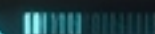
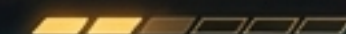


# THE INVISIBLE LINK

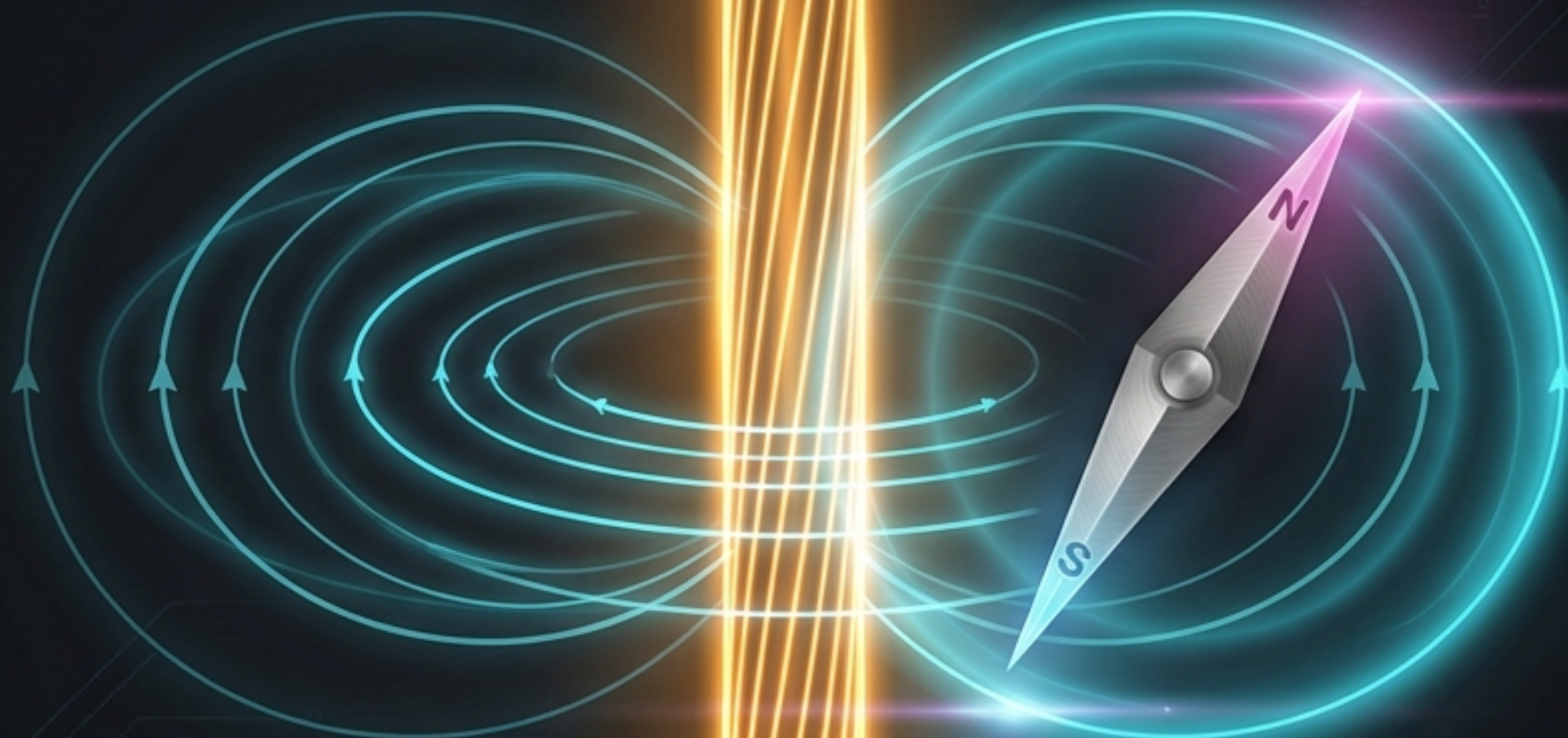
UNLOCKING THE MAGNETIC EFFECTS  
OF ELECTRIC CURRENT



CURRENT: 5.6A



MAGNETIC FIELD: 25 $\mu$ T



CURRENT: 5.6A

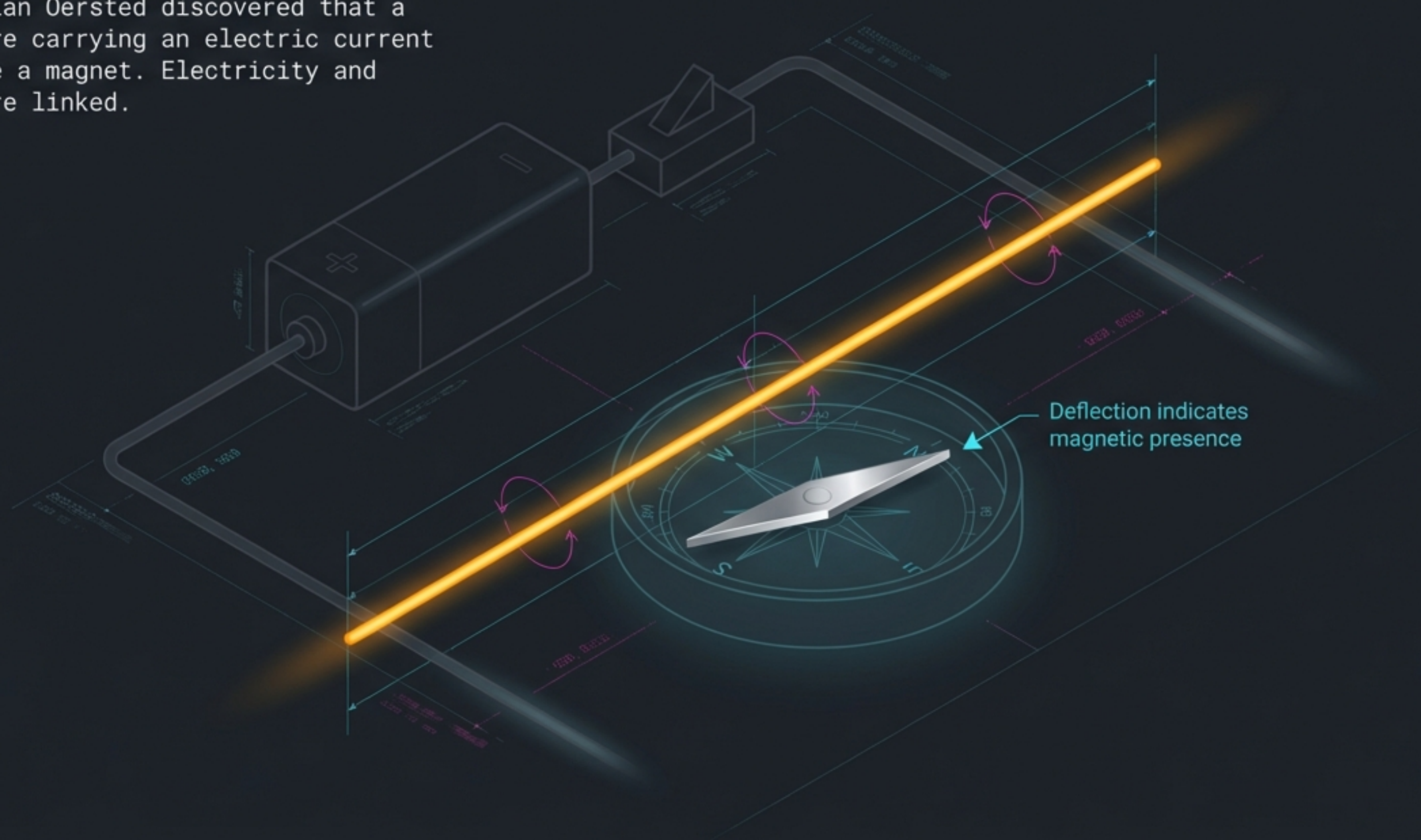
FORCE: 1.2mN

PHYSICS LEGEND:

