Intertwining of superconductivity and magnetism
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The observation of coexisting magnetism and superconductivity in a particular copper-oxide superconductor suggests that the two types of order can be spatially modulated and intertwined, supporting recent theoretical predictions. Understanding the relationship between superconductivity and a type of atomic magnetic correlation (antiferromagnetism, wherein neighboring atomic spins are oriented in opposite directions) remains a challenge. The magnetism is associated with the localization of electrons, whereas superconductivity is a state in which electrons are paired and can flow without resistance.

Previous experiments have shown that these two states do not like to coexist in the same space. Researchers from Brookhaven National Laboratory characterized slow magnetic fluctuations in a copper-oxide superconductor. Their discovery shows that the slowly fluctuating magnetism does not disappear in the superconducting state; in fact, it grows stronger at the lowest fluctuation frequencies.

The state of intertwined superconductivity and antiferromagnetism that has been proposed by theorists provides a likely explanation of the observations. These results indicate an intimate connection between superconductivity and magnetism in copper oxides, an important clue for developing a predictive theory of high-temperature superconductivity.


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