies inspired by the human brain. Such hardware could help overcome the growing energy and performance limitations of conventional computers, paving the way for the next generation of intelligent computing systems.

The research paper, titled “Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing,” has been published in Nature Nanotechnology, one of the world’s leading journals in nanoscience and nanotechnology.

भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर
Indian Institute of Technology Bhubaneswar

Media/Publication	**The Pioneer**		
Date	**14th July 2026**	**Language**	**English**
Headline	**IITBBS scientist part of new Next-G computing**		

IIT BBS scientist part of new Next-G computing

Study shows world's largest synchronised network of over 1L spintronic oscillators

PNS ■ Bhubaneswar

An international team of scientists, including researchers from the Indian Institute of Technology (IIT) Bhubaneswar, has achieved a major breakthrough towards faster, smarter and energy-efficient computing. The findings, published in Nature Nanotechnology, demonstrate the world's largest synchronised network of more than 100,000 nanoscale spintronic oscillators, tiny magnetic devices that work together like a coordinated orchestra.

Unlike conventional computer chips that process information sequentially, these devices naturally synchronise within 45 billionths of a second (45 nanoseconds), enabling extremely fast information processing while consuming only a fraction of the energy used by today's electronic technologies.

The synchronised network is nearly 1,000 times larger than previously demonstrated coherent spintronic systems, marking a major advance towards practical next-generation computing hardware. Using advanced microwave and optical microscopy techniques, researchers directly observed thousands of the devices spontaneously organising into a single synchronized state, confirming that even ultra-large networks can coordinate remarkably fast.

Although still at the research stage, the technology could transform artificial intelligence (AI), smarter communication networks, real-time data analysis, financial modelling and optimisation, intelligent transportation systems, and scientific simulations requiring enormous computing power.

One of the study's lead authors and IIT Bhubaneswar Department of Physics Assistant Professor Dr Nilamani Behera, said the growing demand for computing power, especially with the rise of AI, requires new approaches. He said the research demonstrates that very large networks of nanoscale magnetic devices can naturally synchronise within a few billionths of a second, opening possibilities for computing technologies that are faster and far more energy-efficient.

The study was conducted through an international collaboration involving the University of Gothenburg (Sweden), IIT Bhubaneswar (India), and Tohoku University (Japan).

Besides advancing the fundamental understanding of how large networks of interacting nanoscale devices behave, the findings provide an important foundation for developing brain-inspired computing technologies that could overcome the growing energy and performance limitations of conventional computers.

The research paper, "Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing," has been published in Nature Nanotechnology, one of the world's leading journals in nanoscience and nanotechnology.

Media/Publication	**OdishaStand.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**Thermal hotspots expanding by 2 to 9 percent annually in parts of Odisha**		
Link	**https://odishastand.com/iit-bhubaneswar-spintronic-oscillator-network-nature-nanotechnology-computing-breakthrough**		

In a development that could radically redefine the future of digital processing, an international team of scientists—including researchers from the Indian Institute of Technology (IIT) Bhubaneswar—has engineered a massive, self-synchronizing nano-network capable of processing data at blazing speeds with unprecedented energy efficiency. Published today in the world-renowned scientific journal *Nature Nanotechnology*, the landmark study details the successful coordination of over 100,000 nanoscale spintronic oscillators. These sub-microscopic magnetic devices operate in unison, mimicking the harmonious, collective behavior of a massive orchestra.

Traditional computer hardware relies on silicon transistors that process information sequentially, a method that creates significant energy bottlenecks. In stark contrast, these spintronic nano-devices utilize intrinsic magnetic properties to spontaneously synchronize with one another in just 45 nanoseconds (billionths of a second). By working simultaneously rather than in a sequence, the ultra-large network handles complex data processing tasks in a fraction of the time, consuming only a sliver of the power required by modern electronic chips. Furthermore, this achievement scales the technology to a level nearly 1,000 times larger than any previously recorded coherent spintronic system, proving that brain-inspired, unconventional computing hardware can transition from theoretical physics to practical engineering.

The research team deployed state-of-the-art microwave techniques and advanced optical microscopy to visually track and verify the exact moment thousands of individual nano-oscillators locked into a singular, synchronized state. This rapid phase ordering across such a massive grid proves that massive networks can maintain lightning-fast coordination. While currently localized to laboratory environments, the scaling milestone lays the groundwork for transformative applications across everyday industries. The technology is expected to drive high-speed, low-power Artificial Intelligence (AI) models, optimize intelligent transit frameworks, power real-time big data analytics, streamline complex financial market forecasting and accelerate compute-heavy scientific simulations.

Dr. Nilamani Behera, Assistant Professor in the Department of Physics at IIT Bhubaneswar and a lead author of the study, emphasized the shifting paradigm in hardware requirements. He explained that as the global appetite for raw processing power escalates alongside the rise of artificial intelligence, their work proves that extensive networks of nanoscale magnetic systems can naturally align in mere billionths of a second. This biological-like synchronization, he noted, opens immediate pathways toward creating computer systems that are fundamentally faster and vastly more sustainable.

This breakthrough represents a multi-year global effort uniting the University of Gothenburg in Sweden, IIT Bhubaneswar in India and Tohoku University in Japan. By mapping out how immense webs of interacting nanoscale components communicate, the collaboration provides a critical blueprint for neuromorphic hardware designed to emulate the human brain's efficiency. The full study, titled "Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing," is available to the scientific community and public via *Nature Nanotechnology* at https://www.nature.com/articles/s41565-026-02216-y.

Media/Publication	**OdishaHaat.com**		
Date	**13th July 2026**	**Language**	**English**
Headline	**IIT Bhubaneswar Scientist Cohorts in Landmark Nature Nanotechnology Study for Energy-Efficient Spintronic Computing**		
Link	**https://odishahaat.com/iit-bhubaneswar-scientist-breakthrough-nature-nanotechnology-spintronic-computing**		

Imagine computers capable of solving complex problems at lightning speeds while consuming only a fraction of the energy required by today's machines. A massive stride toward this future has been achieved by an international team of scientists, including researchers from the Indian Institute of Technology (IIT) Bhubaneswar. The team has reported a landmark discovery in the prestigious journal *Nature Nanotechnology*, demonstrating the world's largest synchronized network of more than 100,000 nanoscale spintronic oscillators. These tiny magnetic devices are capable of working together in perfect coordination, much like a finely tuned orchestra.

Unlike conventional computer chips that process information sequentially, these miniature devices naturally synchronize with one another within a mere 45 billionths of a second (45 nanoseconds). Working in tandem, they process information extremely quickly while operating on a highly reduced energy footprint compared to today's standard electronic technologies. This achievement represents a giant leap forward in the development of next-generation computing hardware. Crucially, this synchronized network is nearly 1,000 times larger than any previously demonstrated coherent spintronic system, proving for the first time that such technology can be scaled up for practical, real-world applications.

To validate their findings, the researchers utilized advanced microwave and optical microscopy techniques to directly observe how thousands of these tiny devices spontaneously organized themselves into a single, synchronized state. The study confirms that even exceptionally large networks can coordinate remarkably fast, opening exciting possibilities for future computing architectures. Although the technology is still in its research stage, it holds the potential to transform numerous areas of everyday life. Future applications may include faster and energy-efficient artificial intelligence (AI), smarter communication networks, real-time data analysis, financial modelling and optimization, intelligent transportation systems and scientific simulations that require massive computing power.

Dr. Nilamani Behera, Assistant Professor in the Department of Physics at IIT Bhubaneswar and one of the lead authors of the study, highlighted the significance of the breakthrough, stating that the demand for computing power is growing rapidly, especially with the rise of artificial intelligence. He noted that their work demonstrates how very large networks of nanoscale magnetic devices can naturally synchronize in just a few billionths of a second, which opens exciting possibilities for developing future computing technologies that are both faster and far more energy-efficient.

