



# The Mini Page

Betty Debnam, Founding Editor and Editor at Large

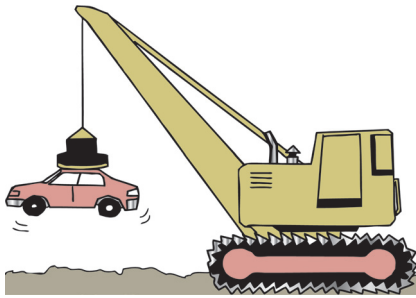


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## The Attractive Force

The little ornaments holding pictures to your refrigerator and the giant cranes picking up cars in a junkyard are all using magnets.



Magnets attract objects made of certain metals. They can also push away, or **repel**, other magnets.

The Mini Page talked with an expert from the National Science Foundation to learn more about this force of attraction.

### Matter

**Matter** is the stuff all around us: people, animals, paper clips, magnets, air and this paper you're reading.

Matter is made up of tiny **atoms**, which are made up of even tinier particles: **protons**, **electrons** and **neutrons**.



Protons have a positive charge, and electrons have a negative charge. (Neutrons have no charge.)

# Magnetism

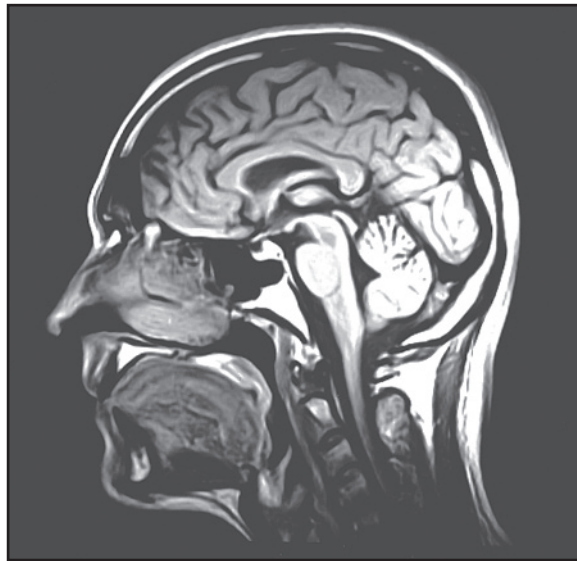


photo courtesy FONAR Corporation and the National Science Foundation

Technology called **Magnetic Resonance Imaging**, or **MRI**, can take special pictures of the insides of our bodies, as with this person's brain. An MRI machine surrounds the patient with magnets, producing conditions that allow experts to see what's going on inside.

### Close relations

Magnetism is closely related to electricity. Scientists often refer to the two forces together as **electromagnetism**.

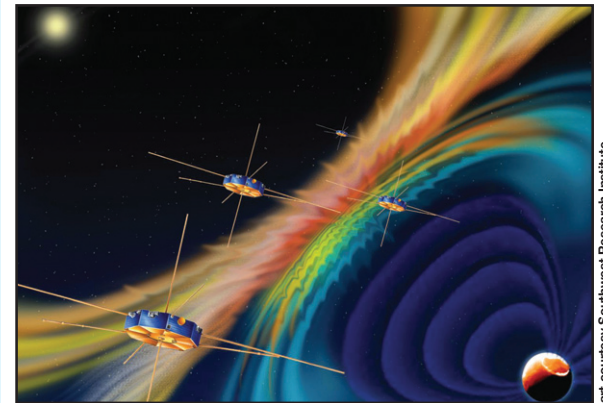
**Magnetism** comes from moving electrical charges. An electrical current running along a wire produces magnetism.

It works the other way too. If a wire is moved near a magnet, the magnetic force produces an electrical current. It makes electrical charges move.

### Poles

A **pole** is the area in a magnet where the magnetism is the strongest. A magnet always has two opposite poles, a south pole and a north pole. The south pole is at one end, and the north pole is at the other.

