Synchrotrons help bring superconductors out of the cold

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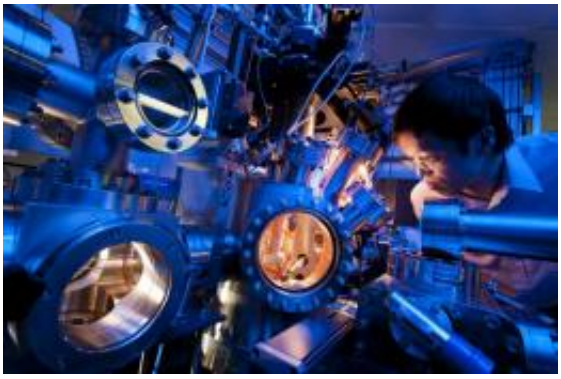

Dr. Feizhou He observes a sample at the Canadian Light Source beamline where the superconductor data was gathered. Credit: Canadian Light Source Inc.

(Phys.org) -- The longstanding search for a room temperature superconductor is fueled by a tantalizing set of possible applications that sound like science fiction: infinitely long power lines that never lose energy, magnetically levitating trains, and incredibly fast quantum computers.

Superconductors have zero resistance, the electric equivalent to friction, when cooled below a specified temperature. The temperatures involved are alarmingly low, ranging from a couple of degrees above absolute zero to a balmy -135°C, still too cold for large scale practical use. Advances in high temperature superconductor research have been slow in part because their physics is poorly understood.

Now an international team of researchers has made a major breakthrough in understanding the limits of these materials. The collaboration, including researchers from the Canadian Light Source, University of Waterloo, and the University of British Columbia, used no less than four synchrotron facilities worldwide in order to confirm their results.

A synchrotron, like Saskatoon's CLS, where some of the experiments were performed, is a football-field-sized source of brilliant light that enables scientists to study the microstructure and chemical properties of materials

The team found the first experimental evidence that a so-called "charge-density-wave instability" competes with superconductivity. Armed with this knowledge, scientists can start to design new materials that will bring superconductors out of the cold and into large-scale real world applications.

"Without very specific evidence it is like theorists are shooting in the dark. Our new data will narrow their target significantly" explained Canadian Light Source scientist Dr. Feizhou He.

The collaboration involved several prominent institutions, including the Max Planck Institute in Germany, Milan Polytechnic University and CNR-SPIN. The results were published this week in the journal *Science*.

More information: www.sciencemag.org/content/ear … 7/11/science.1223532

Provided by Canadian Light Source