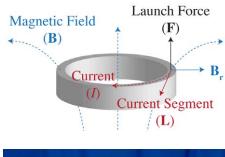
Eddy Currents

Electricity and Magnetism

Electromagnetic Induction







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, L is the current segment length in the direction of the current, and B_r is the radial component of the coil's magnetic field. Note that there is also

Equipment:

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

an *axial* component of **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 <u>Am. J. Phys. **79**, 353 (2011)</u> and <u>Am. J. Phys. **68**, 238 (2000)).</u>

Procedure:

- 1. Verify that the ring launcher is plugged in, the Variac power supply is on and set to 100 V maximum and the trigger box is armed.
- 2. Slide one of the rings onto the shaft of the launcher so that it sits on the acrylic platform.
- 3. Press the "launch" button to activate the ring launcher. Do not depress the switch for more than 1 sec!
- * Be aware of low ceilings. Liquid nitrogen cooled rings may launch substantially higher than 1 meter.

	Aluminum Ring	Copper Ring	Split Aluminum Ring	Induction Coil & Bulb
Action	Launches ~ 1 m	Launches ~ 0.5 m	None	Lights up