Like, or similar, poles repel each other, and opposite poles attract each other. The south pole in one magnet attracts the north pole in another magnet. The south poles of two magnets repel each other. The north poles of two magnets also repel each other.



art courtesy Southwest Research Institute

When magnetic forces from the sun and the Earth cross, they create a great burst of energy. NASA plans to launch four spacecraft in the fall of 2014 to study this system, in the **Magnetospheric Multiscale (MMS)** mission.

# A Moving Force

## Putting a spin on things

Magnetism comes from moving electrical charges. If electrical charges stay still, there is no magnetism.

An electron moving around the **nucleus**, or center, of its atom produces magnetism. In a similar way, a moving electrical current in a loop of wire produces magnetism.

There is another type of movement. Many charged particles such as electrons and protons spin like a top. The moving charge within those particles can produce magnetism.

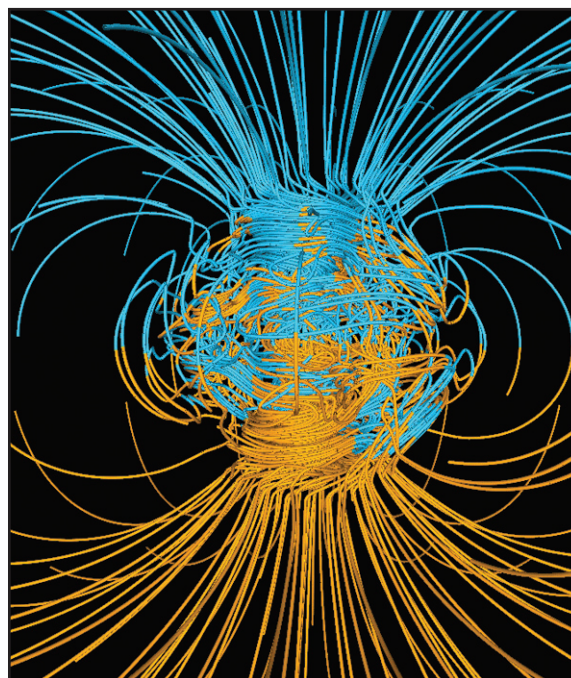
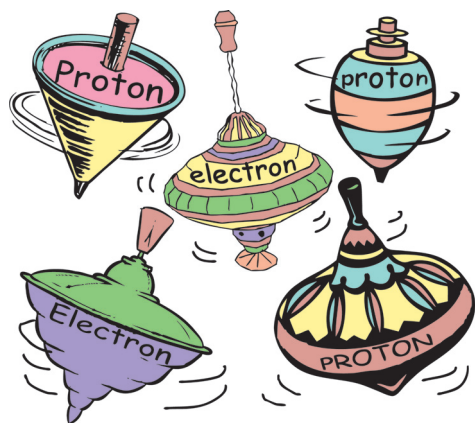


photo courtesy NASA

A giant magnetic field called the magnetosphere surrounds the Earth. Constantly changing magnetic fields can affect satellites, so NASA and other agencies are trying to learn as much as possible about the magnetosphere.

The sun also has a magnetic field. It encloses the whole solar system. The sun's magnetic field is called the heliosphere. Sunspots are connected to magnetic loops in the sun.

## Magnetic materials

In many materials, the charged particles in the atom are orbiting and spinning in different directions. Magnetic effects from the moving electrons cancel each other out. Those materials have little or no magnetism.

But other materials, such as iron, can be treated so most of the particles spin and orbit in the same direction. These materials are strongly magnetic.

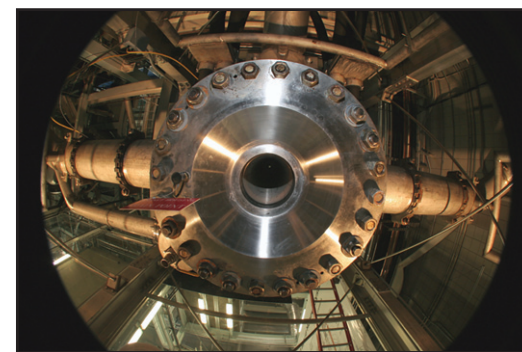


photo courtesy National High Magnetic Field Laboratory

This is the most powerful magnet in the world, at the National High Magnetic Field Laboratory at Florida State University. Super magnets are used as tools to learn more about matter.

