Contacting the molecular world through graphene nanoribbons

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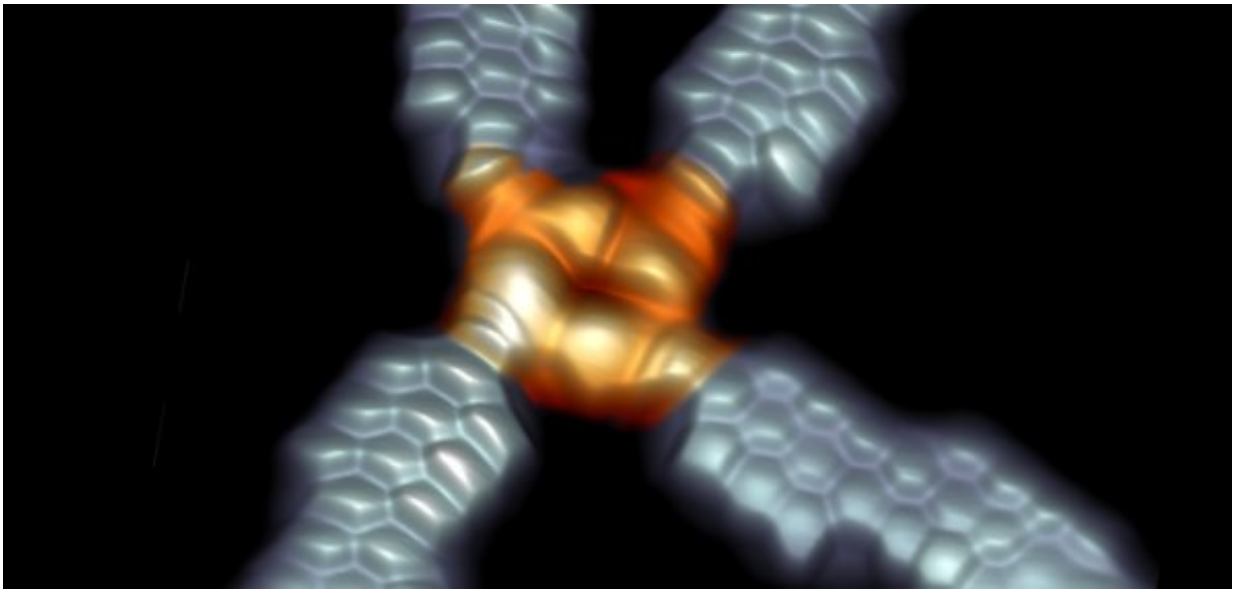

Scanning Tunneling Microscopy image of the new molecular device and its graphene nanoribbons contacts. Credit: CIC nanoGUNE

A single molecule can behave as the smallest electronic component of an electronic system. Researchers in the field of molecular electronics have endeavoured in recent years to develop new approaches to using molecules as electronic logic components.

A recent step forward has been published in *Science Advances*, as a result of a new collaboration between physicists from CIC nanoGUNE,

Donostia International Physics Center (DIPC) and institutional collaborators. The study resulted in a breakthrough that has allowed reading a single-molecule magnetic device for the first time.

"The idea is fascinating—to store information into a single molecule and read it," says Nacho Pascual, Ikerbasque Professor and leader of the Nanoimaging Group at nanoGUNE. "We have known for long time how to make the molecules, but we could never wire them into a circuit until now," he says. To achieve this goal, scientists used graphene stripes as electrical wires; in addition, they designed a method to ontact the molecule at predefined places.

"We found that the contact to the molecule crucially affects how the molecular device behaves," says Jingcheng Li, first author of the article. "This discovery has made us direct the contacting step with atomic-precision technologies."

To create the molecule, the researchers used a chemical method based on guided chemical reactions over a metallic surface. "The creation of the molecular device is simple," says CiQUS team leader Diego Peña: "we designed and synthesized the building blocks with 'glue-like' chemical terminations at the points where contacts are to be created; from then on, nature does the rest of the job for us."

To illustrate the process, the team uses a visual metaphor: "We can see it as a molecular LEGO," they said.

Dr. Pascual says, "We are learning how to use nature's laws for assembling molecules into more complex nanostructures."

The authors demonstrated the working function of the molecular device using scanning tunneling microscopy (STM), confirming under which conditions the magnetic information stored in the molecule could survive

to the contact, opening a new way to develop novel materials for efficient electronics.

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