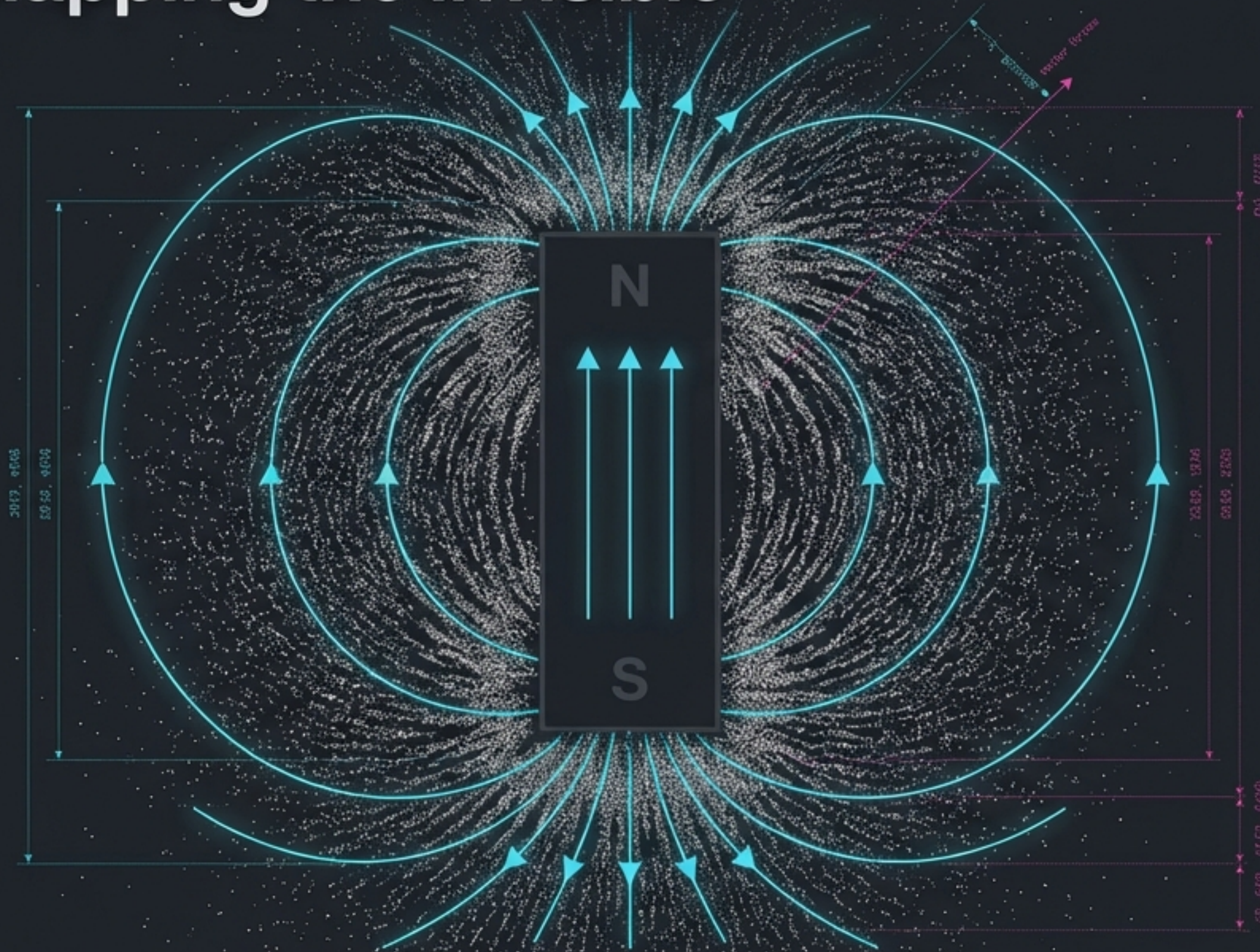
- Electric Current (**I**)
- Magnetic Field (**B**)
- Force (**F**)

# 1820: The Accidental Bridge

Hans Christian Oersted discovered that a metallic wire carrying an electric current behaves like a magnet. Electricity and magnetism are linked.



# Mapping the Invisible

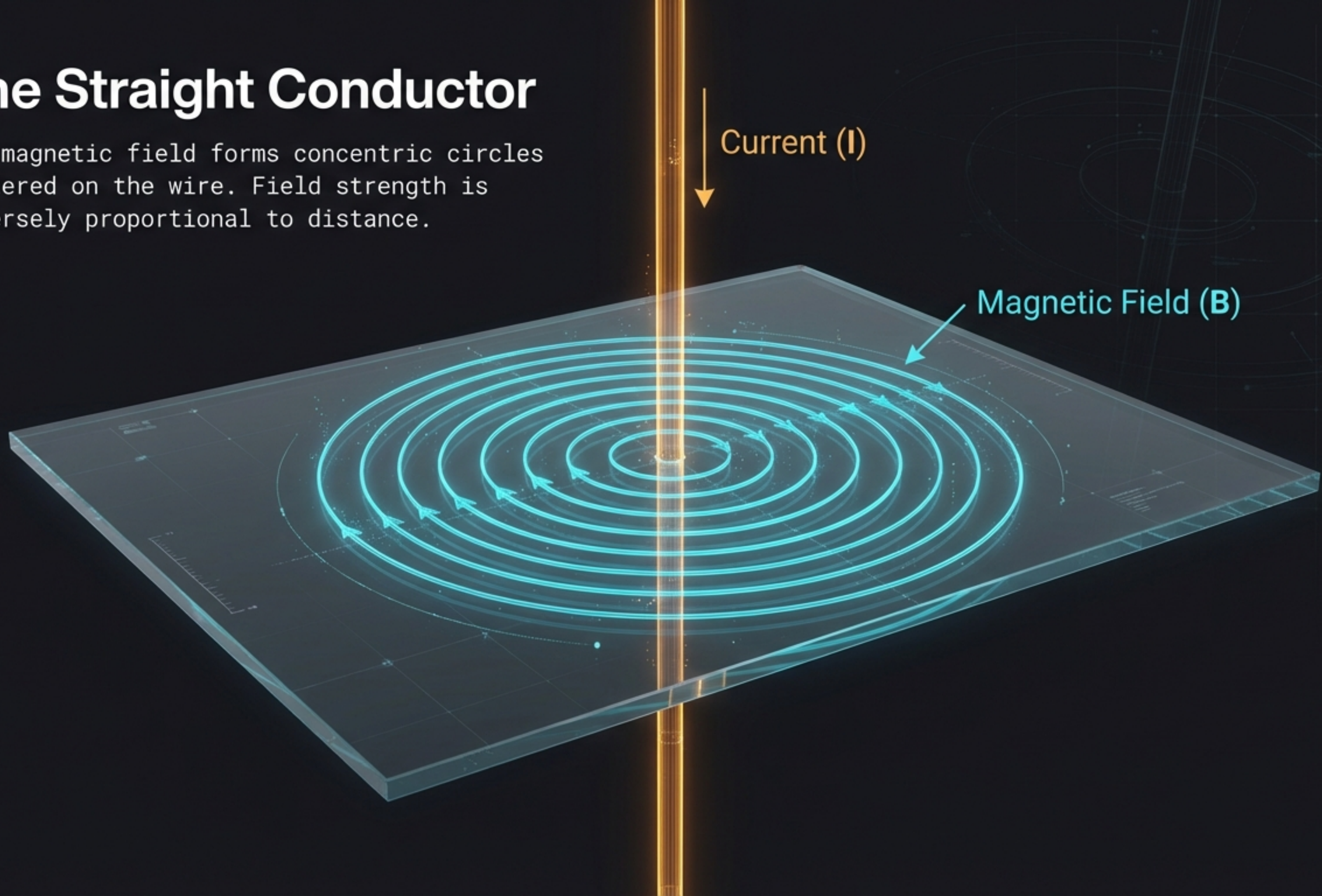


## FIELD RULES:

- 01. Direction:**  
North → South (External),  
South → North (Internal).
- 02. Strength:**  
Indicated by density.  
Closer lines = Stronger field.
- 03. Constraint:**  
Intersection is impossible.

