IISER scientists discover evidence for new kind of quantum matter

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TWO SCIENTISTS of the Indian Institute of Science Education and Research are among an international team of researchers who claim to have found, for the first time, direct evidence for a novel quantum matter called Kitaev matter - a new kind of matter which may lead to realisation of quantum computing, among other things.

In a study published in the prestigious journal 'Nature Physics' a few days ago, the scientists have said that Kitaev matter is expected to show many "exotic physical properties, and can possibly host special particles which can be used for robust quantum computation". Until now, quantum computers exist only theoretically and Kitaev matter has either been difficult to prepare artificially or all its evidence has been indirect.

The two scientists from IISER include Assistant Professor Dr Yogesh Singh and research scholar Kavita Mehlawat.

"We carried out the research in a compound called sodium iridate using advanced X-ray measurement techniques. Elementary particles such as electrons have, in addition to charge and mass, a fundamental property called spin. Spins are like tiny magnets the particles carry and may align when a magnetic field is applied - leading to magnetism. They also 'talk' to other spins nearby and affect them," said Singh.

He added, "In Kitaev matter, an electron spin talks to another spin depending on the direction of the other spin. The honeycomb-like structure of sodium iridate provides numerous possible ways for Kitaev interactions and such a phenomenon is called magnetic frustration. We prepared high-quality samples on which Kitaev physics could be studied and developed a technique called 'diffuse magnetic X-Ray scattering' to study the interactions between magnetic moments."

Singh said that they found direct evidence of this new kind of matter which has wide implications in the field of quantum physics. "Developing quantum computers has only been a dream until now and this development is a potential step in the development of such computers," he said.

Dr Tankeshwar Kumar, a physics professor at PU, said, "Quantum computing is the future of computing as the power, speed and efficiency in quantum computers is expected to be much higher than the digital computers."

Meanwhile, Dr Anand K Bachhawat, Dean (Research and Development), said, "The study is another important research at this institute, and the paper has been reviewed by international experts in this field before being published online in the reputed journal."

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