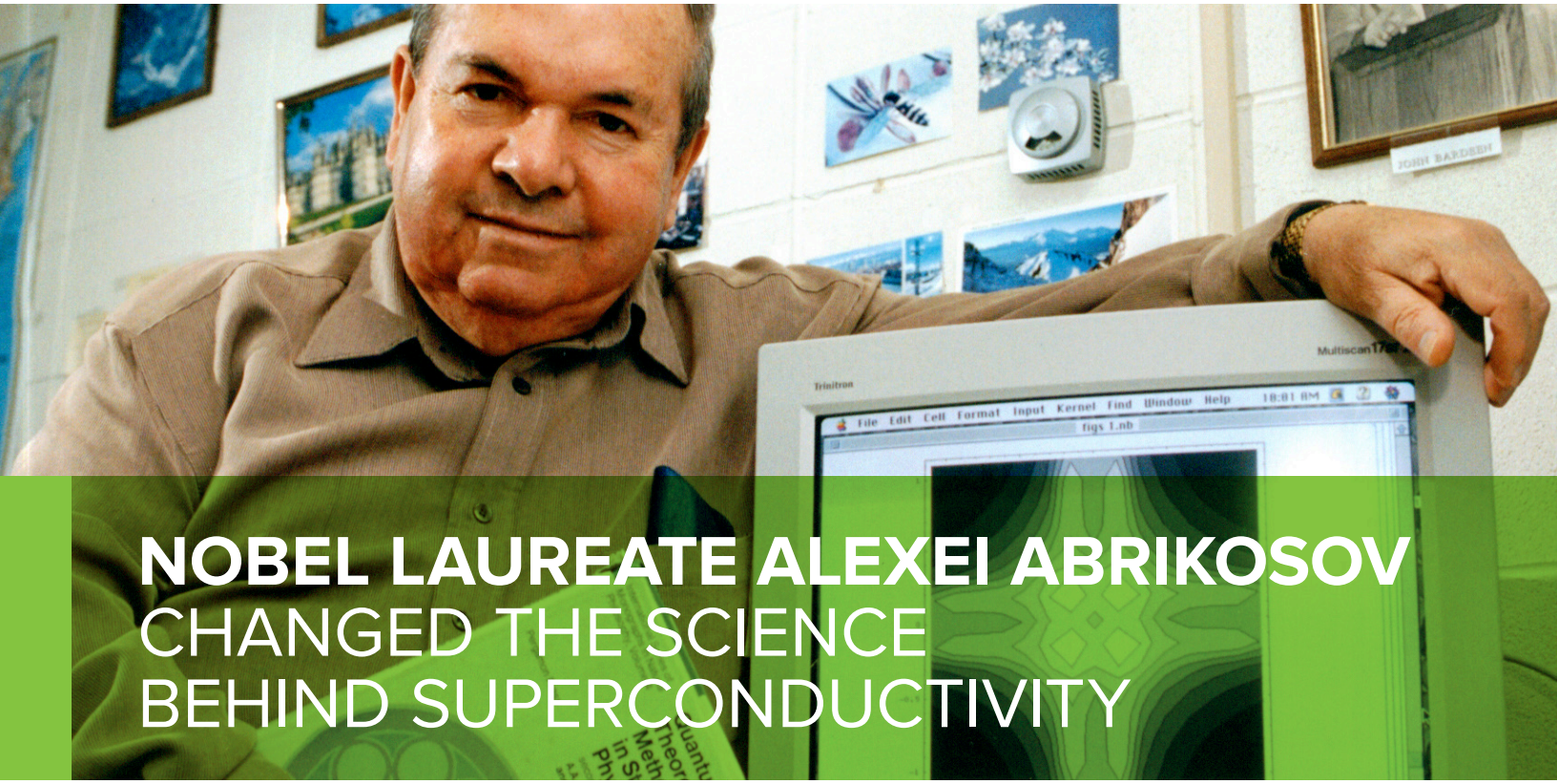
Argonne NATIONAL LABORATORY



NOBEL LAUREATE ALEXEI ABRIKOSOV CHANGED THE SCIENCE BEHIND SUPERCONDUCTIVITY

Alexei Abrikosov, who worked at Argonne National Laboratory from 1991 to 2014, won the Nobel Prize in Physics in 2003.

BACKGROUND

Alexei Abrikosov was born in 1928 in Moscow and earned his Ph.D. in 1951 from Moscow's Institute for Physical Problems. Between 1951 and 1991, he worked at several Moscow institutes, including the Landau Institute for Theoretical Physics from 1965 to 1988.

In 1991, Abrikosov began working at the U.S. Department of Energy's Argonne National Laboratory as a Distinguished Scientist in the Materials Science Division. The following year, he became the leader of Argonne's Condensed Matter Theory Group, a position he held until 2000. Abrikosov continued working with Argonne's Materials Science Division until he left Argonne in 2014.

THE PIVOTAL DISCOVERY

Prior to his time at Argonne, Abrikosov began working on his theory of superconductors, which are materials that can conduct electricity with no energy loss at extremely low temperatures.

Until 1952, scientists only understood one type of superconductor, and the superconductivity in that type broke when the magnetic field rose too high. Abrikosov's theory on a second type of superconductor showed that higher magnetic fields could penetrate a superconducting material as long as it was with vortices that remained in the same position.

Because of his theory on magnetic vortices, the vortex behavior became known as Abrikosov vortex lattice. Additionally, his superconductor theory became known as "type-II" superconductors, which can be made with materials that hold higher currents and thus create stronger magnetic fields.

Based on his pioneering work on superconductivity, Abrikosov shared the 2003 Nobel Prize in Physics with Vitaly Ginzburg and Anthony James Leggett.

THE IMPACT:

- Abrikosov's work has had profound implications for a range of technologies, including particle accelerators, fusion reactors, cell phone towers, and wind turbine compact motors.
- MRI machines are designed based on type-II superconductors, which were first theorized by Abrikosov.
- Abrikosov's work led to a breakthrough in topological matter that involves two-dimensional superconductors, a theory that has also received the Nobel Prize.

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