# The Straight Conductor

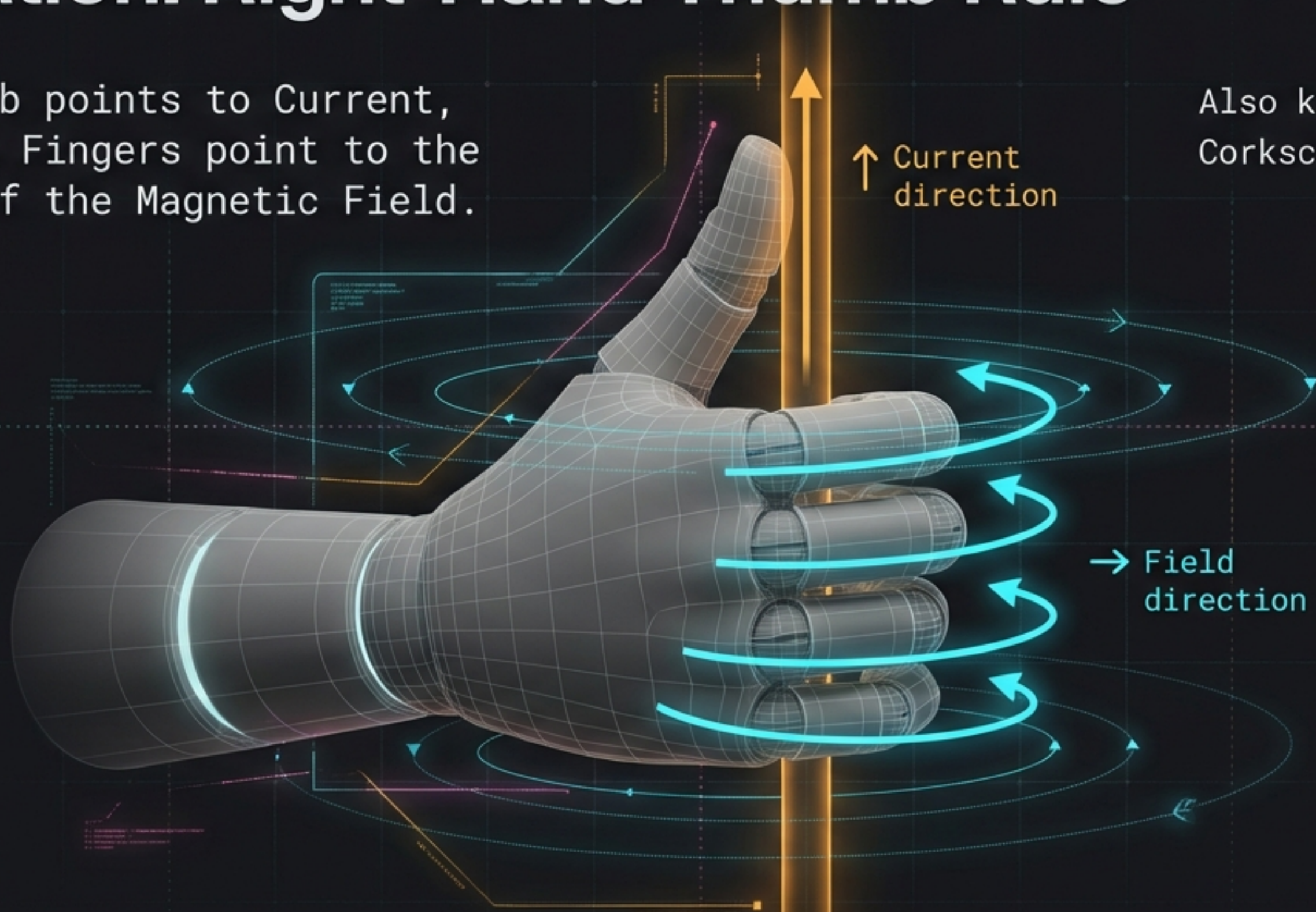
The magnetic field forms concentric circles centered on the wire. Field strength is inversely proportional to distance.



# Navigation: Right-Hand Thumb Rule

If the Thumb points to Current, the Wrapped Fingers point to the direction of the Magnetic Field.

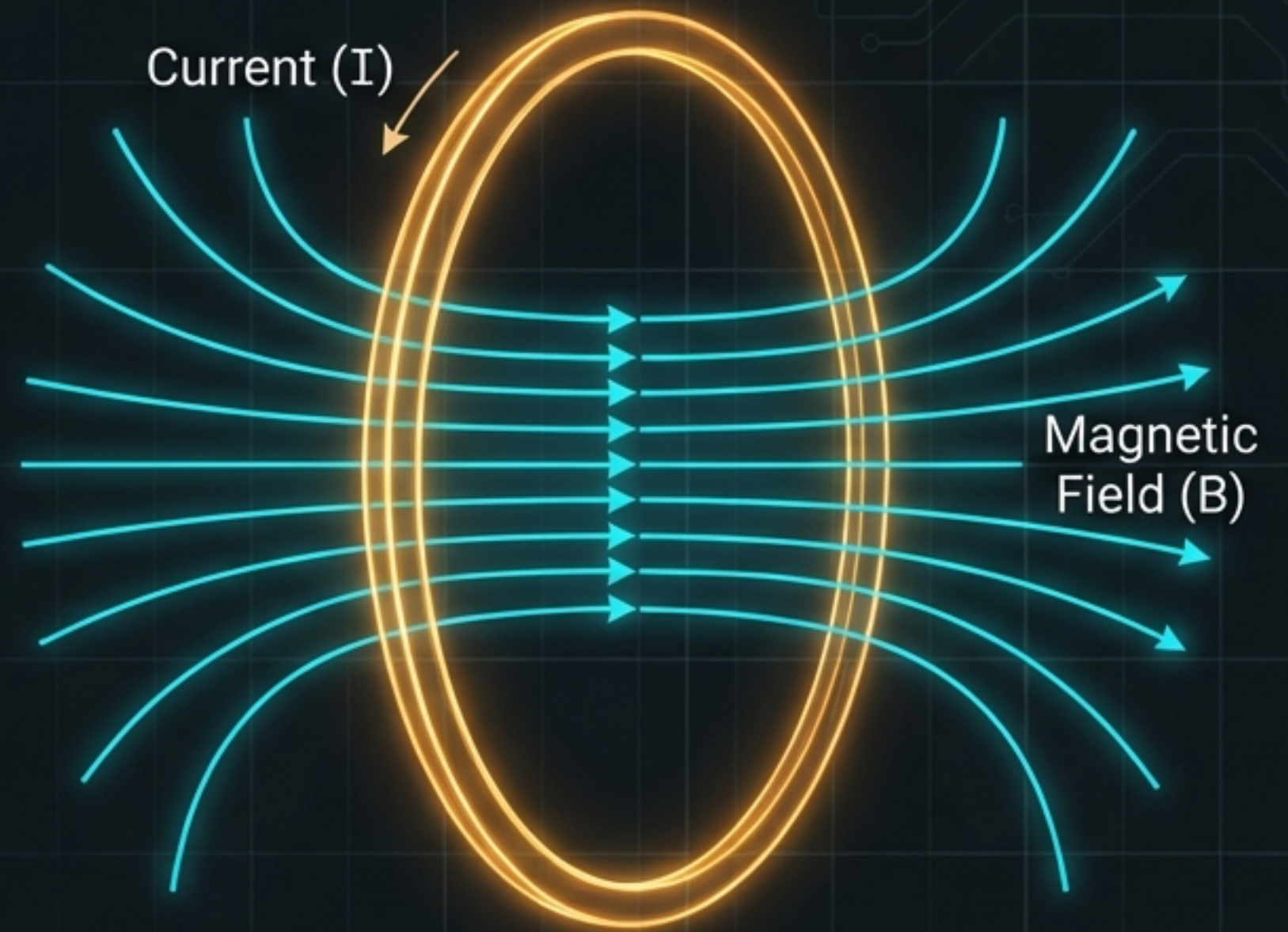
Also known as Maxwell's Corkscrew Rule.



