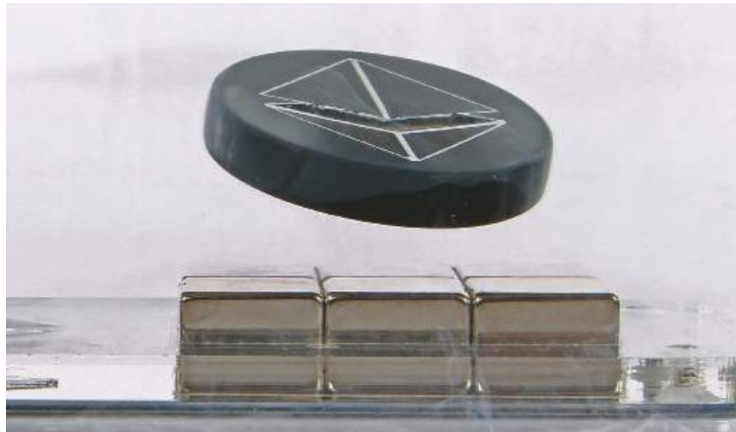


# Quantum

## Superconducting Levitation Demonstration



### 1. Why are superconductors relevant to society and the lives of high schoolers?

Superconductors are materials that can conduct electricity without any resistance when they are cooled below a certain critical temperature. They have the potential to revolutionize various industries, such as energy, transportation, and computing. Some applications of superconductors include:

- Power transmission: Superconducting power lines can efficiently transmit electricity over long distances, reducing energy loss and environmental impact.
- Transportation: Superconducting Maglev (magnetic levitation) trains use powerful magnets to levitate above the tracks, enabling faster and more efficient transportation.
- Medical imaging: Superconducting magnets are used in MRI machines, providing high-resolution images for better diagnostics and treatment.
- Quantum computing: Superconductors are essential components in developing advanced quantum computers, which can potentially solve complex problems much faster than classical computers.

### 2. Details of the demonstration

In this hands-on demonstration, you'll explore the following exciting phenomena:

- Levitation: A small magnet will levitate above a superconducting material cooled below its critical temperature. This is due to the Meissner effect, where the superconductor expels the magnetic field, creating a repulsive force that causes the magnet to hover.
- Quantum locking: when a superconductor is cooled in the presence of a magnetic field, the magnetic field is allowed to penetrate the material, but only in discrete quantities. This causes the superconductor to "lock" in place relative to the magnet, enabling it to maintain a fixed position even when tilted or turned upside down.
- Superconducting Maglev track: A small superconducting "train" will levitate and glide along a track, demonstrating the potential for efficient, high-speed transportation.

# Quantum

## 3. Big unsolved problems relating to superconductivity

While superconductivity offers numerous benefits, there are still many unanswered questions and challenges in the field. Some of the most pressing issues include:

Room-temperature superconductivity: Most superconductors require extremely low temperatures to function, which can be costly and impractical. The discovery of a room temperature superconductor could revolutionize numerous industries and applications.

Quantum computing: How do we build a quantum computer using superconductors? Here we show you a prototype “mask” used during the fabrication of a 4-bit quantum CPU here at Purdue.

As you explore the fascinating world of superconductivity, we hope this demonstration sparks your curiosity and inspires you to learn more about the potential impact of these advanced materials on society and future technologies.

Want to learn more?

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