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Superconductivity in Graphene

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Original title

Unconventional superconductivity in magic-angle graphene superlattices.[1]

Introduction

When electricity moves through material some of its energy is lost due to conversion into heat and light. The loss of energy is dependent on the material, and a superconductor is a material where no energy is lost. Superconductivity was initially found by cooling down pure materials (such as mercury and lead) to very low temperatures near absolute zero (i.e. -273°C/-459°F/0°K). Compared to the original superconductivity, unconventional superconductivity has different physical properties, can be a mixture of materials, and may work at higher temperatures. Unconventional superconductivity has been researched for many years, but scientists are still struggling to understand how it works. Therefore, scientists are trying to make new techniques and equipment to study and understand it better.

Findings

The authors of "Unconventional superconductivity in magic-angle graphene superlattices" [1] describe a completely new way of generating superconductivity: By placing 2 layers of the material graphene on top of each other, and twisting them at a certain angle. This 'magic' angle differs from material to material and for graphene it was found to be 1.1°. Graphene is a simple layer of carbon structured in a manner similar to chicken wire but with 6 corners (hexagons). The twisting offsets the grid a tiny bit, which affects the way electricity travels through the material. The scientists were thereby able to fine-tune their system by simply applying electric currents of various strengths. This is much simpler than previous unconventional superconductivity systems (such as cuprates), which required strong magnetic fields in order to be tuned.

Conclusions

Even though the discovery still requires very low temperatures of -271°C/-457°F/1.7°K, there is hope that it may pave the way for new superconductors that would function at higher temperatures. If scientists are able to find a way to generate superconductors that work at room temperature, they could be used to minimize energy loss in everything using electricity. Research into superconductors is therefore of very high importance for the sustainable future of the world. With the discovery of a user-friendly and easy-to-study system described here, we may soon be getting closer to a solution.

Article info

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References

1. Cao, Y. *et al.* Unconventional superconductivity in magic-angle graphene superlattices. *Nature* **556**, 43–50 (2018).