# Filling a "Gap" in Iron-based Superconductor Research

## Scientific Achievement

**Found evidence for a full superconducting energy gap in a high-temperature (high-$T_c$) iron-based superconductor**

## Significance and Impact

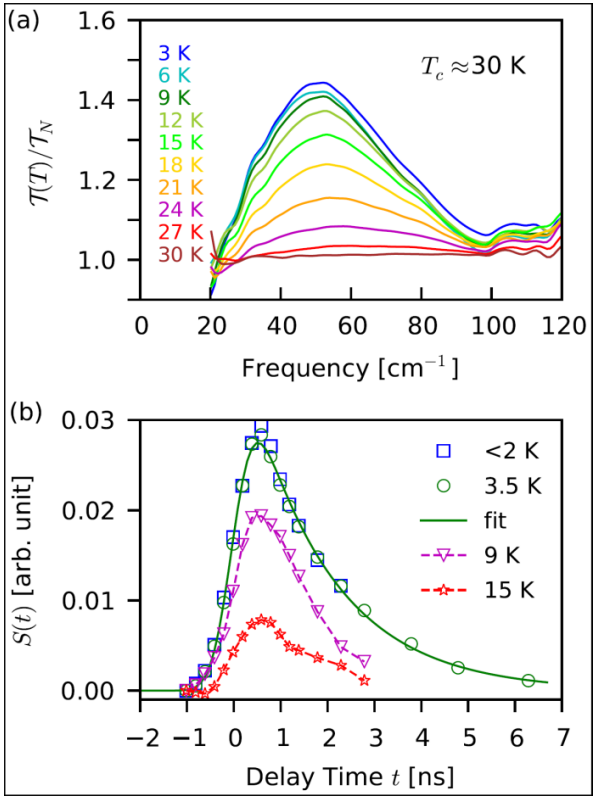
**Results help create a unified picture of how high-$T_c$ iron-based superconductors work, a step toward determining how to use them in practical applications**

## Research Details

- The first iron-based material found to superconduct at temperatures above those of conventional superconductors is $LaFeAsO_{1-x}F_x$, a compound of lanthanum, iron, arsenic, and oxygen, with x near 0.1 (10% of oxygen replaced with fluorine)
- Evidence of a full superconducting gap in a 300-nanometer $LaFeAsO_{1-x}F_x$ thin film was revealed using two synchrotron infrared techniques, one transmission and the other pump-probe to sense the relaxation time of electron excitations
- Additional research needed to explore the structure of the gap and its role in superconductivity in $LaFeAsO_{1-x}F_x$

X Xi, YM Dai, CC Homes, M Kidszun, S Haindl, GL Carr, *Phys. Rev. B,* **87**, 180509(R) (2013)

Work was performed at Brookhaven National Laboratory




(a) Data taken from 3 to 30K showing the temperature dependence of infrared transmission through the $LaFeAsO_{1-x}F_x$ thin film, normalized to the transmission at 33K (b) Time-resolved infrared transmission data through the sample from about 2K to 15K. The slow (ns) relaxation time indicates the presence of a full superconducting gap.