The groundbreaking research was carried out through a high-level international collaboration involving the University of Gothenburg in Sweden, IIT Bhubaneswar in India and Tohoku University in Japan. The findings not only advance the fundamental scientific understanding of how large networks of interacting nanoscale devices behave, but they also provide an important foundation for developing future computing technologies inspired by the human brain. Such neuromorphic hardware could help overcome the growing energy and performance limitations of conventional computers, effectively paving the way for the next generation of intelligent computing systems. The research paper, titled "Nanosecond Phase Ordering in Ultra-large Spin Hall Nano-oscillator Lattices for Unconventional Computing," is officially published and accessible in *Nature Nanotechnology* at https://www.nature.com/articles/s41565-026-02216-y.

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Indian Institute of Technology Bhubaneswar

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ସ୍ମାର୍ଟ-ଶକ୍ତି ଓ ଦକ୍ଷ କମ୍ପ୍ୟୁଟିଂରେ ଆଇଆଇଟି ବୈଜ୍ଞାନିକଙ୍କ ସଫଳତା

■ ଜଟଣୀ,ତା୧୩।୭(ପିଏନଏସ)

ଭାରତୀୟ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ସଂସ୍ଥାନ (ଆଇଆଇଟି) ଭୁବନେଶ୍ୱରର ଗବେଷକଙ୍କ ସମେତ ବୈଜ୍ଞାନିକମାନଙ୍କ ଏକ ଅନ୍ତର୍ଜାତୀୟ ଦଳ ଦ୍ୱାରା କମ୍ପ୍ୟୁଟର ଭବିଷ୍ୟତ ଆଡ଼କୁ ଏକ ପ୍ରମୁଖ ପଦକ୍ଷେପ ହାସଲ କରାଯାଇଛି। ଏପରି କମ୍ପ୍ୟୁଟର ଯାହା ଆଜିର ମେସିନଗୁଡ଼ିକ ଦ୍ୱାରା ବ୍ୟବହୃତ ଶକ୍ତିର ଏକ ଅଂଶ ମାତ୍ର ବ୍ୟବହାର କରି କଷ୍ଟକର ସମସ୍ୟାଗୁଡ଼ିକୁ ବହୁତ ଶୀଘ୍ର ସମାଧାନ କରିପାରିବ। ଗବେଷକଙ୍କ ଏହି ଦଳ ପ୍ରତିଷ୍ଠିତ ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି ପତ୍ରିକାରେ ଏକ ଐତିହାସିକ ଆବିଷ୍କାର ରିପୋର୍ଟ କରିଛି, ଯେଉଁଥିରେ ୧୦୦,୦୦୦ରୁ ଅଧିକ ନାନୋସ୍କେଲ୍ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ଅସିଲେଟରର ବିଶ୍ୱର ସର୍ବବୃହତ ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କ ପ୍ରଦର୍ଶନ କରାଯାଇଛି - ଛୋଟ ଚୁମ୍ବକୀୟ ଉପକରଣ ଯାହା ଏକ ସଂପୂର୍ଣ୍ଣ ସମନ୍ୱିତ ଅର୍କେଷ୍ଟ୍ରା ପରି ଏକାଠି କାମ କରିପାରିବ।

ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟର ଚିପ୍ସ ପରି ନୁହେଁ, ଯାହା ସୂଚନାକୁ କ୍ରମାନୁସାରେ ପ୍ରକ୍ରିୟାକରଣ କରେ, ଏହି କ୍ଷୁଦ୍ର ଉପକରଣଗୁଡ଼ିକ ସ୍ୱାଭାବିକ ଭାବରେ କେବଳ ଏକ ସେକେଣ୍ଡର ୪୫ ବିଲିୟନ ଅଂଶ (୪୫ ନାନୋସେକେଣ୍ଡ) ମଧ୍ୟରେ ପରସ୍ପର ସହିତ ସମନ୍ୱିତ ହୁଏ। ଏକାଠି କାମ କରି, ସେମାନେ ଆଜିର ଇଲେକ୍ଟ୍ରୋନିକ୍ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ତୁଳନାରେ ବହୁତ କମ୍ ଶକ୍ତି ବ୍ୟବହାର କରି ସୂଚନାକୁ ଅତ୍ୟନ୍ତ ଶୀଘ୍ର ପ୍ରକ୍ରିୟାକରଣ କରିପାରିବେ। ଏହି ସଫଳତା ପରବର୍ତ୍ତୀ ପିଢ଼ିର କମ୍ପ୍ୟୁଟିଂ ହାର୍ଡୱେୟାର ବିକାଶରେ ଏକ ବିରାଟ ଲମ୍ଫ ପ୍ରତିନିଧିତ୍ୱ କରେ। ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ନେଟୱାର୍କ ପୂର୍ବରୁ ପ୍ରଦର୍ଶିତ ସୁସଙ୍ଗତ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ସିଷ୍ଟମ ଅପେକ୍ଷା ପ୍ରାୟ ୧୦୦୦ ଗୁଣ ବଡ଼, ଏହା ପ୍ରମାଣିତ କରେ ଯେ ଏପରି ପ୍ରଯୁକ୍ତିବିଦ୍ୟାକୁ ବ୍ୟବହାରିକ ପ୍ରୟୋଗ ପାଇଁ ବୃଦ୍ଧି କରାଯାଇପାରିବ।

