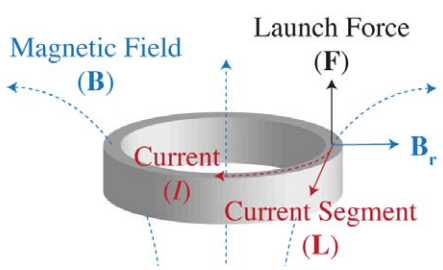
JUMPING RING 5K20.30

Electricity and Magnetism | Electromagnetic Induction | Eddy Currents



Concept:

This is a crowd pleaser with subtle physics. The upward force on the ring requires that the coil's B-field have a *radial* component, and this arises only because the field fringes as shown in the diagram above. The upward launching force on the ring is given by:

$$\mathbf{F} = I\mathbf{L} \times \mathbf{B}_r$$

where I is the induced current in the ring with direction given by Lenz's Law, $\mathbf{L}$ is the current segment length in the direction of the current, and $\mathbf{B}_r$ is the radial component of the coil's magnetic field. Note that there is also an *axial* component of $\mathbf{B}$ (not shown), which exerts a *compressive* force on the ring but with unseen effect because of the ring's stiffness. The reason this demonstration works with AC supplied to the coil is due to a phase difference between the supplied AC and the current induced in the ring (see Am. J. Phys. **79**, 353 (2011) and Am. J. Phys. **68**, 238 (2000)).

Equipment:

- Ring Launcher Apparatus
- (2) Large Aluminum Rings
- Induction Coil and Bulb
- Copper Ring
- Split Aluminum Ring
- Small Aluminum Ring
- Liquid Nitrogen*, tongs and Dewar (upon request)

Procedure:

1. Verify that the ring launcher is plugged in and the green light is on.
2. Slide one of the rings onto the center rod.
3. Press the "launch" switch to activate the ring launcher. Don't depress the switch for more than 1 sec!

* Be aware of low ceilings. Liquid nitrogen cooled rings may launch substantially higher than 1 meter.

	Large Aluminum Ring	Small Aluminum Ring	Copper Ring	Split Aluminum Ring	Induction Coil & Bulb
Action	Launches ~ 2 m	Launches ~ 1 m	Launches ~ 1 m	None	Lights up