

# PhET Tips for Teachers    Magnets and Electromagnets

## Tips for controls:

- Try these related sims: [Magnet and Compass](#), [Faraday's Electromagnetic Lab](#), [Generator](#), and [Faraday's Law](#)

## Important modeling notes / simplifications:

- To understand the direction of field in magnet: Electric current is moving charge. Magnetic fields are created by electric currents. The current creating the magnetic field could be the current in a wire or it could be the current created by the motion of electrons in atoms. In a permanent magnet, the electron currents in the atoms are aligned so that the net effect of all the microscopic electron currents is to make a macroscopic current which is just like the current in a solenoid. So you should think of a bar magnet as a bar-shaped solenoid of current. The magnetic field of a bar magnet is exactly the same as the magnetic field of a solenoid since the currents are the same.
- The Earth's north geographic pole (where Santa lives) is near the earth's south magnetic pole. This is why a compass needle's north end points to the north geographic pole (because compass's north end points in the direction of the magnetic field).
- In the Electromagnet tab, the flow of electrons is shown. The flow of current is opposite to the direction of the flow of electrons. "Current" is defined as the flow of (imaginary) positive charges. We chose not to complicate the sim by showing both.

## Insights into student use / thinking:

- Students may have difficulty understanding why the field direction inside the magnet is toward the north end. Again, the modeling notes above may be helpful.

## Suggestions for sim use:

- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)