ଗବେଷକମାନେ ଉନ୍ନତ ମାଇକ୍ରୋୱେଭ୍ ଓ ଅପ୍ଟିକାଲ୍ ମାଇକ୍ରୋସ୍କୋପି କୌଶଳ ବ୍ୟବହାର କରି ସିଧାସଳଖ ପର୍ଯ୍ୟବେକ୍ଷଣ କରିଛନ୍ତି ଯେ କିପରି ହଜାର ହଜାର କ୍ଷୁଦ୍ର ଉପକରଣ ସ୍ୱତଃସ୍ଫୂର୍ତ୍ତ ଭାବରେ ଏକ ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ଅବସ୍ଥାରେ ସଂଗଠିତ ହୋଇଛି। ଏହି ଅଧ୍ୟୟନ ନିଶ୍ଚିତ କରେ ଯେ ଅତ୍ୟନ୍ତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ମଧ୍ୟ ଉଲ୍ଲେଖନୀୟ ଭାବରେ ଦ୍ରୁତ ଗତିରେ ସମନ୍ୱୟ ସ୍ଥାପନ କରିପାରିବେ, ଯାହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ଉତ୍ସାହଜନକ ସମ୍ଭାବନା ଖୋଲିଥାଏ। ଯଦିଓ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ଏପର୍ଯ୍ୟନ୍ତ ଗବେଷଣା ପର୍ଯ୍ୟାୟରେ ଅଛି, ଏଥିରେ ଦୈନନ୍ଦିନ ଜୀବନର ଅନେକ କ୍ଷେତ୍ରକୁ ପରିବର୍ତ୍ତନ କରିବାର ସମ୍ଭାବନା ଅଛି। ଭବିଷ୍ୟତର ପ୍ରୟୋଗଗୁଡ଼ିକରେ ଦ୍ରୁତ ଏବଂ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତା (ଏଆଇ), ସ୍ମାର୍ଟ ଯୋଗାଯୋଗ ନେଟୱାର୍କ, ବାସ୍ତବ-ସମୟ ତଥ୍ୟ ବିଶ୍ଳେଷଣ, ଆର୍ଥିକ ମଡେଲିଂ ଏବଂ ଅପ୍ଟିମାଇଜେସନ୍, ବୁଦ୍ଧିମାନ ପରିବହନ ବ୍ୟବସ୍ଥା, ଏବଂ ବୈଜ୍ଞାନିକ ସିମୁଲେସନ୍ ଅନ୍ତର୍ଭୁକ୍ତ ହୋଇପାରେ ଯାହା ପାଇଁ ପ୍ରଚୁର କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତି ଆବଶ୍ୟକ। ଭୁବନେଶ୍ୱର ଆଇଆଇଟିର ପଦାର୍ଥ ବିଜ୍ଞାନ ବିଭାଗର ସହକାରୀ ପ୍ରଫେସର ଓ ଅଧ୍ୟୟନର ପ୍ରମୁଖ ଲେଖକ ଡକ୍ଟର ନୀଳମଣି ବେହେରା କହିଛନ୍ତି କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତିର ଚାହିଦା ଦ୍ରୁତଗତିରେ ବଢୁଛି, ବିଶେଷକରି କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତାର ବୃଦ୍ଧି ସହିତ ଆମର କାର୍ଯ୍ୟ ଦର୍ଶାଉଛି ଯେ, ନାନୋସ୍କେଲ ଚୁମ୍ବକୀୟ ଉପକରଣର ବହୁତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ପ୍ରାକୃତିକ ଭାବରେ ମାତ୍ର କିଛି ବିଲିୟନ ଅଂଶରେ ସମନ୍ୱିତ ହୋଇପାରେ। ଏହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଆକର୍ଷଣୀୟ ସମ୍ଭାବନା ଖୋଲିଥାଏ ଯାହା ଦ୍ରୁତ ଏବଂ ବହୁତ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ ଏହି ଗବେଷଣା ଗୋଥେନବର୍ଗ ବିଶ୍ୱବିଦ୍ୟାଳୟ(ସ୍ୱିଡେନ), ଆଇଆଇଟି ଭୁବନେଶ୍ୱର (ଭାରତ) ଓ ଟୋହୋକୁ ବିଶ୍ୱବିଦ୍ୟାଳୟ (ଜାପାନ) ସହିତ ଜଡିତ ଏକ ଅନ୍ତର୍ଜାତୀୟ ସହଯୋଗ ମାଧ୍ୟମରେ କରାଯାଇଥିଲା। ଏହି ଫଳାଫଳଗୁଡ଼ିକ ନାନୋସ୍କେଲ୍ ଡିଭାଇସଗୁଡ଼ିକର ବଡ଼ ନେଟୱାର୍କ କିପରି ଆଚରଣ କରେ ତାହାର ମୌଳିକ ବୁଝାମଣାକୁ କେବଳ ଆଗକୁ ବଢାଇ ନାହିଁ ବରଂ ମାନବ ମସ୍ତିଷ୍କ ଦ୍ୱାରା ପ୍ରେରିତ ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଭିତ୍ତିଭୂମି ପ୍ରଦାନ କରେ। ଏପରି ହାର୍ଡୱେର୍ ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟରଗୁଡ଼ିକର ବର୍ଦ୍ଧିତ ଶକ୍ତି ଓ କାର୍ଯ୍ୟଦକ୍ଷତା ସୀମାକୁ ଦୂର କରିବାରେ ସାହାଯ୍ୟ କରିପାରେ। ପରବର୍ତ୍ତୀ ପିଢ଼ିର ବୁଦ୍ଧିମାନ କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ପଥ ପ୍ରଶସ୍ତ କରିଥାଏ। ନାନୋସେକେଣ୍ଡ ଫେଜ୍ ଅର୍ଡରିଂ ଇନ୍ ଅଲଟ୍ରା-ଲାର୍ଜ ସ୍ପିନ୍ ହଲ୍ ନାନୋ-ଅସିଲେଟର୍ଲାଟିସେସ୍ ଅର୍ନକନଭେନସଲ୍ କଂପ୍ୟୁଟିଂ ଶୀର୍ଷକ ଗବେଷଣା ପତ୍ର ନାନୋସାଇନ୍ସ ଓ ନାନୋଟେକ୍ନୋଲୋଜିରେ ବିଶ୍ୱର ପ୍ରମୁଖ ପତ୍ରିକା ମଧ୍ୟରୁ ଗୋଟିଏ, ନେଚର ନାନୋଟେକ୍ନୋଲୋଜିରେ ପ୍ରକାଶିତ ହୋଇଛି।

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ଦ୍ରୁତ, ସ୍ମାର୍ଟ ଏବଂ ଶକ୍ତି–ଦକ୍ଷ କମ୍ପ୍ୟୁଟିଂ ଦିଗରେ

ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ବୈଜ୍ଞାନିକଙ୍କ ପ୍ରମୁଖ ସଫଳତା

ଭୁବନେଶ୍ୱର,୧୩।୭ (ନି.ପ୍ର) : କଳ୍ପନା କରନ୍ତୁ ଏପରି କମ୍ପ୍ୟୁଟର ଯାହା ଆଜିର ମେସିନଗୁଡ଼ିକ ଦ୍ୱାରା ବ୍ୟବହୃତ ଶକ୍ତିର ଏକ ଅଂଶ ମାତ୍ର ବ୍ୟବହାର କରି କଷ୍ଟକର ସମସ୍ୟାଗୁଡ଼ିକୁ ବହୁତ ଶୀଘ୍ର ସମାଧାନ କରିପାରିବ। ଭାରତୀୟ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ସଂସ୍ଥାନ (ଆଇଆଇଟି) ଭୁବନେଶ୍ୱରର ଗବେଷକମାନଙ୍କ ସମେତ ବୈଜ୍ଞାନିକମାନଙ୍କ ଏକ ଆନ୍ତର୍ଜାତୀୟ ଦଳ ଦ୍ୱାରା ସେହି ଭବିଷ୍ୟତ ଆଡ଼କୁ ଏକ ପ୍ରମୁଖ ପଦକ୍ଷେପ ହାସଲ କରାଯାଇଛି।

ଗବେଷକଙ୍କ ଏହି ଦଳ ପ୍ରତିଷ୍ଠିତ ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି ପତ୍ରିକାରେ ଏକ ଐତିହାସିକ ଆବିଷ୍କାର ରିପୋର୍ଟ କରିଛି, ଯେଉଁଥିରେ ୧୦୦,୦୦୦ ରୁ ଅଧିକ ନାନୋସ୍କେଲ୍ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ଅସିଲେଟରର ବିଶ୍ୱର ସର୍ବବୃହତ ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କ ପ୍ରଦର୍ଶନ କରାଯାଇଛି - ଛୋଟ ଚୁମ୍ବକୀୟ ଉପକରଣ ଯାହା ଏକ ସମ୍ପୂର୍ଣ୍ଣ ସମନ୍ୱିତ ଅର୍କେଷ୍ଟ୍ରା ପରି ଏକାଠି କାମ କରିପାରିବ। ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟର ଚିପ୍ସ ପରି ନୁହେଁ ଯାହା ସୂଚନାକୁ କ୍ରମାନୁସାରେ ପ୍ରକ୍ରିୟାକରଣ କରେ, ଏହି କ୍ଷୁଦ୍ର ଉପକରଣଗୁଡ଼ିକ ସ୍ୱାଭାବିକ ଭାବରେ କେବଳ ଏକ ସେକେଣ୍ଡର ୪୫ ବିଲିୟନ ଅଂଶ (୪୫ ନାନୋସେକେଣ୍ଡ) ମଧ୍ୟରେ ପରସ୍ପର ସହିତ ସମନ୍ୱିତ ହୁଏ। ଏକାଠି କାମ କରି, ସେମାନେ ଆଜିର ଇଲେକ୍ଟ୍ରୋନିକ୍ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ତୁଳନାରେ ବହୁତ କମ୍ ଶକ୍ତି ବ୍ୟବହାର କରି ସୂଚନାକୁ ଅତ୍ୟନ୍ତ ଶୀଘ୍ର ପ୍ରକ୍ରିୟାକରଣ କରିପାରିବେ।

