



# Superconductivity An Introductory E-book for High School Students

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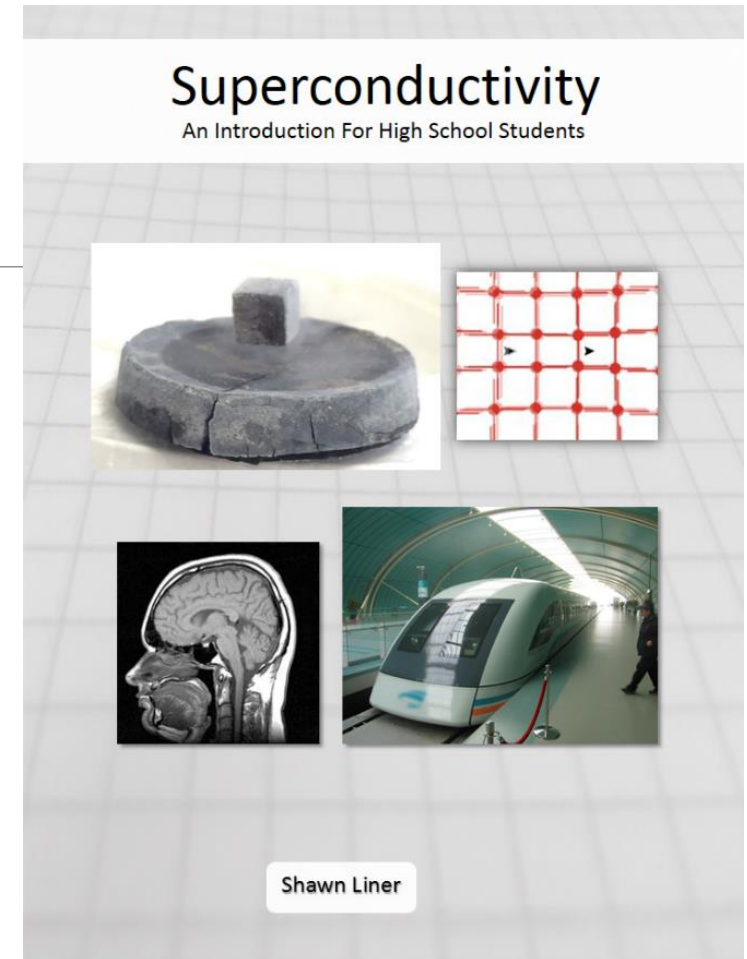


**LSU**



# Goals

- **Cheap - We want it available to students and teachers**
- **Readily Available – easy to get and cross platform**
- **High School Level – our target audience**
- **Informative – teach them something**
- **Motivational – leave them with an interest in more**
- **Multimedia – hold their attention better with demos**
- **Interactive – allow them to touch and interact**
- **Editable – allow it to be updated in the future**
- **Structured – students have learned a healthy disrespect for websites**



# Proposed Solution

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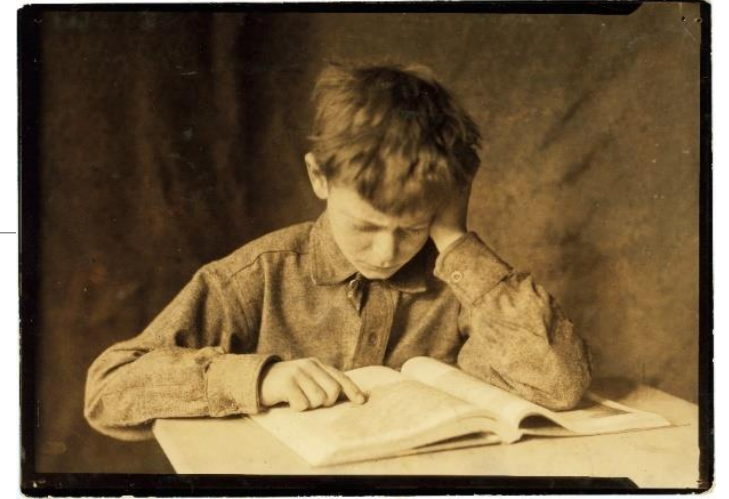
**Publish an interactive multimedia e-book with Habitat on Inkling.com.**

