**Tips for controls:**

* Try these related sims: [Faraday’s Electromagnetic Lab](http://phet.colorado.edu/en/simulation/faraday), [Magnets and Electromagnets](http://phet.colorado.edu/en/simulation/magnets-and-electromagnets), [Generator](http://phet.colorado.edu/en/simulation/generator), and [Faraday’s Law](http://phet.colorado.edu/en/simulation/faradays-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 by 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).

**Insights into student use / thinking:**

* Students may have difficulty understanding why the field direction inside the magnet is toward the north end. 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**](http://phet.colorado.edu/teacher_ideas/contribution-guidelines.php)and [**Using PhET Sims**](http://phet.colorado.edu/teacher_ideas/classroom-use.php)
* 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**](http://phet.colorado.edu/phet-dist/publications/Teaching_physics_using_PhET_TPT.pdf)
* For activities and lesson plans written by the PhET team and other teachers, see: [**Teacher Ideas & Activities**](http://phet.colorado.edu/teacher_ideas/index.php)