ଏହି ସଫଳତା ପରବର୍ତ୍ତୀ ପିଢ଼ିର କମ୍ପ୍ୟୁଟିଂ ହାର୍ଡୱେୟାର ବିକାଶରେ ଏକ ବିରାଟ ଲମ୍ଫ ପ୍ରତିନିଧିତ୍ୱ କରେ। ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ନେଟୱାର୍କ ପୂର୍ବରୁ ପ୍ରଦର୍ଶିତ ସୁସଙ୍ଗତ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ସିଷ୍ଟମ ଅପେକ୍ଷା ପ୍ରାୟ ୧୦୦୦ ଗୁଣ ବଡ଼, ଏହା ପ୍ରମାଣିତ କରେ ଯେ ଏପରି ପ୍ରଯୁକ୍ତିବିଦ୍ୟାକୁ ବ୍ୟବହାରିକ ପ୍ରୟୋଗ ପାଇଁ ବୃଦ୍ଧି କରାଯାଇପାରିବ।

ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ପଦାର୍ଥ ବିଜ୍ଞାନ ବିଭାଗର ସହକାରୀ ପ୍ରଫେସର ଏବଂ ଅଧ୍ୟୟନର ପ୍ରମୁଖ ଲେଖକ ଡକ୍ଟର ନୀଳମଣି ବେହେରା କହିଛନ୍ତି: କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତିର ଚାହିଦା ଦ୍ରୁତ ଗତିରେ ବଢ଼ୁଛି, ବିଶେଷକରି କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତାର ବୃଦ୍ଧି ସହିତ। ଆମର କାର୍ଯ୍ୟ ଦର୍ଶାଉଛି ଯେ ନାନୋସ୍କେଲ ଚୁମ୍ବକୀୟ ଉପକରଣର ବହୁତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ପ୍ରାକୃତିକ ଭାବରେ ମାତ୍ର କିଛି ବିଲିୟନ ଅଂଶରେ ସମନ୍ୱିତ ହୋଇପାରେ। ଏହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଆକର୍ଷଣୀୟ ସମ୍ଭାବନା ଖୋଲିଥାଏ ଯାହା ଦ୍ରୁତ ଏବଂ ବହୁତ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ। ଏହି ଗବେଷଣା ଗୋଥେନବର୍ଗ ବିଶ୍ୱବିଦ୍ୟାଳୟ (ସ୍ୱିଡେନ), ଆଇଆଇଟି ଭୁବନେଶ୍ୱର (ଭାରତ) ଏବଂ ଟୋହୋକୁ ବିଶ୍ୱବିଦ୍ୟାଳୟ (ଜାପାନ) ସହିତ ଜଡିତ ଏକ ଆନ୍ତର୍ଜାତୀୟ ସହଯୋଗ ମାଧ୍ୟମରେ କରାଯାଇଥିଲା।

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ଦ୍ରୁତ, ସ୍ମାର୍ଟ ଓ ଶକ୍ତି-ଦକ୍ଷ କମ୍ପ୍ୟୁଟିଂ ଦିଗରେ

ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ବୈଜ୍ଞାନିକଙ୍କ ପ୍ରମୁଖ ସଫଳତା

ଜଟଣୀ,(ନି.ସୂ),୧୩।୦୭: କଳ୍ପନା କରନ୍ତୁ ଏପରି କମ୍ପ୍ୟୁଟର ଯାହା ଆଜିର ମେସିନଗୁଡ଼ିକ ଦ୍ୱାରା ବ୍ୟବହୃତ ଶକ୍ତିର ଏକ ଅଂଶ ମାତ୍ର ବ୍ୟବହାର କରି କଷ୍ଟକର ସମସ୍ୟାଗୁଡ଼ିକୁ ବହୁତ ଶୀଘ୍ର ସମାଧାନ କରିପାରିବ। ଭାରତୀୟ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ସଂସ୍ଥାନ (ଆଇଆଇଟି) ଭୁବନେଶ୍ୱରର ଗବେଷକମାନଙ୍କ ସମେତ ବୈଜ୍ଞାନିକମାନଙ୍କ ଏକ ଆନ୍ତର୍ଜାତୀୟ ଦଳ ଦ୍ୱାରା ସେହି ଭବିଷ୍ୟତ ଆଡ଼କୁ ଏକ ପ୍ରମୁଖ ପଦକ୍ଷେପ ହାସଲ କରାଯାଇଛି।