## Ready Resources

The Mini Page provides ideas for websites, books or other resources that will help you learn more about this week's topics.

### On the Web:

- [explainthatstuff.com/magnetism.html](http://explainthatstuff.com/magnetism.html)
- [magnet.fsu.edu/about/welcome/scientistandsample.html](http://magnet.fsu.edu/about/welcome/scientistandsample.html)

### At the library:

- "Magnet Science" by Glen Vecchione
- "Amazing Magnetism (Magic School Bus Chapter Book No. 12)" by Rebecca Carmi
- "The Attractive Story of Magnetism With Max Axiom, Super Scientist" by Andrea Gianopoulos



Words that remind us of magnetism are hidden in the block below. Some words are hidden backward or diagonally. See if you can find: ATOM, ATTRACT, AURORA, BAR, CHARGED, CORE, EARTH, ELECTRON, FORCE, IMAGING, IRON, MAGNET, MAGNETIC, METAL, MOVING, NORTH, PARTICLES, POLE, REPEL, SOUTH, SPIN, SUN, TOP.



R	M	H	T	R	A	E	A	R	O	R	U	A	P	K
N	E	E	M	O	V	I	N	G	T	N	U	S	A	E
A	O	P	T	N	O	R	I	L	V	O	C	C	R	L
T	S	R	E	A	K	M	E	L	O	P	P	H	T	E
T	S	O	T	L	L	M	O	T	A	N	F	A	I	C
R	C	P	U	H	H	L	E	C	R	O	F	R	C	T
A	O	B	I	T	G	N	I	G	A	M	I	G	L	R
C	R	A	H	N	H	T	E	N	G	A	M	E	E	O
T	E	R	L	C	I	T	E	N	G	A	M	D	S	N

## Magnetism

TRY 'N'  
FIND

# Mini Spy . . .



Mini Spy and her friends are watching the aurora borealis. See if you can find:

- banana
- horse
- letter L
- elephant
- carrot
- teapot
- heart
- head
- lips • bird
- caterpillar
- mushroom
- two word
- ruler
- dragon
- fudge pop
- MINIs



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## Rookie Cookie's Recipe Vegetable Beef Stew

### You'll need:

- 1 pound ground beef
- 2 teaspoons olive oil
- 1/2 cup carrots, chopped
- 1/2 cup onion, chopped
- 1/2 cup green pepper, chopped
- 2 (10<sup>3</sup>/<sub>4</sub>-ounce) cans condensed minestrone soup
- 1 (15-ounce) can ranch-style beans
- 1 (10-ounce) can diced tomatoes with green chilies
- 2 cups water
- 1/2 teaspoon chili powder

### What to do:

1. Brown ground beef in medium skillet.
2. In a large soup pot, heat olive oil and cook carrots, onion and green pepper until tender.
3. Add minestrone soup, beans, tomatoes, 2 cups water and chili powder.
4. Stir in ground beef.
5. Simmer for one hour to blend flavors.

*You will need an adult's help with this recipe.*

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## Meet Hayley Faith



photo courtesy PBS

Hayley Faith is the voice of Peg in the new PBS Kids TV math series, "Peg + Cat." She shares the series character's love of math.

Hayley, 9, was born in New York City. She now lives in Connecticut with her mother, father and brother. She goes to public school and has appeared in several school talent shows.

She started taking dancing lessons when she was 2 years old and piano lessons when she was 7. She has also appeared in several TV commercials.

Hayley enjoys playing lacrosse, soccer and basketball. She loves going to sleep-away camp during the summer.

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## Gus Goodsport's Report Supersport: Jadeveon Clowney

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**Height: 6-6 Weight: 274 Hometown: Rock Hill, S.C.**

On the football field, Jadeveon Clowney doesn't fool around. He knocks quarterbacks and running backs down. The University of South Carolina's two-time All-America defensive end has done that a lot and continues to wreck opponents' offenses. He's regarded as the nation's top defensive player and a Heisman Trophy candidate.