- **Inkling is available as a tablet app for apple, android and Microsoft products, as well as being available through web browser access.**
- **Epub versions can also be created for use on non-multimedia reading devices.**
- **The structure is maintained as a book and updates are pushed automatically.**
- **Inkling stores the files so they will be readily available and no new storage location has to be created.**
- **The Book can be “sold” for free and the hosting is free, so it will be readily available.**

# Tasks

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- **Learn about superconductors**
- **Create an outline of the content.**  
**How much should we include to educate, but still keep them interested.**
- **Create Graphics, images, and videos.**  
**We wanted to own as much of the material as possible.**
- **Create and find demos to include in the material.**



# Topics for the Book

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- Electrical and Magnetic properties of superconductors along with some review of basic electrical and magnetic properties
- A survey of superconducting limitations. This helps prevent misinformation and promotes curiosity about overcoming those limitations
- Superconducting technology. A survey of where the technology is currently being used. Students are amazed that their life is impacted by these topics now.
- Theory. Placed last to maintain interest. Students who are genuinely curious will continue to read without chasing off the casual interest before they learn something.

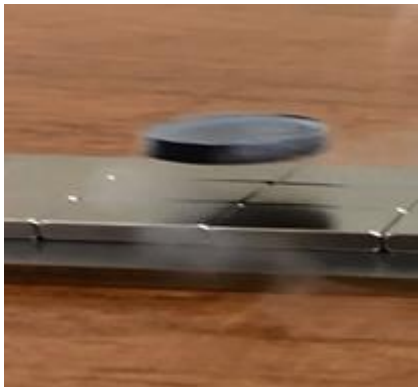


# Demo Maglev Train Model

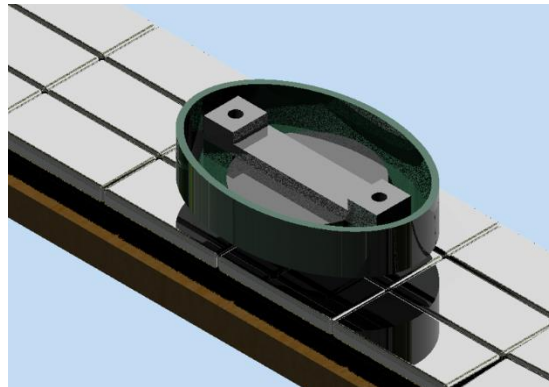
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A track is created from rare earth magnets and a “train” is 3D printed to hold the superconductor and a reservoir of liquid nitrogen. This allows for a longer demo. Long term plan calls for an oval track to be built.

