भारतीय प्रौद्योगिकी संस्थान भुवनेश् वर
Indian Institute of Technology Bhubaneswar

Press Release

IIT Bhubaneswar Scientist Achieves Major Breakthrough Towards Faster, Smarter and Energy-Efficient Computing

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

Bhubaneswar, 13th July 2026: 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.

Link of the Paper:

https://www.nature.com/articles/s41565-026-02216-y
