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Category Number and Subject: 10.0.0 Undergraduate or High School
Research

Theory Experiment

Portable rotating discharge plasma device,* B.L. Dwyer, *Stanford U.*; N.H. Brooks, R.L. Lee, *GA* – We constructed two devices for the purpose of educational demonstration: a rotating tube containing media of two densities to demonstrate axial confinement and a similar device that uses pressure variation to convert a long plasma glow discharge into a long straight arc [1]. In the first device, the buoyant force is countered by the centripetal force, which confines less dense materials to the center of the column. Similarly, a plasma arc heats the gas through which it passes, creating a hot gaseous bubble that is less dense than the surrounding medium. Rotating its containment envelope stabilizes this gas bubble in an analogous manner to an air bubble in a rotating tube of water. In addition to stabilization, the rotating discharge also exhibits a decrease in buoyancy-driven convection currents. This limits the power loss to the walls, which decreases the field strength requirement for maintaining the arc. These devices demonstrate principles of electrodynamics, plasma physics, and fluid mechanics. They are portable and safe for classroom use.

[1] N.H. Brooks, et al., *J. Appl. Phys.* **94**, 1402 (2003).

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