# Bending the Current

Bending the wire focuses the field. At the center of the loop, the arcs straighten, creating a uniform field line.

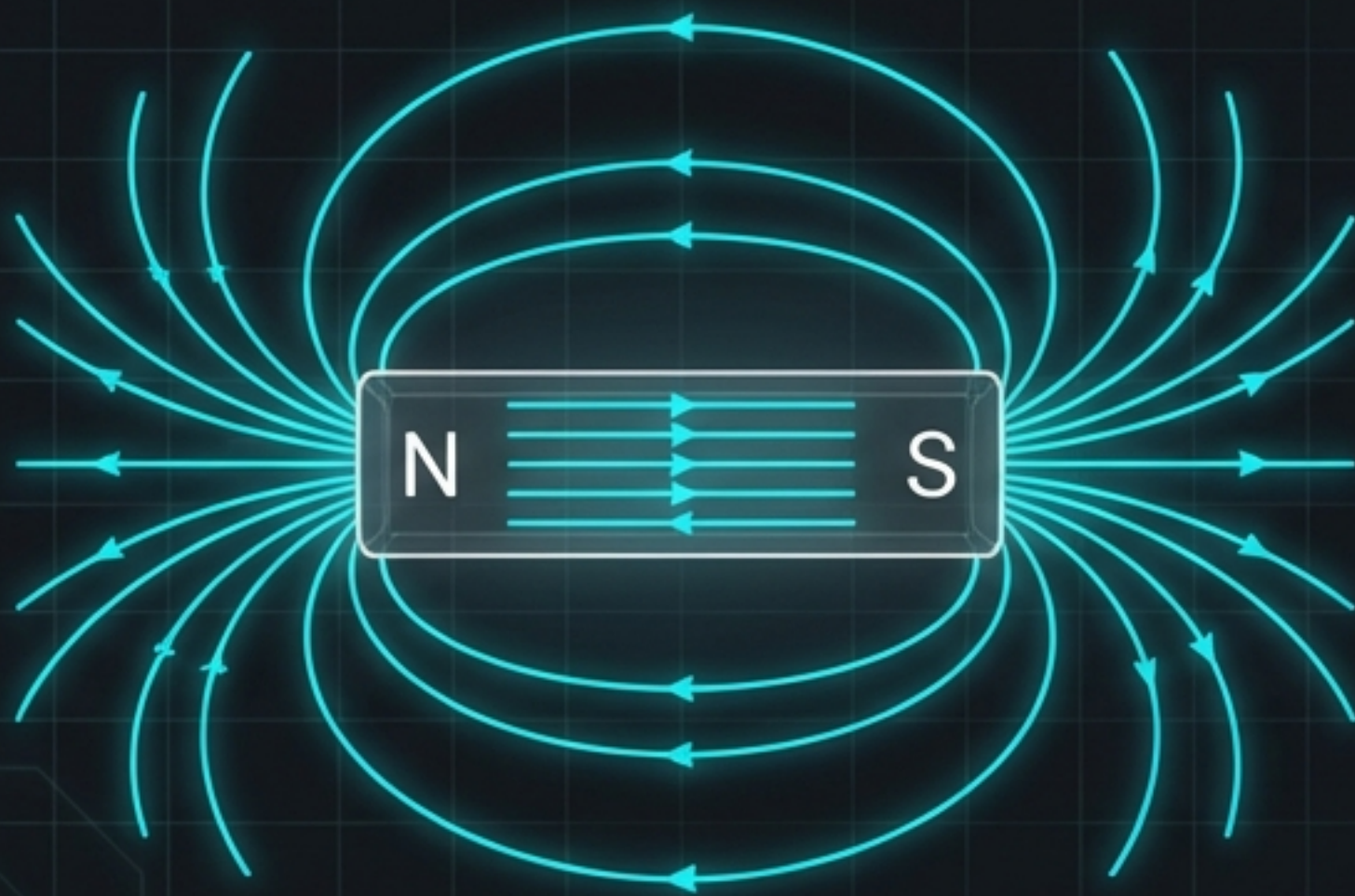
Field Strength  $\propto n$  (number of turns)



