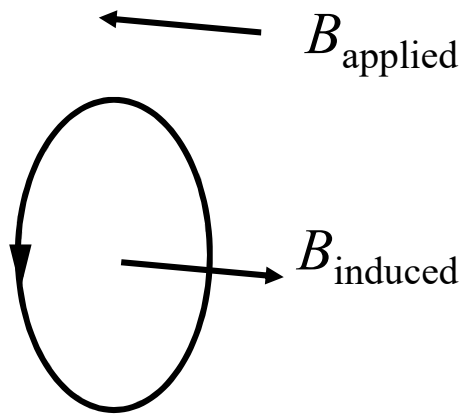
Diamagnetism

Diamagnetism

A free electron in a magnetic field will travel in a circle



The magnetic created by the current loop is opposite the applied field.

Diamagnetism

Dissipationless currents are induced in a diamagnet that generate a field that opposes an applied magnetic field.

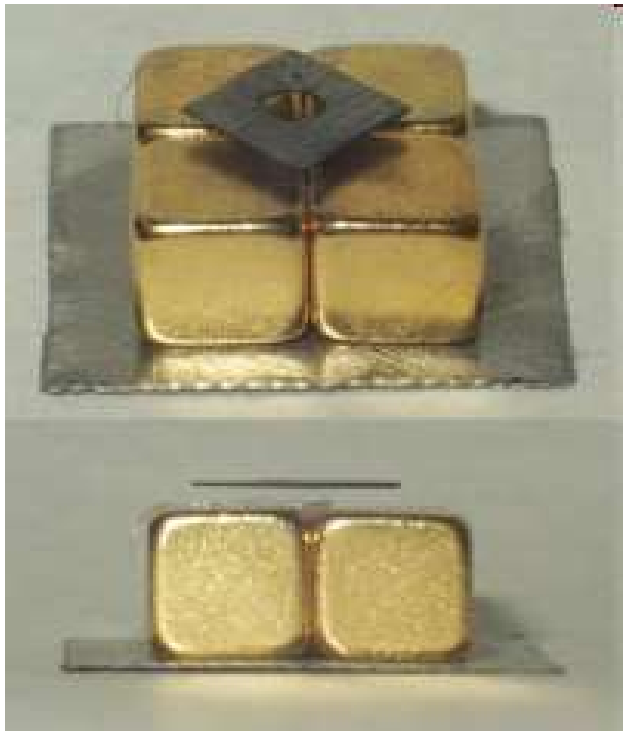
Current flow without dissipation is a quantum effect. There are no lower lying states to scatter into. This creates a current that generates a field that opposes the applied field.

$\chi = -1$ superconductor (perfect diamagnet)

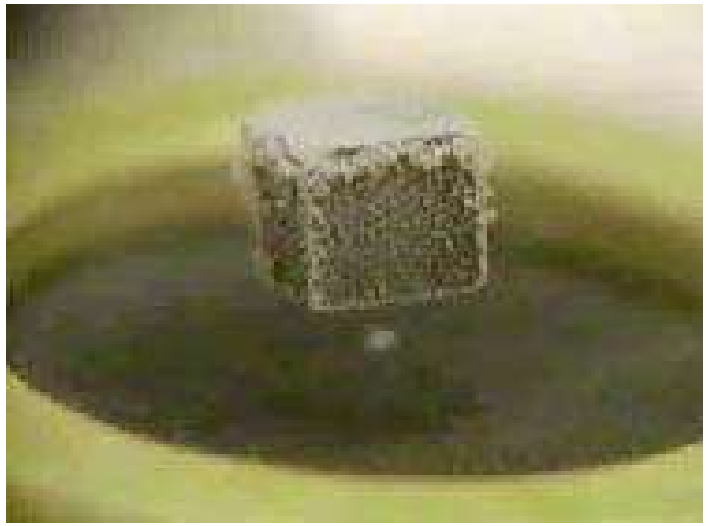
$\chi \sim -10^{-6} - 10^{-5}$ normal materials

Diamagnetism is always present but is often overshadowed by some other magnetic effect.

Levitating diamagnets



Levitating pyrolytic carbon



NOT: Lenz's law

$$V = -\frac{d\Phi}{dt}$$

Levitating frogs

χ for water is -9.05×10^{-6}

16 Tesla magnet at the Nijmegen High Field Magnet Laboratory

http://www.hfml.ru.nl/froglev.html

Andre Geim

2000 Ig Nobel Prize for levitating a frog with a magnet

The Nobel Prize in Physics 2010
Andre Geim, Konstantin Novoselov

The Nobel Prize in Physics 2010

Nobel Prize Award Ceremony

Andre Geim

Biographical
Nobel Lecture
Banquet Speech
Interview
Nobel Diploma
Photo Gallery
Other Resources

Konstantin Novoselov

Andre Geim

Born: 1958, Sochi, Russia

Affiliation at the time of the award:
University of Manchester,
Manchester, United Kingdom

Prize motivation: "for groundbreaking experiments regarding the two-dimensional material graphene"

Diamagnetism

A dissipationless current is induced by a magnetic field that opposes the applied field.

$$\vec{M} = \chi \vec{H}$$

Diamagnetic susceptibility	
Copper	-9.8×10^{-6}
Diamond	-2.2×10^{-5}
Gold	-3.6×10^{-5}
Lead	-1.7×10^{-5}
Nitrogen	-5.0×10^{-9}
Silicon	-4.2×10^{-6}
water	-9.0×10^{-6}
bismuth	-1.6×10^{-4}

Most stable molecules have a closed shell configuration and are diamagnetic.