

Development of Electrode Geometry for testing Dielectrophoresis (DEP) feasibility in applications of Artificial Gravity

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Introduction

Dielectrophoresis (DEP) is a process that uses non-uniform electric fields to induce a physical force on dielectric substances such as water. Current applications of DEP exist only on the microscopic scale for the manipulation of cells. This research intends to prove the viability of DEP on macroscopic applications. Prior research into DEP has found:

- Observation of DEP forces approximately 20% of earth's gravity at 60 kV (1).
- Theoretical applications of DEP on the containment of cryogenic hydrogen for spaceflight (2).

Design

Design and fabrication of five varying electrode designs was conducted, two were selected to gather the following data. Design was based upon:

- Asymmetry created by the geometry
- Reduction of arcing risk
- Geometries effective on the microscopic scale

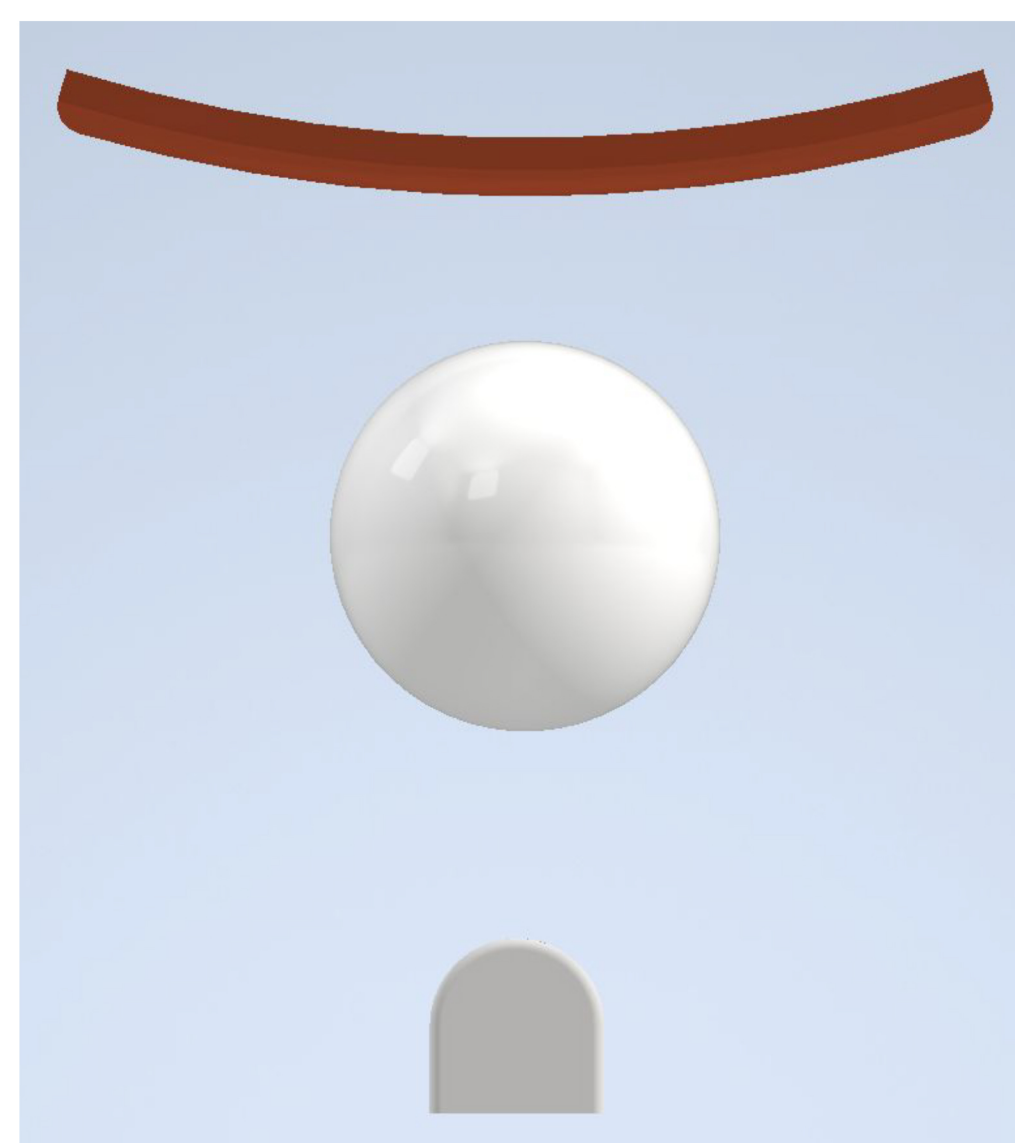


Figure 1. CAD Rendering of
CPC Geometry

References:

1. Flaherty, Savannah, "Dielectrophoretic Control of Macroscopic Media for in-Space Applications" (2021). Summer Community of Scholars Posters (RCEU and HCR Combined Programs). 89. <https://louis.uah.edu/rceu-hcr/89>
2. Darakorn na Ayuthya, Pongkrit, and Jason T. Cassibry. "Study of Dielectrophoresis for Wall-free Confinement of Cryogenic Hydrogen." AIAA Propulsion and Energy 2020 Forum. 2020. <https://doi.org/10.2514/6.2020-3837>

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Results

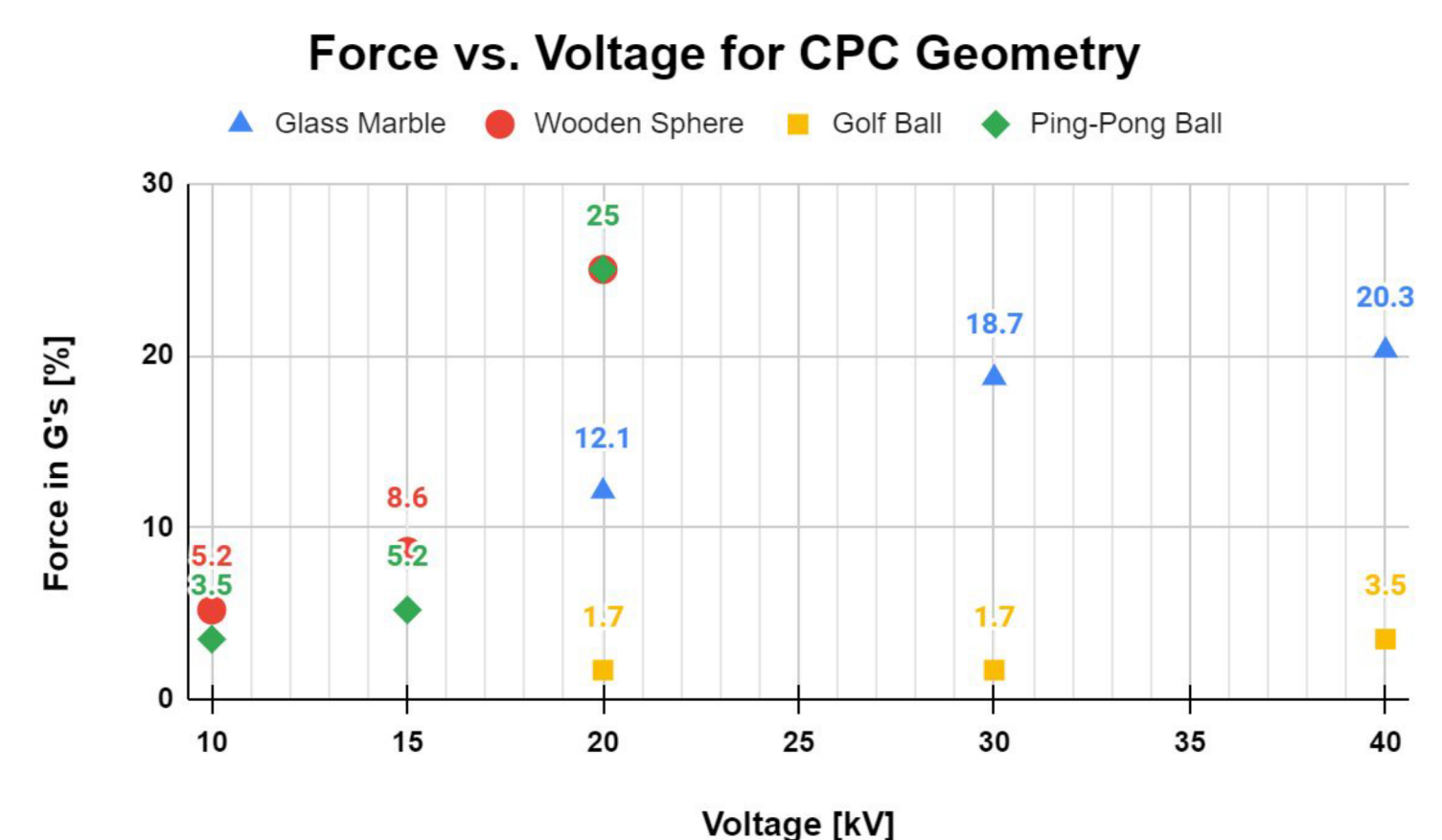


Figure 2. Testing Data for CPC Geometry

