Rail Gun Visuals Information

Slide 3:
A ***magnetic field*** is set up due to the movement of electric charges within a material. Charges move in the atoms of a material: electrons orbit the nucleus but also have a north and south pole and are tiny magnets or ***dipoles*** due to electron spin and angular momentum. These tiny magnets line up with other atoms in a region to produce a ***magnetic domain*** (less than 1 mm). In unmagnetized materials, the magnetic domains are directed randomly and there is no overall magnetic pole.

Slide 4:
In ***ferromagnetic*** materials, the magnetic domains line up even in the absence of an external magnetic field (such as in iron or rare-earth magnets).
In ***paramagnetic*** materials, the magnetic domains line up only in the presence of an external magnetic field (such as magnesium, lithium, aluminum).

Slide 5:
Magnetic fields are a way to represent the 3D space surrounding a magnetic object (we see them in 2D). They represent the force a magnetized object would experience due to its position relative to the magnet.

Slide 9:
When an electric current is run through a straight conducting wire, the thumb is pointed in the direction of conventional current, and the fingers wrap around the wire in the direction of the magnetic field lines.

Slide 11:
When an electric current is run through a solenoid (or coiled helix of wire), the fingers wrap in the direction of conventional current, and the thumb points in the direction of magnetic north.

Slide 15:
From Faraday's Law of Induction and Maxwell's Equations (which connect electricity, magnetism, and light), it can be deduced that a force is produced on a point charge that is moving in an electric and magnetic field.

Slide 16:
When an electric current is run through a conducting wire in a magnetic field, the thumb points in the direction of conventional current, the fingers point in the direction of the magnetic field lines, and the force acting on the wire points upward from the palm.