1. Detailed Experimental Design Diagram

**Title:** The Effect of Various Electromagnetic Wave Exposure Times on the Growth Rates of Mealworms

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**Grade Level:** 12

**Science Discipline:** Physics/Biology

**Problem to be Studied:** What effects does long term EMF exposure have on the growth rates of organisms, specifically mealworms?

**Hypothesis:** As the duration mealworms are exposed to EMFs increases, the growth rate of the mealworms will decrease and the death rate of the mealworms will increase.

<table>
<thead>
<tr>
<th>Time exposed (Hours per day)</th>
<th>0 (Control)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Mealworms exposed</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

**IV:** Duration of Exposure

**DV:** Average Mass of mealworms (g)
- Time taken for average life cycles for mealworms in each container (days)
- Number of deaths in container

**Constants:** Environment/Habitat
- Type of Food each week
- Amount of food
- Power supply model and specifications
- Orientation of EMF wire coil at each container

2. Materials List

- 4 Computer power supplies and computer fans (donated by Armada High School)
- 280’ 12 gauge household wire
- 3 Timer wall plugs
- 12 330 Ohm Resistors
- 4 Rocker switches
- 4 Push buttons
- 12 LEDs
- 4 NPN Transistors
- 600 Mealworms
- 5 Mealworm containers (plastic boxes cut to size)
3. Procedure

Preparing the system:
Refer to the ‘PSU Modification Procedure’ in the appendix. (Or shared on Google Drive if online)

Initial Procedure:
- Set up mealworm habitat the same for each container
- Place mealworms that were just recently hatched into containers
- Power on systems, 3 connected to timer plugs

Data Collection (Repeated) Procedure:
- Randomly select 30 mealworms from each container to record mass from
- Count and record the number of dead mealworms
- Refill food sources
- Record emf strength levels to ensure the field is not changing over time
- Record number of larvae that are in pupa or adult stages
- Record Behavioral changes
- Repeat each week

4. Research Calendar

No randomization is needed. The only data collected is the change in mass of the mealworms.

Week 1: Begin experiment, collect initial masses.
Week 2: Standard Data collection procedure.
Weeks 3-15: Same as week 2.

5. Experiment Design

5 identical containers will be made for mealworms. 4 computer power supplies will be modified into lab power sources, with 12V, 36A being the active power. Connect these to a wire coil that is set around the container. Turn on each system and be sure to prevent circuit shorts.