

Apparatus Title: 3-in-1: Centrifugal Effect, Coriolis Effect, Thermal Instability

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Abstract: Acrylic disk-shaped enclosure contains rheoscopic fluid (water + crystals), food color and an air bubble, on a turntable base, which is slightly tilted to cause the bubble to be at rest at the top edge. RF and bubble simulate atmosphere and cloud, respectively. By spinning the disk the bubble, which is lighter than the RF, is forced to the center, demonstrating the centrifugal effect. Also, the Coriolis effect can be observed by noticing how the bubble sidles to right or left, depending on the initial spin direction, once the disk is stopped and the bubble moves back to its resting place. Furthermore, if the disk is placed on a cup of hot beverage, within 30-45 seconds convection cells are observed on the top surface. These arise due to the high temperature at the bottom and room temperature at the top of the disk.

Construction of Apparatus: Although this is a new disk enclosure, its construction follows published procedure in reference 1. Briefly, it is made of small length of acrylic tubing that is covered at its two ends by two disks. RF is dispensed into the disk via a hole drilled in the tubing. Once filling is done and appropriate size bubble is achieved (by squeezing the two disks), the hole is covered with a small piece of acrylic and glued/sealed. Ref. 1. Fluids Demonstrations, The Physics Teacher, pp. 248-252, April 2018.

Use of Apparatus: It is simple to use the disk enclosure. Simply spin the disk until the bubble is forced to the center (centrifugal effect). Stop the disk. Observe how the air bubble moves/sidles as it moves back to its resting position at the top edge. The direction of sidle depends on the spin direction, and is a demonstration of the Coriolis effect. For CCW spin, the sidle is to the right (Northern Hemisphere), and for a CW spin, the sidle is to the left (Southern Hemisphere). For observing thermal instability, a hot temperature source is need. A convenient source is a cup of hot beverage. Remove the disk from its base, and place it on the cup. Within 30-45 seconds, thermal convection cells (known as Benard cells) are visible on the surface. These cells are developed due to temperature differential between the bottom of the disk (high temperature) and the top of the disk (low or room temperature).