ଗବେଷକଙ୍କ ଏହି ଦଳଟି ପ୍ରତିଷ୍ଠିତ ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି ପତ୍ରିକାରେ ଏକ ଐତିହାସିକ ଆବିଷ୍କାର ରିପୋର୍ଟ କରିଛି, ଯେଉଁଥିରେ ୧୦୦,୦୦୦ ରୁ ଅଧିକ ନାନୋସ୍କେଲ୍ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ଅସିଲେଟରର ବିଶ୍ୱର ସର୍ବବୃହତ ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କ ପ୍ରଦର୍ଶନ କରାଯାଇଛି - ଛୋଟ ଚୁମ୍ବକୀୟ ଉପକରଣ ଯାହା ଏକ ସମ୍ପୂର୍ଣ୍ଣ ସମନ୍ୱିତ ଅର୍କେଷ୍ଟ୍ରା ପରି ଏକାଠି କାମ କରିପାରିବ। ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟର ଚିପ୍ସ ପରି ନୁହେଁ ଯାହା ସୂଚନାକୁ କ୍ରମାନୁସାରେ ପ୍ରକ୍ରିୟାକରଣ କରେ, ଏହି କ୍ଷୁଦ୍ର ଉପକରଣଗୁଡ଼ିକ ସ୍ୱାଭାବିକ ଭାବରେ କେବଳ ଏକ ସେକେଣ୍ଡର ୪୫ ବିଲିୟନ ଅଂଶ (୪୫ ନାନୋସେକେଣ୍ଡ) ମଧ୍ୟରେ ପରସ୍ପର ସହିତ ସମନ୍ୱିତ ହୁଏ। ଏକାଠି କାମ କରି, ସେମାନେ ଆଜିର ଇଲେକ୍ଟ୍ରୋନିକ୍ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ତୁଳନାରେ ବହୁତ କମ୍ ଶକ୍ତି ବ୍ୟବହାର କରି ସୂଚନାକୁ ଅତ୍ୟନ୍ତ ଶୀଘ୍ର ପ୍ରକ୍ରିୟାକରଣ କରିପାରିବେ।ଏହି ସଫଳତା ପରବର୍ତ୍ତୀ ପିଢ଼ିର କମ୍ପ୍ୟୁଟିଂ ହାର୍ଡୱେୟାର ବିକାଶରେ ଏକ ବିରାଟ ଲମ୍ଫ ପ୍ରତିନିଧିତ୍ୱ କରେ। ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ନେଟୱାର୍କ ପୂର୍ବରୁ ପ୍ରଦର୍ଶିତ ସୁସଙ୍ଗତ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ସିଷ୍ଟମ ଅପେକ୍ଷା ପ୍ରାୟ ୧୦୦୦ ଗୁଣ ବଡ଼, ଏହା ପ୍ରମାଣିତ କରେ ଯେ ଏପରି ପ୍ରଯୁକ୍ତିବିଦ୍ୟାକୁ ବ୍ୟବହାରିକ ପ୍ରୟୋଗ ପାଇଁ ବୃଦ୍ଧି କରାଯାଇପାରିବ। ଗବେଷକମାନେ ଉନ୍ନତ ମାଇକ୍ରୋୱେଭ୍ ଏବଂ ଅପ୍ଟିକାଲ୍ ମାଇକ୍ରୋସ୍କୋପି କୌଶଳ ବ୍ୟବହାର କରି ସିଧାସଳଖ ପର୍ଯ୍ୟବେକ୍ଷଣ କରିଛନ୍ତି ଯେ କିପରି ହଜାର ହଜାର କ୍ଷୁଦ୍ର ଉପକରଣ ସ୍ୱତଃସ୍ଫୂର୍ତ୍ତ ଭାବରେ ଏକ ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ଅବସ୍ଥାରେ ସଂଗଠିତ ହୋଇଛି। ଏହି ଅଧ୍ୟୟନ ନିଶ୍ଚିତ କରେ ଯେ ଅତ୍ୟନ୍ତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ମଧ୍ୟ ଉଲ୍ଲେଖନୀୟ ଭାବରେ ଦ୍ରୁତ ଗତିରେ ସମନ୍ୱୟ ସ୍ଥାପନ କରିପାରିବେ, ଯାହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ଉତ୍ସାହଜନକ ସମ୍ଭାବନା ଖୋଲିଥାଏ। ଯଦିଓ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ଏପର୍ଯ୍ୟନ୍ତ ଗବେଷଣା ପର୍ଯ୍ୟାୟରେ ଅଛି, ଏଥିରେ ଦୈନନ୍ଦିନ ଜୀବନର ଅନେକ କ୍ଷେତ୍ରକୁ ପରିବର୍ତ୍ତନ କରିବାର ସମ୍ଭାବନା ଅଛି। ଭବିଷ୍ୟତର ପ୍ରୟୋଗଗୁଡ଼ିକରେ (ସ) ଦ୍ରୁତ ଏବଂ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତା (ଇଓ), (ସସ) ସ୍ମାର୍ଟ ଯୋଗାଯୋଗ ନେଟୱାର୍କ, (ସସସ) ବାସ୍ତବ-ସମୟ ତଥ୍ୟ ବିଶ୍ଳେଷଣ, (ସଙ୍ଖ) ଆର୍ଥିକ ମଡେଲିଂ ଏବଂ ଅପ୍ଟିମାଇଜେସନ୍, (ଙ୍ଖ) ବୁଦ୍ଧିମାନ ପରିବହନ ବ୍ୟବସ୍ଥା, ଏବଂ (ଙ୍ଖସ) ବୈଜ୍ଞାନିକ ସିମୁଲେସନ୍ ଅନ୍ତର୍ଭୁକ୍ତ ହୋଇପାରେ ଯାହା ପାଇଁ ପ୍ରଚୁର କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତି ଆବଶ୍ୟକ। ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ପଦାର୍ଥ ବିଜ୍ଞାନ ବିଭାଗର ସହକାରୀ ପ୍ରଫେସର ଏବଂ ଅଧ୍ୟୟନର ପ୍ରମୁଖ ଲେଖକ ଡକ୍ଟର ନୀଳମଣି ବେହେରା କହିଛନ୍ତି: ‘କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତିର ଚାହିଦା ଦ୍ରୁତ ଗତିରେ ବଢୁଛି, ବିଶେଷକରି କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତାର ବୃଦ୍ଧି ସହିତ। ଆମର କାର୍ଯ୍ୟ ଦର୍ଶାଉଛି ଯେ ନାନୋସ୍କେଲ ଚୁମ୍ବକୀୟ ଉପକରଣର ବହୁତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ପ୍ରାକୃତିକ ଭାବରେ ମାତ୍ର କିଛି ବିଲିୟନ ଅଂଶରେ ସମନ୍ୱିତ ହୋଇପାରେ। ଏହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଆକର୍ଷଣୀୟ ସମ୍ଭାବନା ଖୋଲିଥାଏ ଯାହା ଦ୍ରୁତ ଏବଂ ବହୁତ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ।‘ ଏହି ଗବେଷଣା ଗୋଥେନବର୍ଗ ବିଶ୍ୱବିଦ୍ୟାଳୟ (ସ୍ୱିଡେନ), ଆଇଆଇଟି ଭୁବନେଶ୍ୱର (ଭାରତ) ଏବଂ ଟୋହୋକୁ ବିଶ୍ୱବିଦ୍ୟାଳୟ (ଜାପାନ) ସହିତ ଜଡିତ ଏକ ଆନ୍ତର୍ଜାତୀୟ ସହଯୋଗ ମାଧ୍ୟମରେ କରାଯାଇଥିଲା। ଏହି ଫଳାଫଳଗୁଡ଼ିକ ନାନୋସ୍କେଲ୍ ଡିଭାଇସଗୁଡ଼ିକର ବଡ଼ ନେଟୱାର୍କ କିପରି ଆଚରଣ କରେ ତାହାର ମୌଳିକ ବୁଝାମଣାକୁ କେବଳ ଆଗକୁ ବଢାଇ ନାହିଁ ବରଂ ମାନବ ମସ୍ତିଷ୍କ ଦ୍ୱାରା ପ୍ରେରିତ ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଭିତ୍ତିଭୂମି ପ୍ରଦାନ କରେ। ଏପରି ହାର୍ଡୱେର୍ ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟରଗୁଡ଼ିକର ବର୍ଦ୍ଧିତ ଶକ୍ତି ଏବଂ କାର୍ଯ୍ୟଦକ୍ଷତା ସୀମାକୁ ଦୂର କରିବାରେ ସାହାଯ୍ୟ କରିପାରେ, ପରବର୍ତ୍ତୀ ପିଢ଼ିର ବୁଦ୍ଧିମାନ କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ପଥ ପ୍ରଶସ୍ତ କରିଥାଏ। ‘ନାନୋସେକେଣ୍ଡ ଫେଜ୍ ଅର୍ଡରିଂ ଇନ୍ ଅଲ୍ଟ୍ରା-ଲାର୍ଜ ସ୍ପିନ୍ ହଲ୍ ନାନୋ-ଅସିଲେଟର୍ ଲାଟିସେସ୍ ଫର୍ ଅନକନଭେନସଲ୍ କମ୍ପ୍ୟୁଟିଂ‘ ଶୀର୍ଷକ ଗବେଷଣା ପତ୍ର ନାନୋସାଇନ୍ସ ଏବଂ ନାନୋଟେକ୍ନୋଲୋଜିରେ ବିଶ୍ୱର ପ୍ରମୁଖ ପତ୍ରିକା ମଧ୍ୟରୁ ଗୋଟିଏ, ନେଚର ନାନୋଟେକ୍ନୋଲୋଜିରେ ପ୍ରକାଶିତ ହୋଇଛି।

