Physics for the 21st Century
Unit 6 Extra: The Meissner Effect
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WOLFGANG RUECKNER: I'd like to show you the Meissner Effect, one of the remarkable properties of superconductors. I have here a piece of high temperature superconducting material. It's high temperature because most materials, if they become superconductors, do so near liquid helium temperature, which is around 4 degrees Kelvin. A high temperature superconductor will turn into a superconductor at much higher temperature. In particular, this one will be above the temperature of liquid nitrogen, which is 77 degrees Kelvin. I have some liquid nitrogen here, which I'm going to use to cool down this material.

I'm going to place this disk of superconducting material on the bottom of this Styrofoam cup and place on top a small but strong magnet. And it just sits there. Nothing remarkable happens. But once I cool down the disk to liquid nitrogen temperatures by pouring on liquid nitrogen, first the liquid nitrogen is rapidly boiling away because the disk is relatively warm and causes it to boil. But as the disk cools down the boiling ceases and the material will pass through this transition where it is a normal conductor and becomes a superconductor.

As you can see the magnet is rising above the disk. What is happening is in the Meissner Effect, the magnetic lines of flux that are coming from the magnet are being expelled from the disk of the superconducting material and force the magnet to rise up in the air and float above the disk. The fact that it's floating, you can see if I give this disk a little spin, it does so freely because it's not touching anything.