

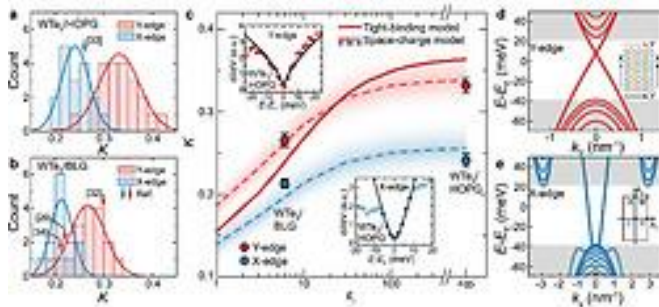
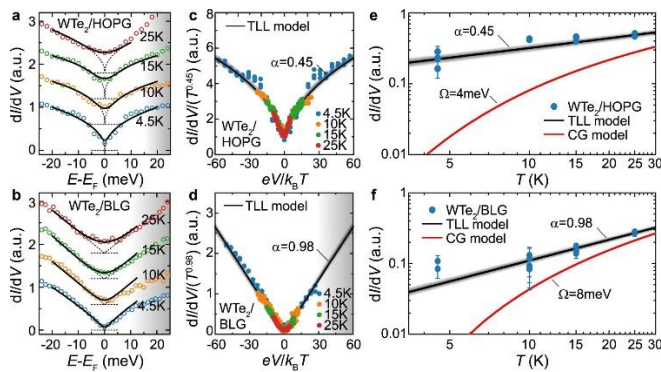
Electrons that behave like liquids help quantum computers move forward

English translation

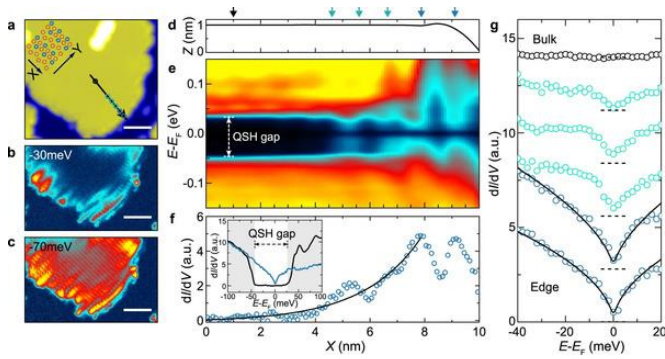
Niels Breen

November 4, 2022 11:34

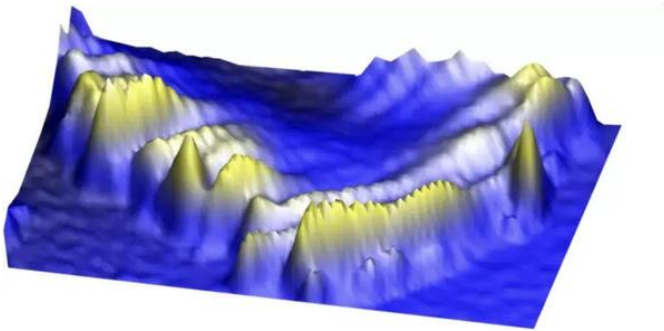
Researchers at Nanyang Technological University in Singapore have obtained results in an experiment that indicate the existence of parafermions. This is an abstract concept that can best be described as electrons that do not exist as a cloud, but as small groups. This is special, because the negative charges of electrons normally repel each other.



To achieve this, a temperature of 4.5 Kelvin was needed, at which superconductivity occurs. Here the particles contain much less energy and therefore move less. The electrons in a so-called helical Tomonaga-Luttinger liquid experience far fewer interactions between them, so that the exchange of energy with the environment is less. This means that the level of interference drops, making quantum systems more stable and accurate.



To keep the electrons in check, an almost two-dimensional material was used that acts as a quantum spin Hall insulator. A single layer of graphene was used to place crystal tungsten ditelluride on it. If this is placed under a scanning tunneling microscope at low temperatures, it becomes clear that the repulsion fields of the electrons on the substrate are so strong that the particles can no longer move separately, but only all at once.



The so-called Luttinger parameter that runs from 0 to 1 was 0.21 to 0.33. If it is below 0.5, the interactions are very strong and the electrons can no longer move freely. This is the area where the existence of parafermions is predicted. The experiment will be repeated in the NTU's new Ultra-Low Vibration Laboratory, where temperatures from 150 millikelvine can be realized. The first results are described in the paper ["Tuning the many-body interactions in a helical Luttinger liquid"](#)

Source: [Tom's Hardware](#)

<https://nl.hardware.info/nieuws/83193/elektronen-die-zich-als-vloeistof-gedragen-helpen-quantumcomputers-verder#reacties>