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ବିଜ୍ଞାନ ଓ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା କ୍ଷେତ୍ରରେ ଭାରତ ତଥା ଓଡ଼ିଶା ପାଇଁ ଏକ ବଡ଼ ଗୌରବ ଆସିଛି। ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ବୈଜ୍ଞାନିକ ଏବଂ ଏକ ପ୍ରତିଷ୍ଠିତ ଆନ୍ତର୍ଜାତୀୟ ଗବେଷଣା ଦଳ ପରବର୍ତ୍ତୀ ପିଢ଼ିର କମ୍ପ୍ୟୁଟର ନିର୍ମାଣ ଦିଗରେ ଏକ ଯୁଗାନ୍ତକାରୀ ସଫଳତା ହାସଲ କରିଛନ୍ତି। ବିଶ୍ୱର ପ୍ରମୁଖ ବିଜ୍ଞାନ ପତ୍ରିକା 'ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି'ରେ ସେମାନଙ୍କର ଏହି ଗବେଷଣା ସ୍ଥାନ ପାଇଛି। ଏହି ବୈଜ୍ଞାନିକମାନେ ୧ ଲକ୍ଷରୁ ଅଧିକ କ୍ଷୁଦ୍ର ଚୁମ୍ବକୀୟ ଉପକରଣ ବା 'ନାନୋସ୍କେଲ୍ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ଅସିଲେଟର'କୁ ଏକାଠି ଯୋଡ଼ି ବିଶ୍ୱର ସବୁଠାରୁ ବଡ଼ ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କ ତିଆରି କରିବାରେ ସଫଳ ହୋଇଛନ୍ତି। ଏହି ନେଟୱାର୍କ ଏକ ଅର୍କେଷ୍ଟ୍ରା ଦଳ ଭଳି ସମ୍ପୂର୍ଣ୍ଣ ତାଳମେଳ ରଖି ଅତି କମ୍ ଶକ୍ତିରେ ଏବଂ ସୁପରଫାଷ୍ଟ ଗତିରେ କାମ କରିପାରିବ, ଯାହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ଦୁନିଆକୁ ସମ୍ପୂର୍ଣ୍ଣ ବଦଳାଇ ଦେବାର ସାମର୍ଥ୍ୟ ରଖିଛି।

ଆମେ ଦୈନନ୍ଦିନ ବ୍ୟବହାର କରୁଥିବା ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟର ଚିପ୍ସଗୁଡ଼ିକ ସୂଚନା ବା ଡାଟାକୁ ଗୋଟିଏ ପରେ ଗୋଟିଏ କ୍ରମାନୁସାରେ ପ୍ରକ୍ରିୟାକରଣ କରିଥାନ୍ତି, ଯେଉଁଥିରେ ଅଧିକ ସମୟ ଏବଂ ଶକ୍ତି ନଷ୍ଟ ହୁଏ। ମାତ୍ର ଆଇଆଇଟି ବୈଜ୍ଞାନିକଙ୍କ ଦ୍ୱାରା ପ୍ରସ୍ତୁତ ଏହି କ୍ଷୁଦ୍ର ଉପକରଣଗୁଡ଼ିକ ଏକ ସେକେଣ୍ଡର ୪୫ ବିଲିୟନ ଭାଗରୁ ଭାଗେ ବା ମାତ୍ର ୪୫ ନାନୋସେକେଣ୍ଡ ମଧ୍ୟରେ ସ୍ୱାଭାବିକ ଭାବେ ପରସ୍ପର ସହ ସମନ୍ୱିତ ହୋଇଯାନ୍ତି। ଏହି ଅଦ୍ଭୁତ କ୍ଷମତା ଯୋଗୁଁ ସେମାନେ ଆଜିର ଇଲେକ୍ଟ୍ରୋନିକ୍ସ ପ୍ରଯୁକ୍ତି ତୁଳନାରେ ବିପୁଳ ପରିମାଣର ଶକ୍ତି ସଞ୍ଚୟ କରିବା ସହ ଅତି ଦ୍ରୁତ ଗତିରେ କାମ କରିପାରିବେ। ଏହି ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କଟି ପୂର୍ବରୁ ତିଆରି ହୋଇଥିବା ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ସିଷ୍ଟମ ତୁଳନାରେ ପ୍ରାୟ ୧୦୦୦ ଗୁଣ ବଡ଼, ଯାହା ପ୍ରମାଣ କରୁଛି ଯେ ଏହି ନୂତନ ଜ୍ଞାନକୌଶଳକୁ ଆଗାମୀ ଦିନରେ ବ୍ୟବହାରିକ ଭାବେ ବଡ଼ ବଡ଼ କମ୍ପ୍ୟୁଟର ପ୍ରୋଜେକ୍ଟରେ ସହଜରେ ଲଗାଯାଇପାରିବ।

ବୈଜ୍ଞାନିକମାନେ ଉନ୍ନତ ଧରଣର ମାଇକ୍ରୋୱେଭ୍ ଏବଂ ଅପ୍ଟିକାଲ୍ ମାଇକ୍ରୋସ୍କୋପି କୌଶଳ ବ୍ୟବହାର କରି ଏହି ହଜାର ହଜାର ସୂକ୍ଷ୍ମ ଉପକରଣ କିପରି ଆପେ ଆପେ ସଂଗଠିତ ହୋଇ କାର୍ଯ୍ୟ କରୁଛନ୍ତି, ତାହା ପ୍ରତ୍ୟକ୍ଷ ଭାବେ ଦେଖିଛନ୍ତି। ଯଦିଓ ଏହି ଟେକ୍ନୋଲୋଜି ବର୍ତ୍ତମାନ ଲାବୋରେଟୋରୀ ଗବେଷଣା ସ୍ତରରେ ରହିଛି, ତଥାପି ଏହା ଆଗାମୀ ଦିନରେ କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତାକୁ ଅଧିକ ଶକ୍ତିଶାଳୀ କରିବା, ସ୍ମାର୍ଟ ଟେଲିକମ୍ ଯୋଗାଯୋଗ, ବାସ୍ତବ-ସମୟ ବା ରିୟଲ୍-ଟାଇମ୍ ତଥ୍ୟ ବିଶ୍ଳେଷଣ, ଜଟିଳ ଆର୍ଥିକ ମଡେଲିଂ, ସ୍ମାର୍ଟ ପରିବହନ ବ୍ୟବସ୍ଥା ଏବଂ ବଡ଼ ବଡ଼ ବୈଜ୍ଞାନିକ ସିମୁଲେସନ୍ ଭଳି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ କାର୍ଯ୍ୟକୁ ଅତି ସହଜ ଓ ସ୍ୱଳ୍ପ ଖର୍ଚ୍ଚରେ କରିବାର ବାଟ ଫିଟାଇବ।

ଏହି ସଫଳତା ସମ୍ପର୍କରେ ସୂଚନା ଦେଇ ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ପଦାର୍ଥ ବିଜ୍ଞାନ ବିଭାଗର ସହକାରୀ ପ୍ରଫେସର ତଥା ଅଧ୍ୟୟନର ମୁଖ୍ୟ ଲେଖକ ଡକ୍ଟର ନୀଳମଣି ବେହେରା କହିଛନ୍ତି ଯେ, ଆଜିକାଲି ବିଶେଷ କରି ଏଆଇର ବ୍ୟବହାର ଯୋଗୁଁ କମ୍ପ୍ୟୁଟିଂ ପାୱାରର ଚାହିଦା ବହୁତ ବଢ଼ିଯାଇଛି। ଆମର ଏହି ନୂଆ ଆବିଷ୍କାର ଦର୍ଶାଉଛି ଯେ ନାନୋସ୍କେଲ୍ ଚୁମ୍ବକୀୟ ନେଟୱାର୍କଗୁଡ଼ିକ ମାତ୍ର କିଛି ନାନୋସେକେଣ୍ଡରେ ନିଜ ଭିତରେ ସମନ୍ୱୟ ରକ୍ଷା କରି ପ୍ରାକୃତିକ ଉପାୟରେ ଚାଲିପାରିବେ, ଯାହା ଭବିଷ୍ୟତ ପାଇଁ ଏକ ଦ୍ରୁତ ଓ ଶକ୍ତି-ଦକ୍ଷ କମ୍ପ୍ୟୁଟିଂ ବ୍ୟବସ୍ଥାର ଆଶା ସଞ୍ଚାର କରିଛି। ଏହି ବିଶେଷ ଅଧ୍ୟୟନଟି ଭାରତର ଆଇଆଇଟି ଭୁବନେଶ୍ୱର, ସ୍ୱିଡେନର ଗୋଥେନବର୍ଗ ବିଶ୍ୱବିଦ୍ୟାଳୟ ଏବଂ ଜାପାନର ଟୋହୋକୁ ବିଶ୍ୱବିଦ୍ୟାଳୟର ବୈଜ୍ଞାନିକମାନଙ୍କ ମିଳିତ ସହଯୋଗରେ ସମ୍ଭବ ହୋଇପାରିଛି।

