■ Research Highlights

High temperature superconductors: Discovery of a new form of electronic wave

Electrons in superconductors move without feeling resistance so that no energy is dissipated. Copper-oxide high temperatures superconductors are promising materials to resolve the energy and environment problems of our society.

However, it is still elusive why the electrons can function at high temperatures up to 160 Kelvin (-110 degree Celsius) in the superconductors.

Now, a research group at Okayama University led by Guo-qing Zheng has found that electrons form an order called charge density wave before the material becomes superconducting in the high temperature superconductor Bi2Sr2-xLaxCuO6.

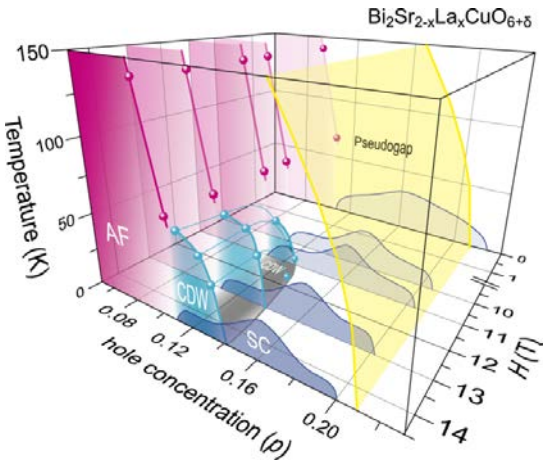

Figure caption: evolution of the new form of electronic wave (labeled as CDW) in the high temperature superconductors $Bi_2Sr_{2-x}La_xCuO_6$.

The finding was made by applying a strong magnetic field up to 45 Tesla in the CuO2 plane which is the most basic unit of the material, then probing how the electrons moving around with the nuclear magnetic resonance (NMR) technique.

Furthermore, Zheng and colleagues demonstrated that electric charge takes over the role of electron spin that forces the material to become a magnet when a certain number of carriers are doped into the parent compound Bi2Sr2CuO6.

This discovery sheds new light on the understanding of high temperature superconductivity and may help find new superconductors functioning at higher temperatures.

Reference:

Authors

Shinji Kawasaki, Zheng Li, Minori Kitahashi, Chengtian Lin, Philip L. Kuhns, Arneil P. Reyes and Guo-qing Zheng.

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Charge-density-wave order takes over antiferromagnetism in $Bi_2Sr_{2-x}La_xCuO_6$ superconductors.

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