**Levitating Disk  
on Track**



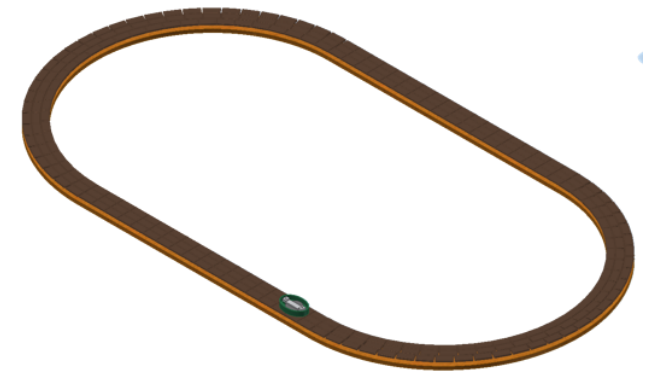
**Design of “train”**



**3D printed “Train”**

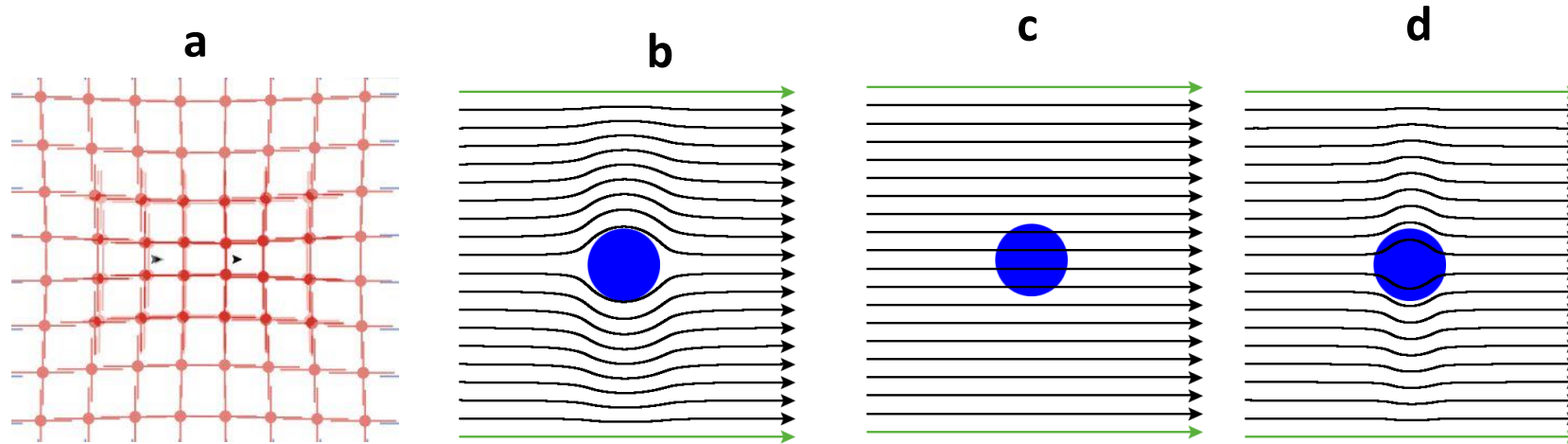


**Model of oval  
Track with “Train”**



# Graphics For Theory

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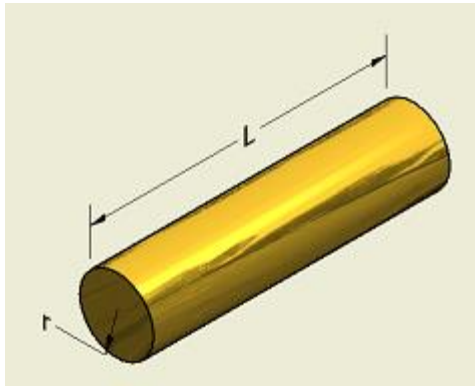


These four images were captured from simulations created in netlogo (a turtle based programming language.)

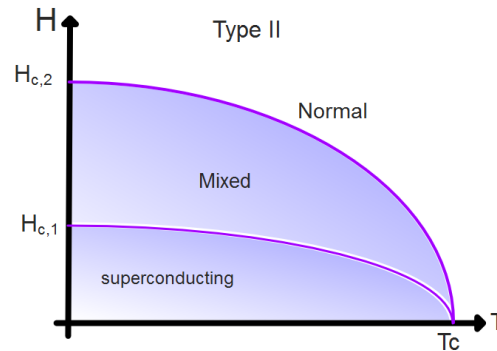
- a) Two arrows represent electrons forming a Cooper Pair.
- b) A superconductor expelling magnetic flux.
- c) A non diamagnetic material allowing the
- d) A Superconductor in a pinning state.

# Graphics For Theory

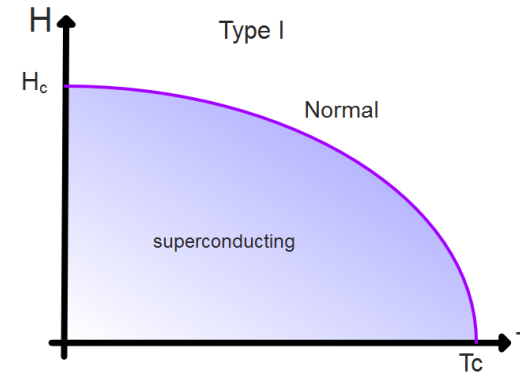
a



b



c



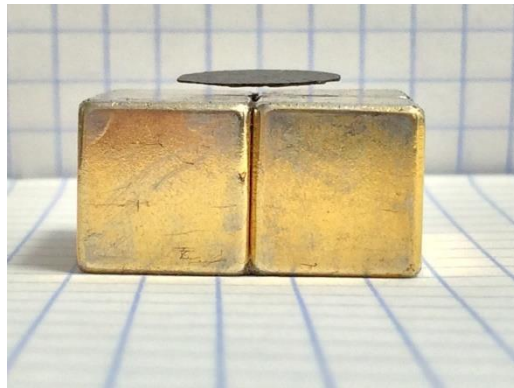
- a) A simple diagram of a wire created to discuss causes of resistance
- b) Type II critical magnetic field as a function of temperature.
- c) Type I critical magnetic field as a function of temperature.



