Solution to distortion effect in STM scanning

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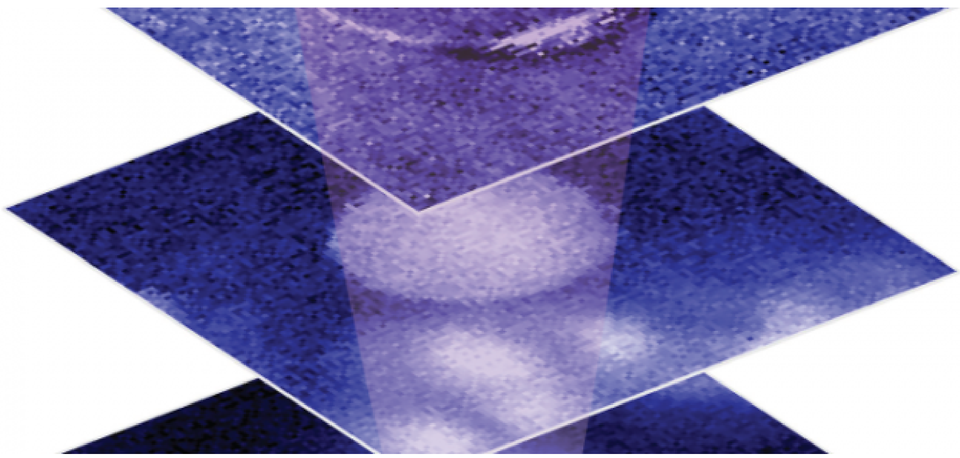

Credit: Leiden University

STM scanning experiments on poorly conducting materials are challenging, and can cause a distortion effect. A new model corrects for this effect, allowing physicists to better study materials in their quest to understand unconventional superconductivity. Publication in *Physical Review B* as Editor's Suggestion.

Back in 1911, Leiden physicist Heike Kamerlingh Onnes discovered superconductivity: an almost magical property of specific materials to conduct electricity without any energy loss, when cooled below a certain temperature. Only very few of these materials are understood; finding a theory that works for all of them is an ongoing quest in physics. Perhaps such a theory would even allow us to find materials that superconduct at room temperature, which will have a world-changing impact. For example, large power-consuming data centers could become energy neutral, we would be able to transport electricity without resistance and wind mills maximize their efficiency.

Distortion effect

Needless to say, physicists are trying to understand superconductivity and find a theory that explains the effect. One of the methods used is Scanning Tunneling Microscopy and Spectroscopy (STM/STS), where a metallic tip scans over the surface of a material, being able to visualize the atomic lattice. However, when measuring poorly conducting materials—precisely the candidate materials for not-so-cold superconductivity—scientists sometimes encounter a distortion effect, called Tip-Induced Band Bending. In other words: the electric field generated by the tip partially penetrates the sample, affecting the voltage difference applied between the two.

Now the research group of Milan Allan has developed a model that corrects for the distortion. This depends on many factors, including distance between tip and sample and voltage applied on the tip, but also individual materials' properties. The team publishes their model in an editor's suggestion article in *Physical Review B*, with Irene Battisti as first author. The model allows scientists worldwide to get rid of the disturbance and improve the interpretation of STM data, helping them in their quest for understanding superconductivity.

More information: I. Battisti et al. Poor electronic screening in lightly doped Mott insulators observed with scanning tunneling microscopy, *Physical Review B* (2017). DOI: 10.1103/PhysRevB.95.235141

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