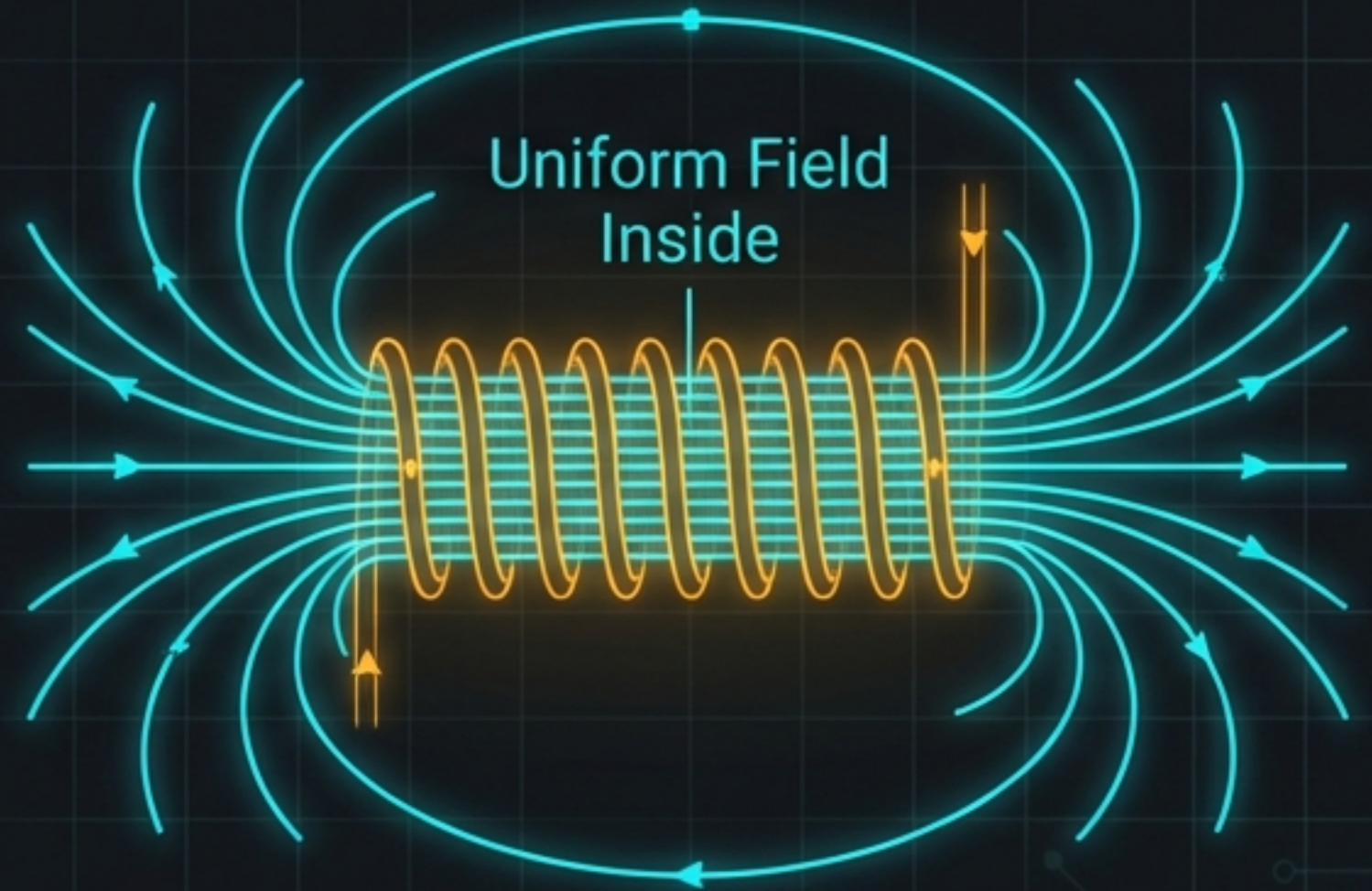
# The Artificial Magnet

## The Solenoid

A coil of many turns produces a field identical to a bar magnet.  
Placing a soft iron core inside creates an Electromagnet.



