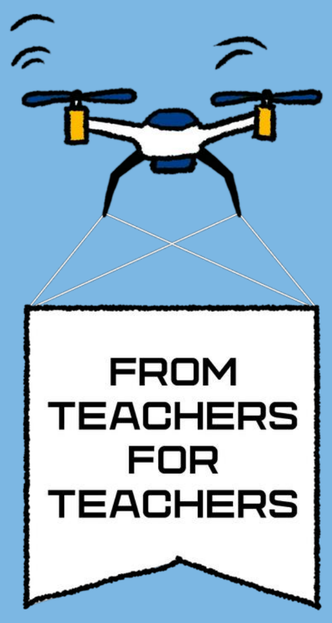

DIVERSITY
in STEM Education

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Hurricane in the cup

Turbulent flow is quite difficult in mathematical description. On the other hand, vortices in the liquid are visually beautiful. These phenomena can encourage young people to become interested in science. For this reason, two methods of observing "hurricanes" in fluids are presented in this poster.

In the first method diffusion of milk poured into coffee was observed. Vortices formed during this process were recorded. The experimental setup is shown in Fig. 1.

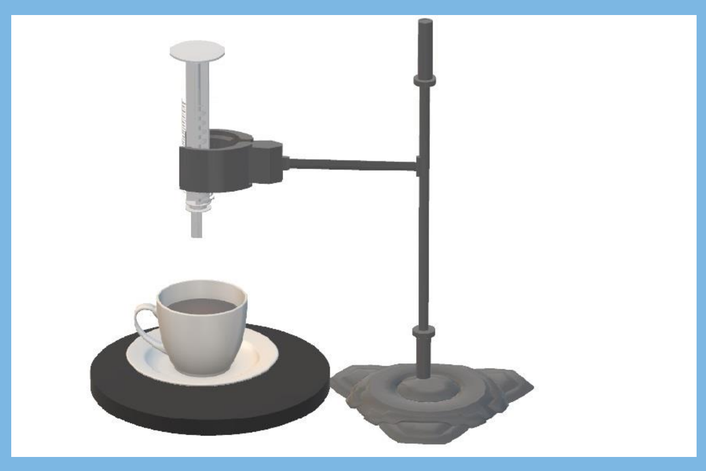

Fig. 1. Scheme of the setup used in the first method.

Ordinary and a thermal imaging cameras were used to record the phenomenon, which enabled a more accurate analysis of the vortex properties (Fig. 2ab). The control of the necessary parameters was possible in system which contains of a cup placed on a rotating disc with adjustable rotation speeds and a syringe on a tripod above the vessel. During the experiment, the temperature of the fluids, the ratio of their volumes, the direction and speed of rotation of the disc, as well as the substances themselves were changed. Dependences of movement parameters on the factors mentioned above were observed. It was also possible to compare them to phenomena occurring on a larger scale.

For instance when the milk is poured into the coffee, the first characteristic form can be observed, consisting of two vortices rotating in opposite directions, known as mushroom vortex rings (Fig. 2b). This occurs as the liquid being poured in, meets resistance and gradually curls, forming spirals. This process disappears as the energy dissipates in the fluid.

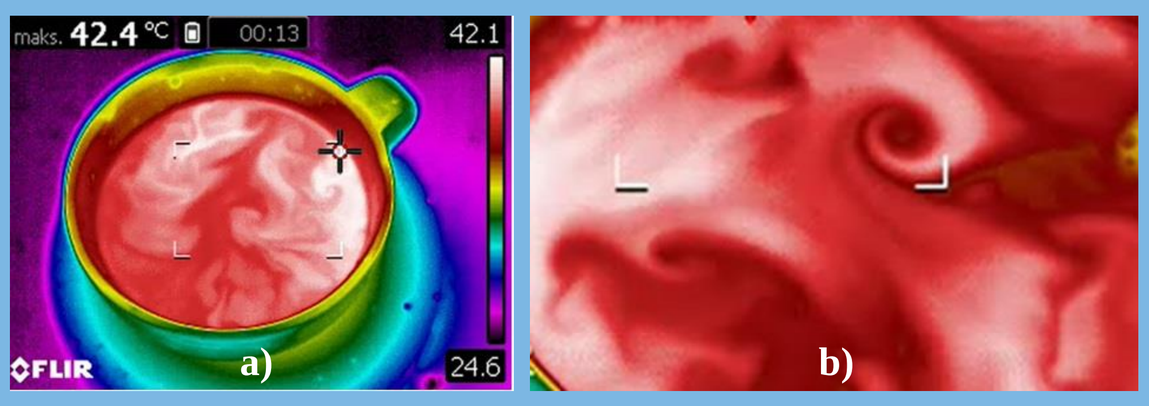

Fig. 2. Pictures from the thermal imaging camera.

In the second method a mixture of powdered mica with water has been used (2g of powder for every 0.2l of water). The movement of mica particles reflecting light in different directions allows the observation of fluid "hurricanes" in various situations – for instance while rotating the liquid in a round (Fig. 3) or square (Fig. 4) vessels.

Fig. 3. A mixture of powdered mica and water rotating in a round vessel.

Fig. 4. A mixture of powdered mica and water rotating in a square vessel.

Conclusion: Fluid dynamics involves many beautiful phenomena that may be observed in every day. For instance enables didactically valuable experiments with "hurricanes" in safe, small scale - just in the cup.

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