ମାନବ ମସ୍ତିଷ୍କର କାର୍ଯ୍ୟଦକ୍ଷତା ଦ୍ୱାରା ଅନୁପ୍ରାଣିତ ହୋଇ କରାଯାଇଥିବା ଏହି ଗବେଷଣା "ନାନୋସେକେଣ୍ଡ ଫେଜ୍ ଅର୍ଡରିଂ ଇନ୍ ଅଲ୍ଟ୍ରା-ଲାର୍ଜ ସ୍ପିନ୍ ହଲ୍ ନାନୋ-ଅସିଲେଟର୍ ଲାଟିସେସ୍ ଫର୍ ଅନକନଭେନସଲ୍ କମ୍ପ୍ୟୁଟିଂ" ଶୀର୍ଷକ ପ୍ରବନ୍ଧ ଜରିଆରେ ବିଶ୍ୱ ସମ୍ମୁଖକୁ ଆସିଛି। ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟରର ସୀମିତ କ୍ଷମତାକୁ ଅତିକ୍ରମ କରି ପରବର୍ତ୍ତୀ ପିଢ଼ିର ସୁପର ସ୍ମାର୍ଟ କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ଗଠନ ପାଇଁ ଏହା ଏକ ମଜଭୁତ ଭିତ୍ତିଭୂମି ସ୍ଥାପନ କରିଛି। ବିଶ୍ୱର ଏହି ପ୍ରମୁଖ ରିସର୍ଚ୍ଚ ପେପର ସମ୍ବନ୍ଧରେ ଅଧିକ ଜାଣିବା ପାଇଁ ପତ୍ରିକାର ଅଫିସିଆଲ୍ ୱେବ୍ ଲିଙ୍କ୍ (https://www.nature.com/articles/s41565-026-02216-y) ପରିଦର୍ଶନ କରାଯାଇପାରିବ।

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Headline	**IIT Bhubaneswar Scientist Achieves Major Breakthrough Towards Faster, Smarter and Energy-Efficient Computing**		
Link	https://yuvasamay.com/iit-bhubaneswar-scientists-breakthrough-in-energy-efficient-spintronic-computing		

କଳ୍ପନା କରନ୍ତୁ ଏପରି ଏକ କମ୍ପ୍ୟୁଟର ଯାହା ଆଜିର ମେସିନଗୁଡ଼ିକ ଦ୍ୱାରା ବ୍ୟବହୃତ ଶକ୍ତିର ଏକ ଅଂଶ ମାତ୍ର ବ୍ୟବହାର କରି କଠିନରୁ କଠିନତର ସମସ୍ୟାଗୁଡ଼ିକୁ ବହୁତ ଶୀଘ୍ର ସମାଧାନ କରିପାରିବ। ଭାରତୀୟ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ସଂସ୍ଥାନ (ଆଇଆଇଟି) ଭୁବନେଶ୍ୱରର ଗବେଷକମାନଙ୍କ ସମେତ ବୈଜ୍ଞାନିକମାନଙ୍କ ଏକ ଆନ୍ତର୍ଜାତୀୟ ଦଳ ଦ୍ୱାରା ସେହି ଭବିଷ୍ୟତ ଆଡ଼କୁ ଏକ ପ୍ରମୁଖ ପଦକ୍ଷେପ ହାସଲ କରାଯାଇଛି। ଗବେଷକଙ୍କ ଏହି ଦଳଟି ପ୍ରତିଷ୍ଠିତ 'ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି' ପତ୍ରିକାରେ ଏକ ଐତିହାସିକ ଆବିଷ୍କାର ରିପୋର୍ଟ କରିଛି, ଯେଉଁଥିରେ ୧୦୦,୦୦୦ ରୁ ଅଧିକ ନାନୋସ୍କେଲ୍ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ଅସିଲେଟରର ବିଶ୍ୱର ସର୍ବବୃହତ ସିଙ୍କ୍ରୋନାଇଜ୍ ନେଟୱାର୍କ ପ୍ରଦର୍ଶନ କରାଯାଇଛି। ଏଗୁଡ଼ିକ ହେଉଛି ଛୋଟ ଚୁମ୍ବକୀୟ ଉପକରଣ ଯାହା ଏକ ସମ୍ପୂର୍ଣ୍ଣ ସମନ୍ୱିତ ଅର୍କେଷ୍ଟ୍ରା ପରି ଏକାଠି କାମ କରିପାରିବ। ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟର ଚିପ୍ସ ପରି ନୁହେଁ ଯାହା ସୂଚନାକୁ କ୍ରମାନୁସାରେ ପ୍ରକ୍ରିୟାକରଣ କରେ, ଏହି କ୍ଷୁଦ୍ର ଉପକରଣଗୁଡ଼ିକ ସ୍ୱାଭାବିକ ଭାବରେ କେବଳ ଏକ ସେକେଣ୍ଡର ୪୫ ବିଲିୟନ ଅଂଶ ବା ୪୫ ନାନୋସେକେଣ୍ଡ ମଧ୍ୟରେ ପରସ୍ପର ସହିତ ସମନ୍ୱିତ ହୋଇଥାନ୍ତି। ଏକାଠି କାମ କରି ସେମାନେ ଆଜିର ଇଲେକ୍ଟ୍ରୋନିକ୍ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ତୁଳନାରେ ବହୁତ କମ୍ ଶକ୍ତି ବ୍ୟବହାର କରି ସୂଚନାକୁ ଅତ୍ୟନ୍ତ ଶୀଘ୍ର ପ୍ରକ୍ରିୟାକରଣ କରିପାରିବେ।

ଏହି ସଫଳତା ପରବର୍ତ୍ତୀ ପିଢ଼ିର କମ୍ପ୍ୟୁଟିଂ ହାର୍ଡୱେୟାର ବିକାଶରେ ଏକ ବିରାଟ ଲମ୍ଫ ପ୍ରତିନିଧିତ୍ୱ କରେ। ଏହି ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ନେଟୱାର୍କ ପୂର୍ବରୁ ପ୍ରଦର୍ଶିତ ସୁସଙ୍ଗତ ସ୍ପିଣ୍ଟ୍ରୋନିକ୍ ସିଷ୍ଟମ ଅପେକ୍ଷା ପ୍ରାୟ ୧୦୦୦ ଗୁଣ ବଡ଼, ଯାହା ପ୍ରମାଣିତ କରେ ଯେ ଏପରି ପ୍ରଯୁକ୍ତିବିଦ୍ୟାକୁ ବ୍ୟବହାରିକ ପ୍ରୟୋଗ ପାଇଁ ବଡ଼ ଆକାରରେ ବୃଦ୍ଧି କରାଯାଇପାରିବ। ଗବେଷକମାନେ ଉନ୍ନତ ମାଇକ୍ରୋୱେଭ୍ ଏବଂ ଅପ୍ଟିକାଲ୍ ମାଇକ୍ରୋସ୍କୋପି କୌଶଳ ବ୍ୟବହାର କରି ସିଧାସଳଖ ପର୍ଯ୍ୟବେକ୍ଷଣ କରିଛନ୍ତି ଯେ କିପରି ହଜାର ହଜାର କ୍ଷୁଦ୍ର ଉପକରଣ ସ୍ୱତଃସ୍ଫୂର୍ତ୍ତ ଭାବରେ ଏକ ସିଙ୍କ୍ରୋନାଇଜ୍ ହୋଇଥିବା ଅବସ୍ଥାରେ ସଂଗଠିତ ହୋଇଛି। ଏହି ଅଧ୍ୟୟନ ନିଶ୍ଚିତ କରେ ଯେ ଅତ୍ୟନ୍ତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ମଧ୍ୟ ଉଲ୍ଲେଖନୀୟ ଭାବରେ ଦ୍ରୁତ ଗତିରେ ସମନ୍ୟୟ ସ୍ଥାପନ କରିପାରିବେ, ଯାହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ଉତ୍ସାହଜନକ ସମ୍ଭାବନା ଖୋଲିଥାଏ।

ଯଦିଓ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ଏପର୍ଯ୍ୟନ୍ତ ଗବେଷଣା ପର୍ଯ୍ୟାୟରେ ଅଛି, ଏଥିରେ ଦୈନନ୍ଦିନ ଜୀବନର ଅନେକ କ୍ଷେତ୍ରକୁ ପରିବର୍ତ୍ତନ କରିବାର ସମ୍ଭାବନା ରହିଛି। ଭବିଷ୍ୟତର ପ୍ରୟୋଗଗୁଡ଼ିକରେ ଦ୍ରୁତ ଏବଂ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତା ବା ଆର୍ଟିଫିସିଆଲ୍ ଇଣ୍ଟେଲିଜେନ୍ସ, ସ୍ମାର୍ଟ ଯୋଗାଯୋଗ ନେଟୱାର୍କ, ବାସ୍ତବ-ସମୟ ତଥ୍ୟ ବିଶ୍ଲେଷଣ, ଆର୍ଥିକ ମଡେଲିଂ ଏବଂ ଅପ୍ଟିମାଇଜେସନ୍, ବୁଦ୍ଧିମାନ ପରିବହନ ବ୍ୟବସ୍ଥା ଏବଂ ବୈଜ୍ଞାନିକ ସିମୁଲେସନ୍ ଅନ୍ତର୍ଭୁକ୍ତ ହୋଇପାରେ, ଯାହା ପାଇଁ ପ୍ରଚୁର କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତି ଆବଶ୍ୟକ ହୋଇଥାଏ।

ଏହି ସଫଳତା ସମ୍ପର୍କରେ ସୂଚନା ଦେଇ ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ପଦାର୍ଥ ବିଜ୍ଞାନ ବିଭାଗର ସହକାରୀ ପ୍ରଫେସର ଏବଂ ଏହି ଗବେଷଣା ଅଧ୍ୟୟନର ପ୍ରମୁଖ ଲେଖକ ଡକ୍ଟର ନୀଳମଣି ବେହେରା କହିଛନ୍ତି ଯେ, କମ୍ପ୍ୟୁଟିଂ ଶକ୍ତିର ଚାହିଦା ଦ୍ରୁତ ଗତିରେ ବଢୁଛି, ବିଶେଷକରି କୃତ୍ରିମ ବୁଦ୍ଧିମତ୍ତାର ବୃଦ୍ଧି ସହିତ। ଆମର କାର୍ଯ୍ୟ ଦର୍ଶାଉଛି ଯେ ନାନୋସ୍କେଲ ଚୁମ୍ବକୀୟ ଉପକରଣର ବହୁତ ବଡ଼ ନେଟୱାର୍କଗୁଡ଼ିକ ପ୍ରାକୃତିକ ଭାବରେ

ମାତ୍ର କିଛି ବିଲିୟନ ଅଂଶରେ ସମନ୍ୱିତ ହୋଇପାରେ। ଏହା ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଆକର୍ଷଣୀୟ ସମ୍ଭାବନା ଖୋଲିଥାଏ ଯାହା ଦ୍ରୁତ ଏବଂ ବହୁତ ଅଧିକ ଶକ୍ତି-ଦକ୍ଷ ହେବ।

ଏହି ଗବେଷଣା ସ୍ୱିଡେନର ଗୋଥେନବର୍ଗ ବିଶ୍ୱବିଦ୍ୟାଳୟ, ଭାରତର ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ଏବଂ ଜାପାନର ଟୋହୋକୁ ବିଶ୍ୱବିଦ୍ୟାଳୟ ସହିତ ଜଡିତ ଏକ ଆନ୍ତର୍ଜାତୀୟ ସହଯୋଗ ମାଧ୍ୟମରେ କରାଯାଇଥିଲା। ଏହି ଫଳାଫଳଗୁଡ଼ିକ ନାନୋସ୍କେଲ୍ ଡିଭାଇସଗୁଡ଼ିକର ବଡ଼ ନେଟୱାର୍କ କିପରି ଆଚରଣ କରେ ତାହାର ମୌଳିକ ବୁଝାମଣାକୁ କେବଳ ଆଗକୁ ବଢାଇ ନାହିଁ ବରଂ ମାନବ ମସ୍ତିଷ୍କ ଦ୍ୱାରା ପ୍ରେରିତ ବା ନ୍ୟୁରୋମର୍ଫିକ ଭବିଷ୍ୟତର କମ୍ପ୍ୟୁଟିଂ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ବିକାଶ ପାଇଁ ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଭିତ୍ତିଭୂମି ପ୍ରଦାନ କରେ। ଏପରି ହାର୍ଡୱେର୍ ପାରମ୍ପରିକ କମ୍ପ୍ୟୁଟରଗୁଡ଼ିକର ବର୍ଦ୍ଧିତ ଶକ୍ତି ଏବଂ କାର୍ଯ୍ୟଦକ୍ଷତା ସୀମାକୁ ଦୂର କରିବାରେ ସାହାଯ୍ୟ କରିପାରେ, ଯାହା ପରବର୍ତ୍ତୀ ପିଢ଼ିର ବୁଦ୍ଧିମାନ କମ୍ପ୍ୟୁଟିଂ ସିଷ୍ଟମ ପାଇଁ ପଥ ପ୍ରଶସ୍ତ କରିଥାଏ। "ନାନୋସେକେଣ୍ଡ ଫେଜ୍ ଅର୍ଡରିଂ ଇନ୍ ଅଲ୍ଟ୍ରା-ଲାର୍ଜ ସ୍ପିନ୍ ହଲ୍ ନାନୋ-ଅସିଲେଟର୍ ଲାଟିସେସ୍ ଫର୍ ଅନକନଭେନସଲ୍ କମ୍ପ୍ୟୁଟିଂ" (Nanosecond phase ordering in ultra-large spin Hall nano-oscillator lattices for unconventional computing) ଶୀର୍ଷକ ଏହି ସ୍ୱେଶାଳ ଗବେଷଣା ପତ୍ରଟି ନାନୋସାଇନ୍ସ ଏବଂ ନାନୋଟେକ୍ନୋଲୋଜି କ୍ଷେତ୍ରରେ ବିଶ୍ୱର ପ୍ରମୁଖ ପତ୍ରିକା 'ନେଚର ନାନୋଟେକ୍ନୋଲୋଜି'ରେ ସଫଳତାର ସହ ପ୍ରକାଶିତ ହୋଇଛି। ଗବେଷଣା ସମ୍ପର୍କିତ ଅଧିକ ସୂଚନା ନେଚର ପତ୍ରିକାର ଅଫିସିଆଲ୍ ଲିଙ୍କ୍ (https://www.nature.com/articles/s41565-026-02216-y) ମାଧ୍ୟମରେ ଉପଲବ୍ଧ ହେଉଛି।