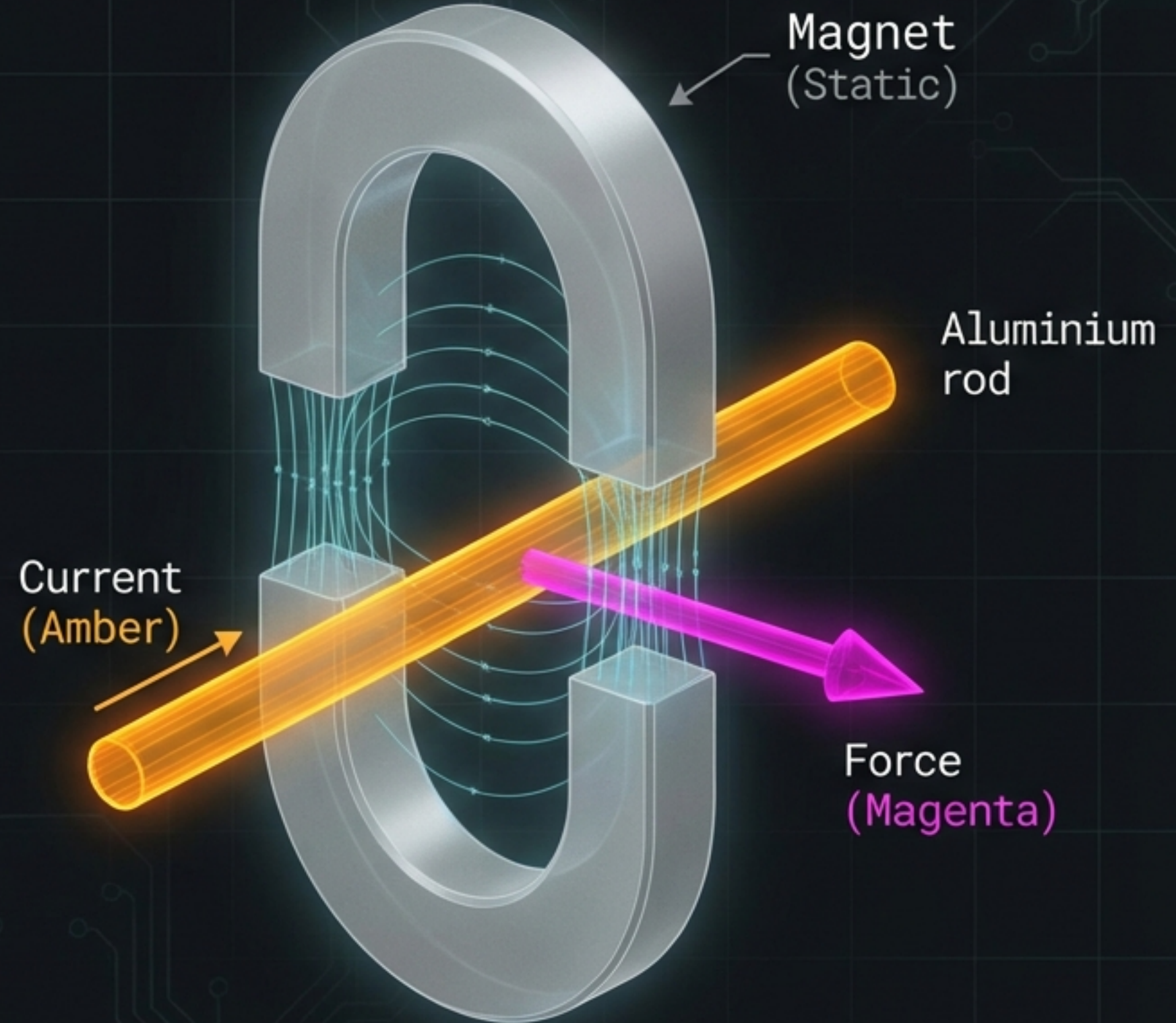
BAR MAGNET



SOLENOID

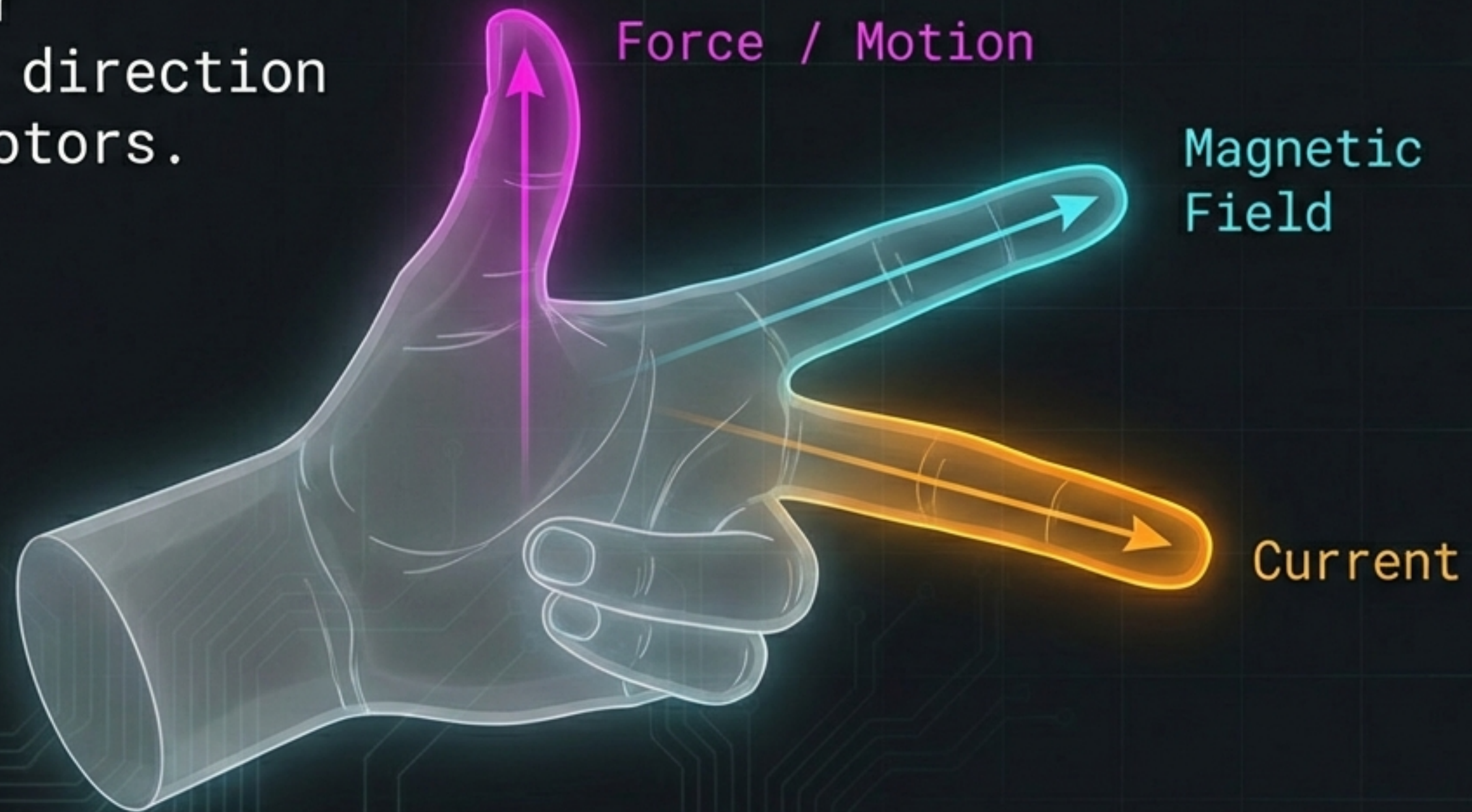
# The Kick

A magnet exerts a force on a magnet or a force on a current-carrying wire. The displacement is largest when the current is perpendicular ( $90^\circ$ ) to the magnetic field.



# Fleming's Left-Hand Rule

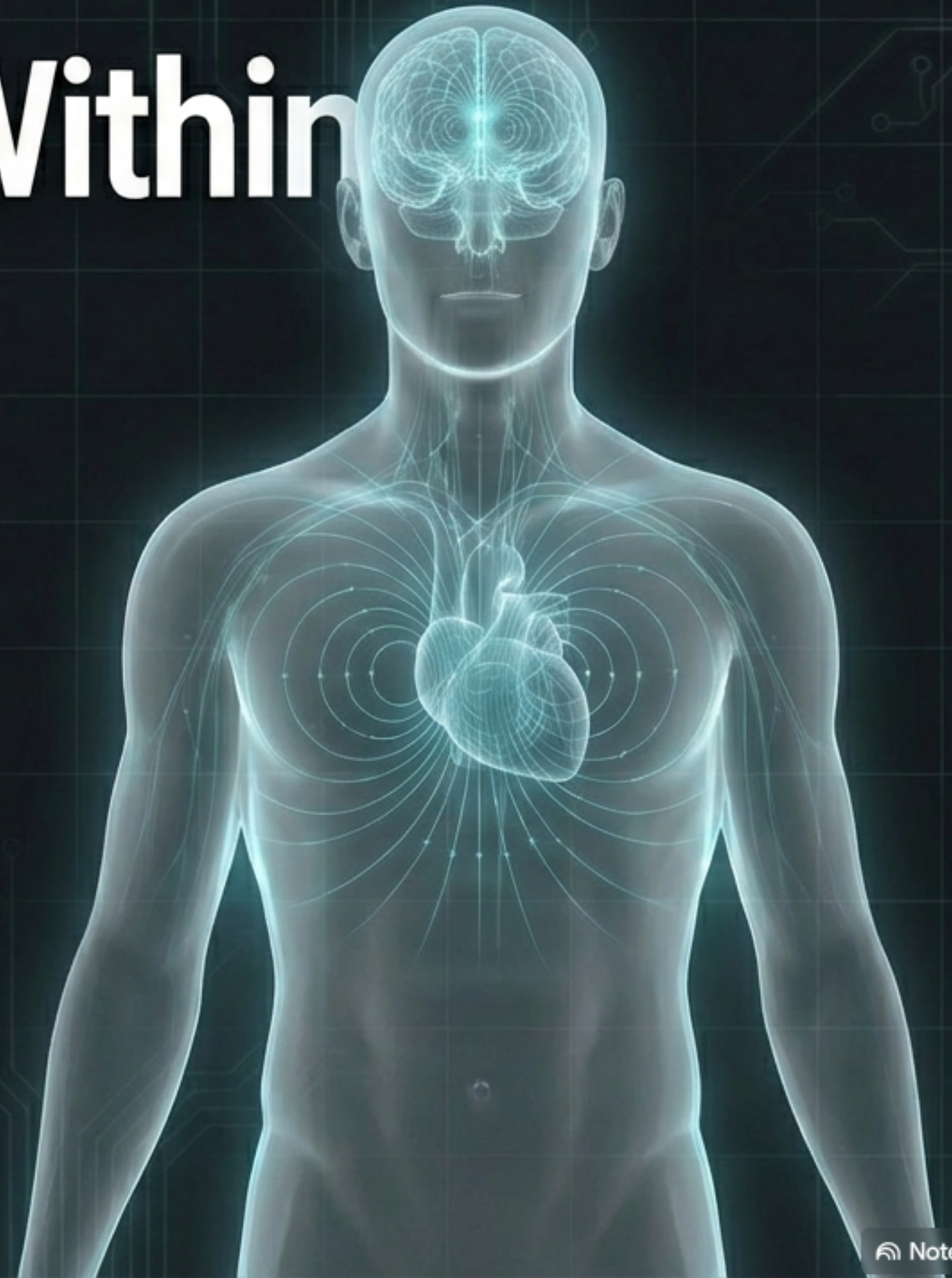
The standard for determining the direction of motion for motors.



# The Magnetism Within

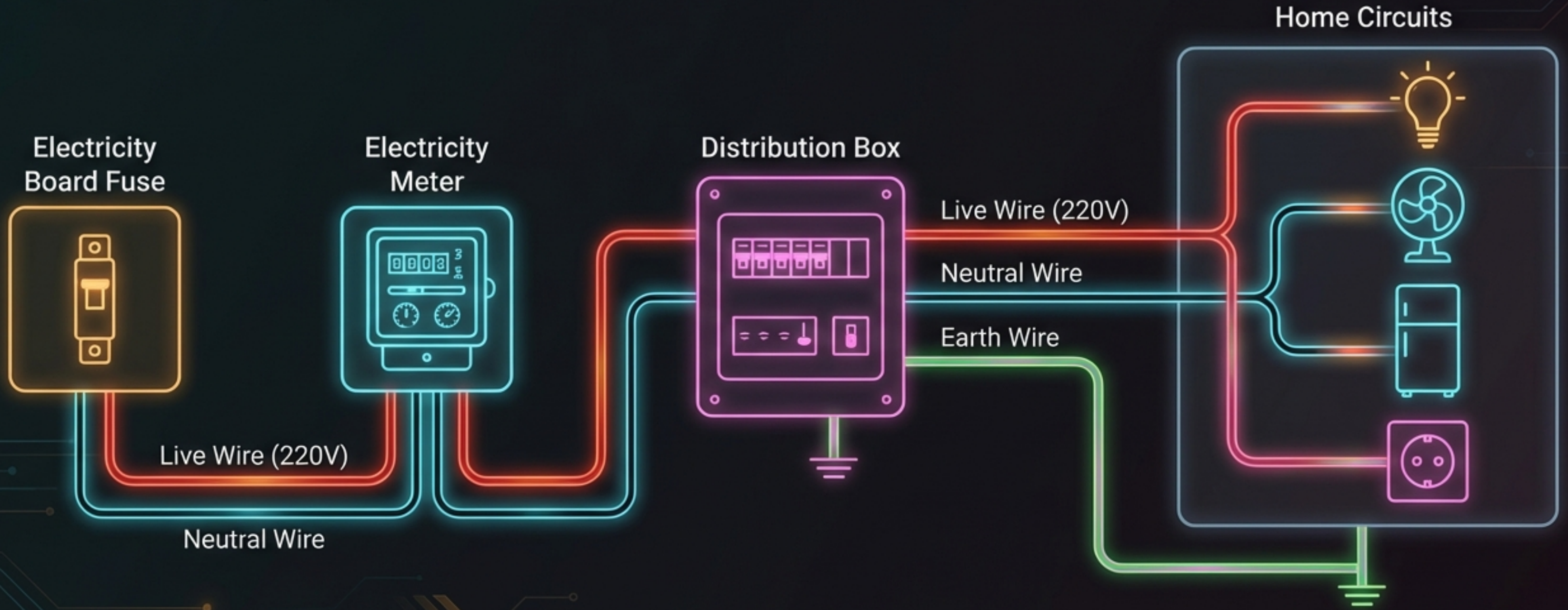
Weak ion currents in nerves produce temporary magnetic fields. This principle powers MRI (Magnetic Resonance Imaging) technology.

