Secrets behind high temperature superconductors revealed

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(PhysOrg.com) -- Scientists from Queen Mary, University of London and the University of Fribourg (Switzerland) have found evidence that magnetism is involved in the mechanism behind high temperature superconductivity.

Writing in the journal *Nature Materials*, Dr Alan Drew from Queen Mary's Department of Physics and his colleagues at the University of Fribourg report on the investigation of a new high temperature superconductor, the so-called oxypnictides. They found that these exhibit some striking similarities with the previously known copper-oxide high temperature superconductors - in both cases superconductivity emerges from a magnetic state. Their results go some way to explaining the mechanisms behind high temperature superconductors.

Superconductors are materials that can conduct electricity with no resistance, but only at low temperatures. High temperature superconductors were first discovered in 1986 in copper-oxides, which increased the operational temperature of superconductors by more than 100°C, to -130°C and opened up a wealth of applications. The complex fundamental physics behind these high temperature superconductors has, however, remained a mystery to scientists.

Dr Drew said "Last year, a new class of high-temperature superconductor was discovered that has a completely different make-up to the ones previously known - containing layers of Arsenic and Iron instead of layers of Copper and Oxygen. Our hope is that by studying them both together, we may be able to resolve the underlying physics behind both types of superconductor and design new superconducting materials, which may eventually lead to even higher temperature superconductors."

Professor Bernhard, of the University of Fribourg, added: "Despite the mysteries of high-temperature superconductivity, their applications are wide-ranging. One exciting applications is using superconducting wire to provide lossless power transmission from power stations to cities. Superconducting wire can hold a much higher current density than existing copper wire and is lossless and therefore energy saving."

An electrical current flowing round a loop of superconducting wire can also continue indefinitely, producing some of the most powerful electromagnets known to man. These magnets are used in MRI scanners, to 'float' the MagLev train, and to steer the proton beam of the Large Hadron Collider (LHC) at CERN. Envisaged future applications of superconductors exist also in ultrafast electronic devices and in quantum computing.

More information: ‘Coexistence of static magnetism and superconductivity in SmFeAsO1-x FX ‘ will be published in the journal *Nature Materials*.

Source: Queen Mary, University of London