# Demo Levitation

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Video Demos are included of both a superconducting caused levitation and that of pyrolytic graphite. The latter was included to show that the property was not specific to superconductors.



**Freeze-frames of the two parts of a video demonstration.**

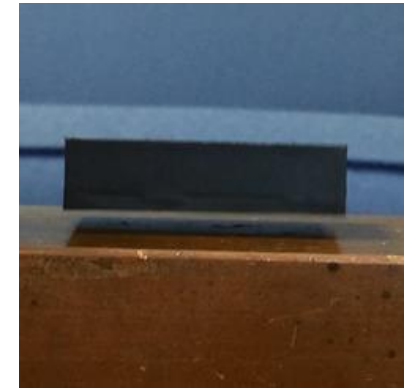
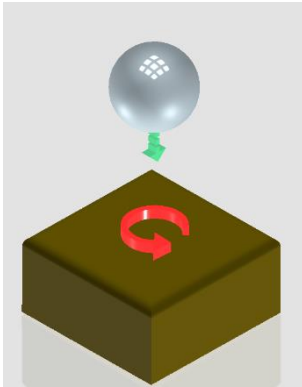
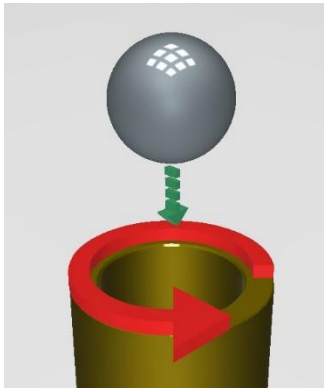
**The left shows pyrolytic graphite levitating above strong magnets.**

**The right shows the standard demo of a magnet levitating above a superconducting disk.**

# Demo Lenz Law

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We included a demo of Lenz's law to help students understand levitation. The pictures include bubbles to explain the concept and the video includes a voice-over to help students see the important parts of the demo.

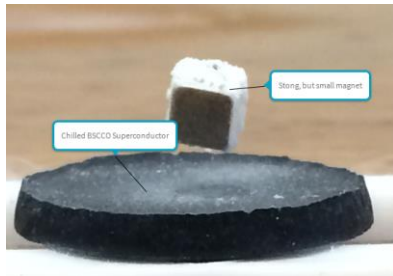


**Illustrations created in Autodesk Inventor to show the current being created as the magnet falls.**

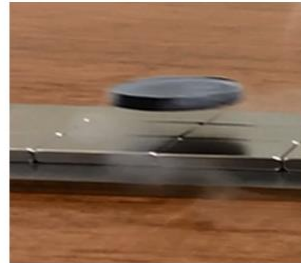
**Freeze-frames of the two parts of a video demonstration. The spherical magnet is dropped through the copper pipe to show it falling slowly. Then a bar magnet is dropped onto a copper plate. It is visibly slowed by the induced magnetic field.**

Clickable table of contents, with images.

# Features of the Book



Pictures zoom and show clickable labels



VIDEO DEMO Maglev Demo Click the image above for a video demo of maglev model train. Shawn Liner

Full Screen "Video Demos"

Links to some interesting maglev information.

- Shanghai maglev Train <http://www.smtdc.com/en/index.html>
- A French group invents a hoverboard. <http://www.supraconductivite.fr/en/index.php#samuser-magsurf>
- Maglev 2000, Organization pushing for trans-continental maglev trains in North America <http://www.maglev2000.com/>
- Antipodes Middle School Robotics Team build project on maglev <http://www.theonerobot.com/maglevresearch>

Links to interesting information

thought of as a materials opposition to the flow  
oh  
a li  
So  
materials are called **insulators** and are used to pr  
see an insulator on the outside of a wire that you use

**Insulator**  
a material with a high resistance to electrical current, like rubber.

Glossary with on page definitions

Table of Contents

View by: **Title** File

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  - ☰ Figure 0: Meissner
  - ☰ Section 1.1: Electrical Characteristics
    - ☰ Figure 1.1: Wire
    - ☰ Figure 1.2: Graph of Linear

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# Questions