Internal fields  $\approx 1/1,000,000,000$  of Earth's field.



# The Domestic Grid

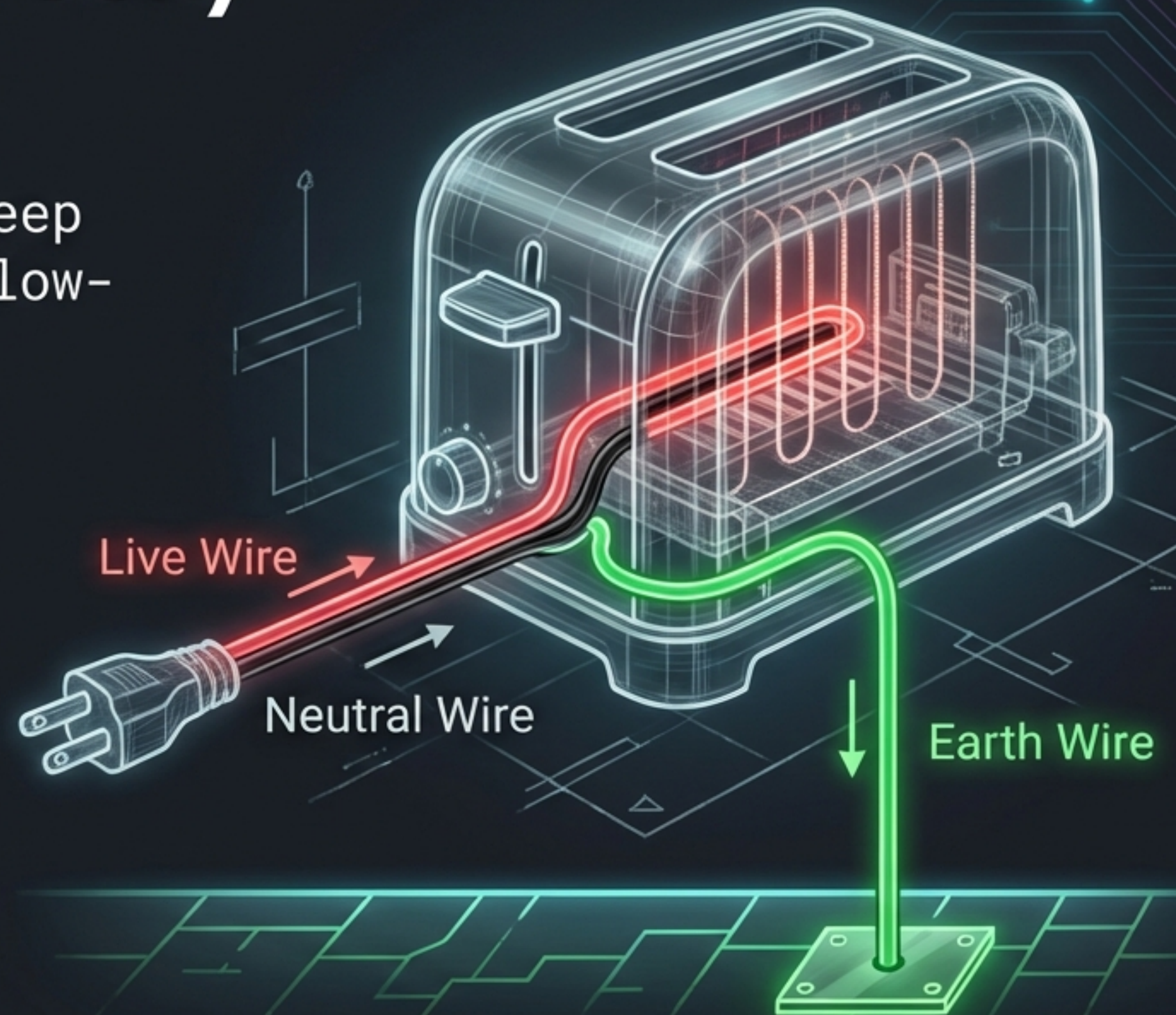
Note: Parallel connection ensures independent voltage for every appliance.



# The Earth Wire (Green)

## The Safety Shield

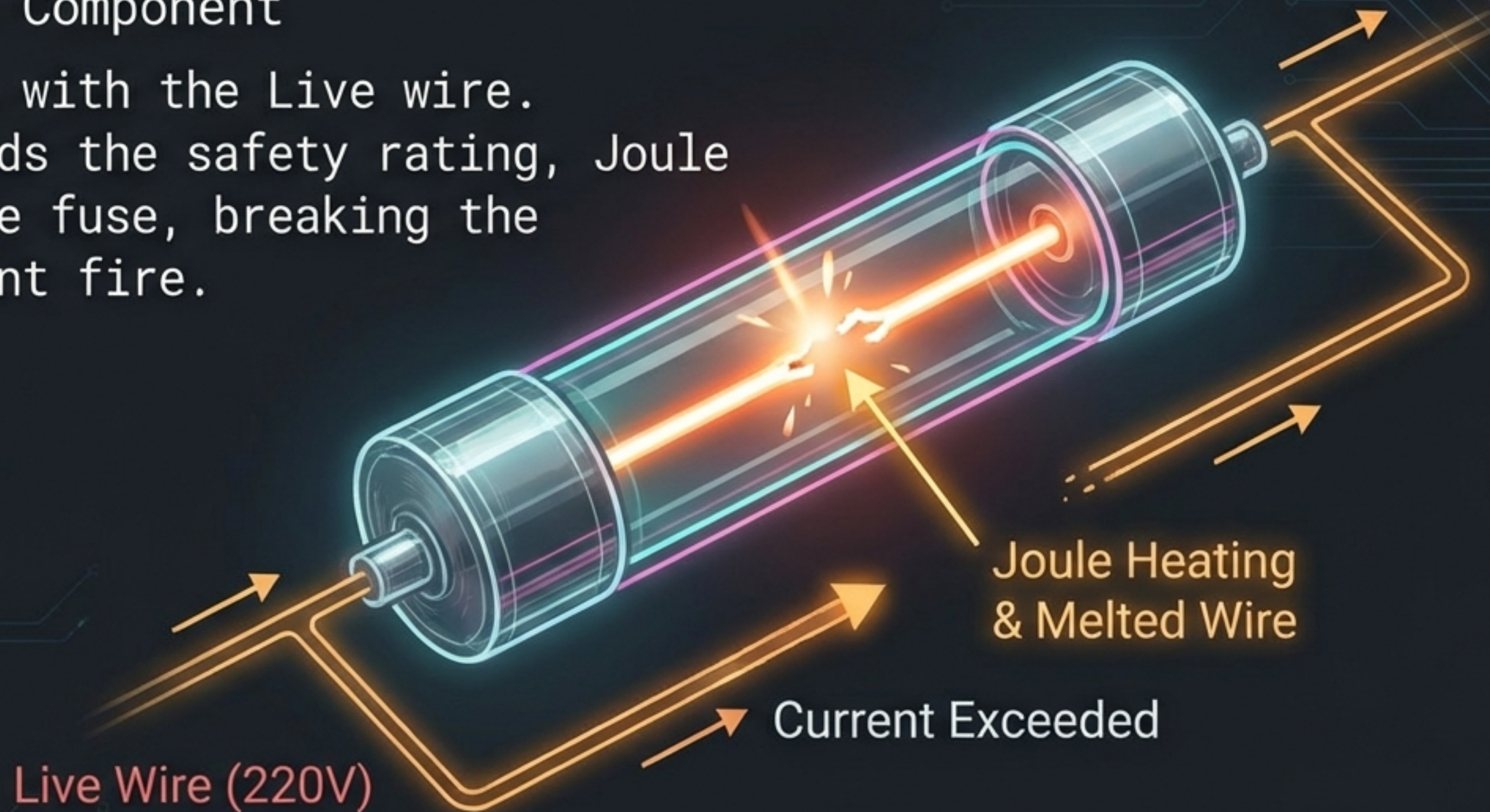
Connected to a metal plate deep in the earth, it provides a low-resistance path for leakage current, preventing shock.