In his first two seasons, Clowney recorded 21 sacks and 35.5 tackles for loss. His tackle — known as "The Hit" — in the Outback Bowl victory over the University of Michigan last season made highlight shows. He smashed into the Wolverines' ball carrier and recovered the fumbled football.

That's Clowney, the hard hitter opponents want to avoid. He took up football at age 6 and likely will play many more years. But now he's helping the Gamecocks pursue a conference championship.



## MIGHTY FUNNY'S Mini Jokes

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All the following jokes have something in common. Can you guess the common theme or category?



**Mark:** What begins with the letter "M" and picks up things?

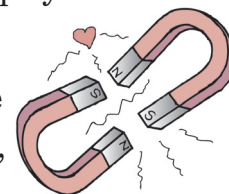
**Mary:** Mother!



**Milly:** Where do magnets play soccer?  
**Moe:** On a magnetic field!

**Melody:** What did one magnet say to the other?

**Mallory:** "You are very attractive to me!"



# Magnetic Planet

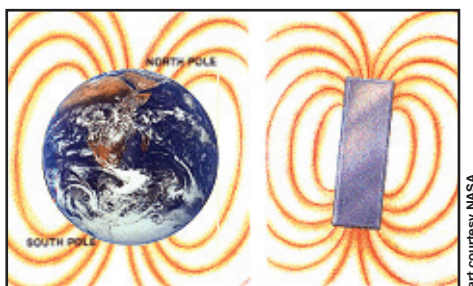
## Bar magnets

A **bar magnet** is just what it sounds like — a magnetized bar. One end has a south pole, and the other end has a north pole. For example, a hand compass is made with a bar magnet.

A spinning electron behaves like a tiny bar magnet. An electron orbiting a nucleus also behaves like a tiny bar magnet.

We can think of matter in this way: It can act as if it has many tiny bar magnets inside. In many cases, those bar magnets point in opposite directions. Then there is no magnetism. In other cases, those bar magnets point in different, random directions. Then there is a little magnetism.

In magnets made from iron, those little bar magnets all line up in the same direction. In other words, all the north poles are pointing in the same direction. The iron is strongly magnetized.



art courtesy NASA

The Earth's magnetic field is similar to the magnetic field of a bar magnet.

The Mini Page thanks Dr. Bradley Keister, program director, National Science Foundation, for help with this issue.

Next week, The Mini Page is about experiments on the International Space Station.



photo by David Miller, courtesy National Geophysical Data Center

The aurora australis, or the southern lights, turn the skies red over Australia. When charged particles from the sun hit the Earth's magnetic field, they can create colorful auroras. The aurora borealis, near the North Pole, and the aurora australis, near the South Pole, create the most dramatic displays.

## Our home, the magnet

The Earth is a giant magnet. Its **molten**, or hot liquid, outer core and its cooler layers are made of materials such as iron that turn the Earth into a magnet.

The North Pole and the South Pole are the opposite ends of the planetary magnet, just as with a smaller bar magnet.

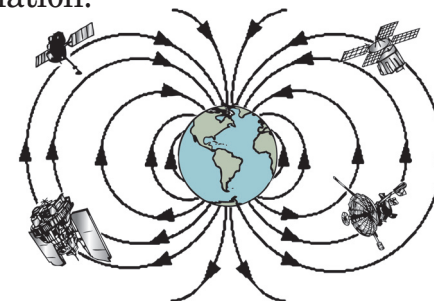
The Earth's liquid iron outer core is constantly moving. This produces charged particles in the core. The moving charge in the core produces a magnetic field. The iron and other materials in the layers of the Earth also help form the Earth's magnetic field.

A compass works because opposite poles attract. The south pole of the thin bar magnet inside the compass always points to the north magnetic pole of the Earth.

## Magnetic shield

Magnetism from the Earth's core extends for thousands of miles around the planet. It acts as a giant protective shield against charged particles blowing out from the sun in the solar wind. This magnetic region is called the **magnetosphere**.

The magnetosphere bounces most of the sun's charged particles back into space. It also protects spacecraft orbiting the Earth from cosmic radiation.



Look through your newspaper for stories about things affected by magnets, such as satellites or medical treatments.

## The Mini Page Staff

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