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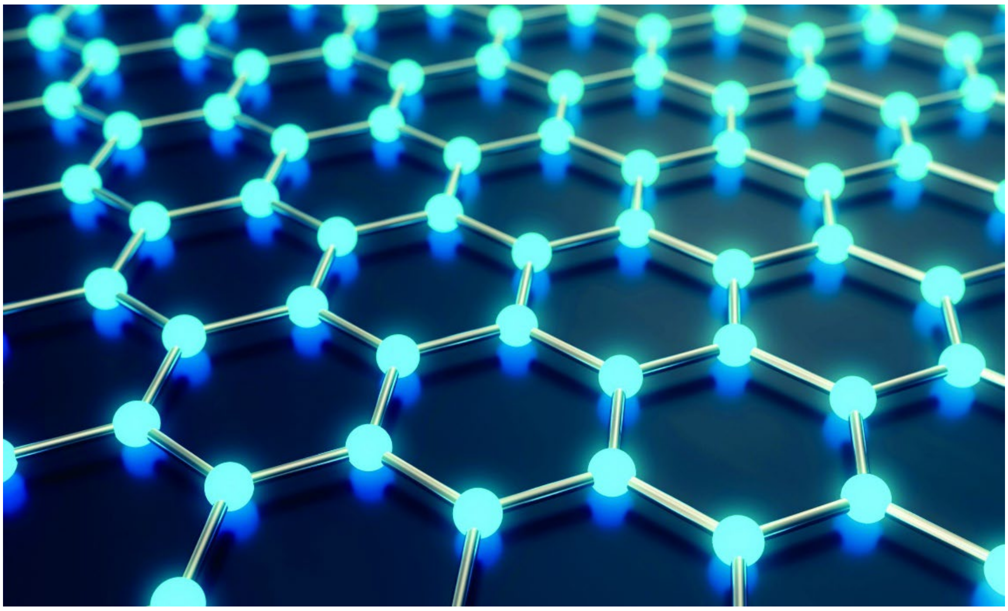
NTU scientists uncover key quantum properties in topological materials



SINGAPORE: Scientists from Nanyang Technological University (NTU), Singapore, have made significant strides in understanding the quantum properties of topological materials, uncovering findings that could pave the way for transformative technologies.

Topological materials are a unique class of quantum materials that allow electrons to flow exclusively along their surface while remaining insulating in their interior.

While these materials hold great promise, their quantum behaviours remain underexplored.

Now, a study co-led by Assistant Professor Chang Guoqing from NTU's School of Physical and Mathematical Sciences sheds light on their potential.

The research, recently published in Nature Physics under the title Tunable topologically driven Fermi arc van Hove singularities, focused on two topological materials—rhodium monosilicide (RhSi) and cobalt monosilicide (CoSi).

The team identified two types of van Hove singularities in these materials.

Van Hove singularities are specific energy levels where strong interactions between subatomic particles, such as electrons, occur, leading to unusual quantum properties.

Significantly, the study found that these singularities are located near the Fermi level—the highest energy level electrons can occupy at absolute zero.

When van Hove singularities align with the Fermi level, materials are more likely to exhibit intriguing quantum properties, including superconductivity at high temperatures and ferromagnetism.

These properties have immense potential in developing advanced technologies, from energy-efficient electronics to next-generation quantum computing systems.

The researchers also demonstrated that the energy levels of these singularities could be fine-tuned by introducing metal atoms into the materials.

This ability to manipulate the energy landscape offers a pathway to designing quantum materials with custom properties tailored for specific applications.

“Our findings open the door to discovering more quantum materials with unique characteristics, which could fuel breakthroughs in fields ranging from computation to energy,” said Assistant Professor Chang.

The study’s findings mark a step forward in harnessing the potential of quantum materials, underscoring the importance of fundamental research in driving innovation in cutting-edge technologies.

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