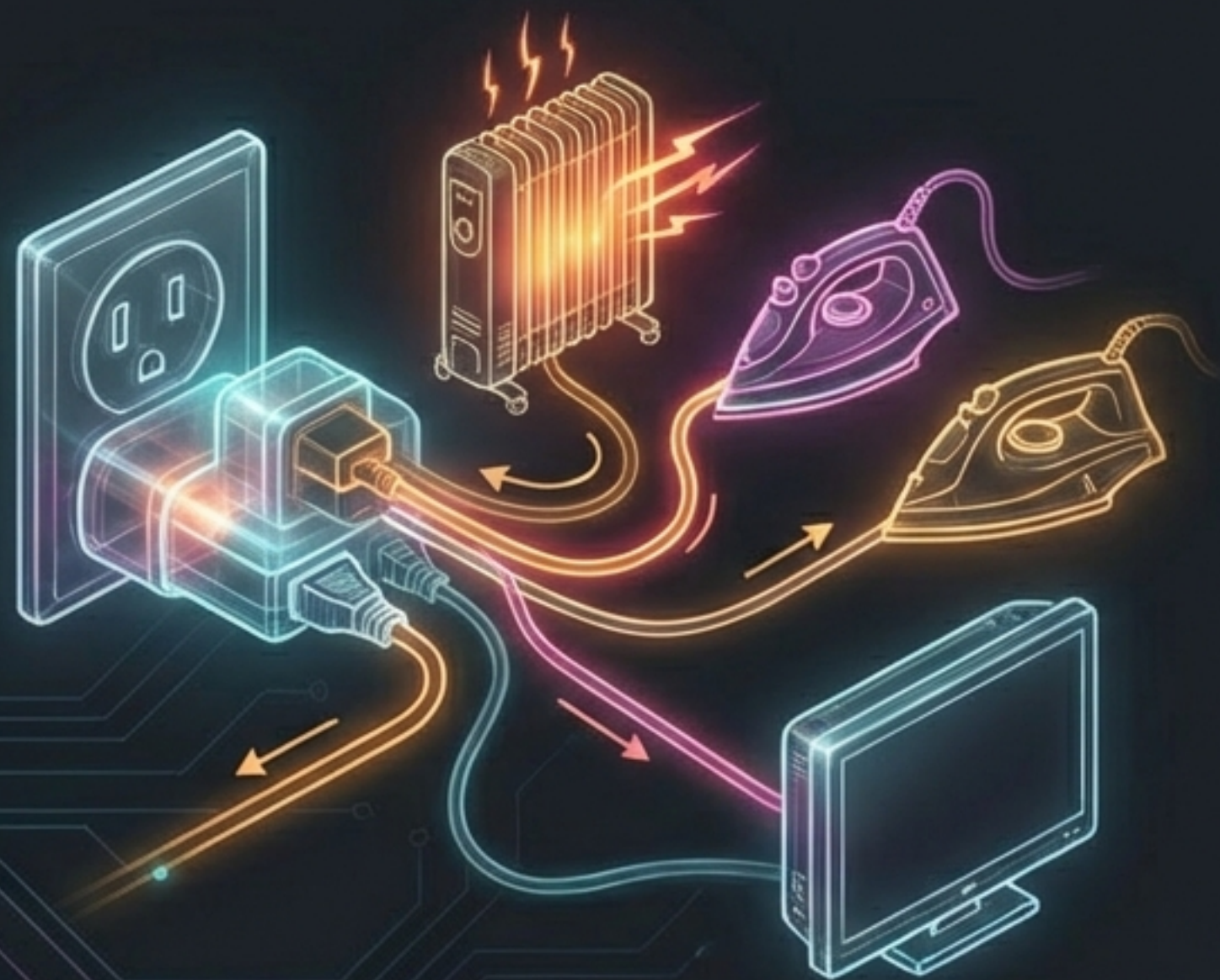
# The Fuse

## The Sacrificial Component

Placed in series with the Live wire.  
If current exceeds the safety rating, Joule heating melts the fuse, breaking the circuit to prevent fire.



# System Failure

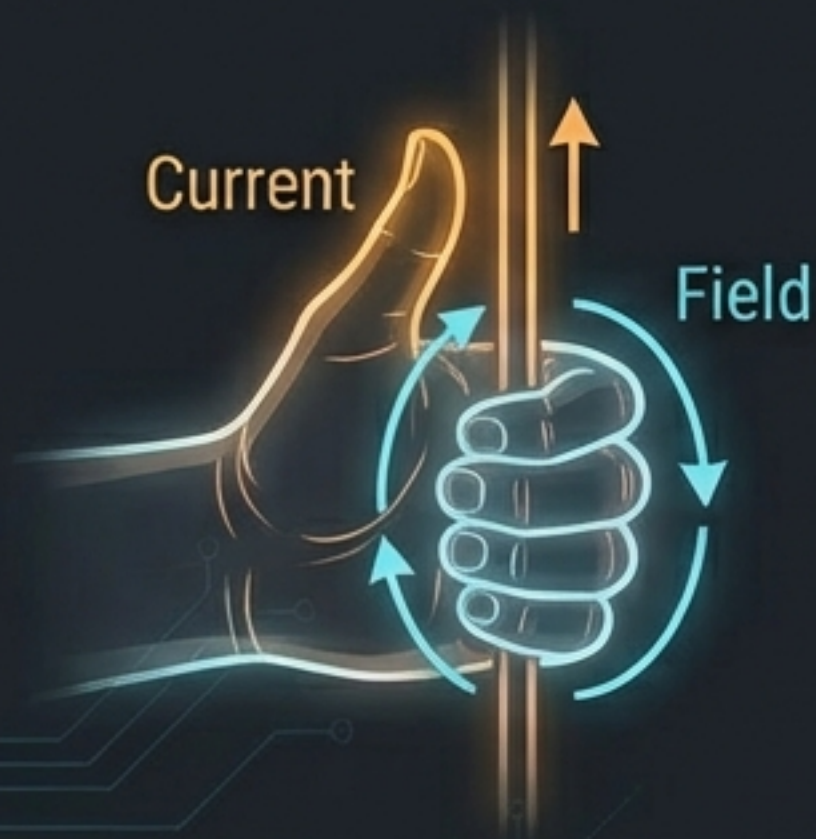


Overloading  
(Too many appliances)



Short-Circuit  
(Live contacts Neutral)

# The Physics Toolkit



Right-Hand Thumb Rule  
(Field Direction)



Fleming's Left-Hand Rule  
(Force Direction)



Domestic Wiring Code

From the deflection of a compass to the safety of our homes.