- The maximum force was 0.015 N
- Highest G force observed was 25% of gravity
- The wood sphere was the most reactive
- 1/4th Voltage used to get the same results as prior testing

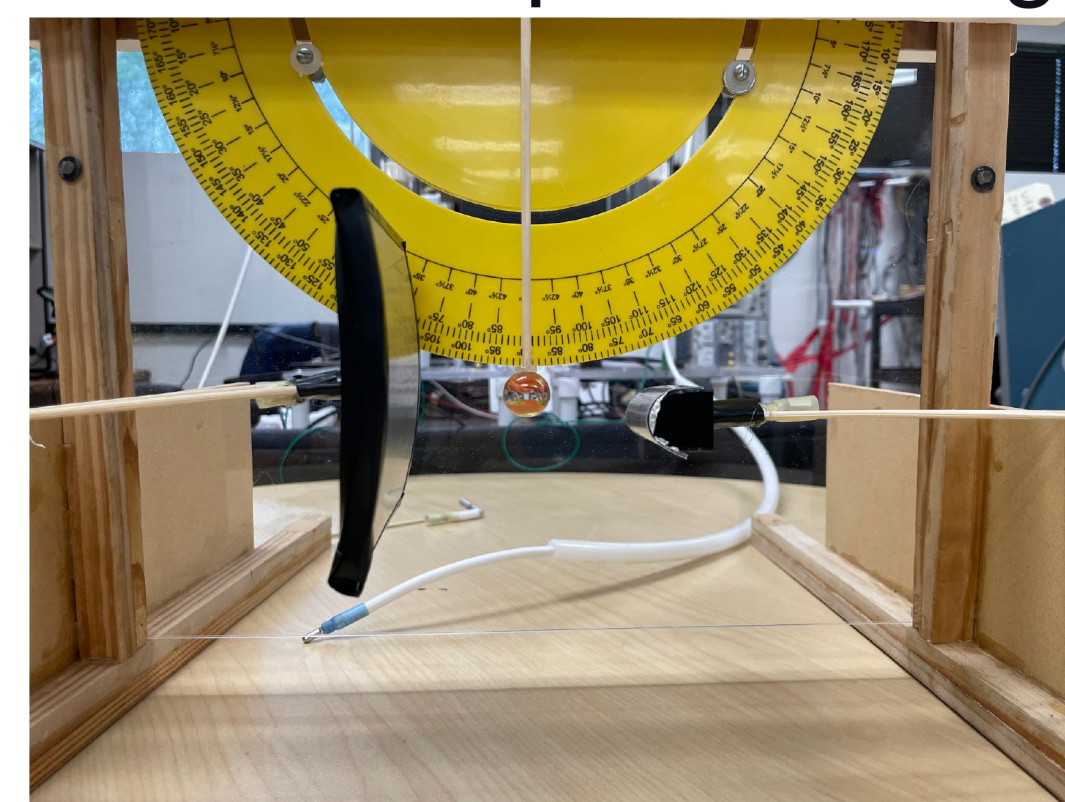


Figure 3. Testing Setup
using Pendulum

Conclusions

The research conducted will act as a foundation and help support the modeling of DEP forces on a macroscopic scale. This aims to help bring the following applications of DEP to reality.

- DEP based artificial gravity for space travel
- Particle filtration in liquids
- Levitation of macroscopic objects

DEP Demonstration:

