

FIG. 1.

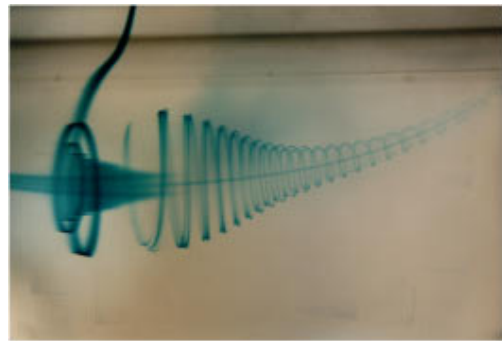


FIG. 3.

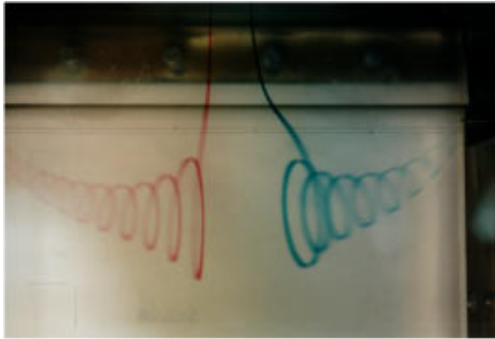


FIG. 2.

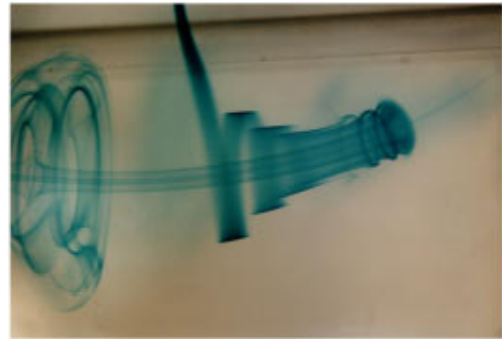


FIG. 4.

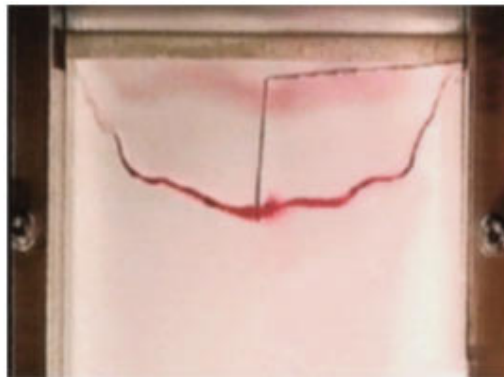


FIG. 5.

## VORTEX STRETCHING AND VORTEX BREAKDOWN

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Two experiments devoted to the study of the structure, dynamics, instabilities, and “explosion” into a turbulent spot of a stretched vortex are presented. They allow an understanding of the fundamental mechanisms which occur in vorticity filaments in turbulent flows. In these experiments, the stretching is produced by suction of the flow. The initial vorticity comes from the vorticity of a boundary layer of a laminar flow in a water channel for the first experiment,<sup>6</sup> and from the rotation of two disks at each of the extremities of

the vortex for the second experiment. Stable vortices can be created as visualized in Fig. 1 where a cross section of the spiral structure is observed, or Fig. 2 where two small dye lines show the stretched vortex.<sup>7</sup>

Instabilities of the stretched vortex are clearly observed in our experiment.<sup>8</sup> Vortex breakdown is observed as shown in Figs. 3 and 4 where an azimuthal component of the vorticity is visualized. Another mechanism for destabilization is visualized in Fig. 5 where a wave along the vortex axis is observed. This instability leads to the explosion of the vortex when it loses its coherence. It appears that the explosion starts from one of the extremities of the vortex where the vortex detaches from the suction slot. This happens most of the time when the mean flow of the channel perturbs the vortex, elongating it for instance. Then, since the pressure is smaller inside the vortex, the destabilization propagates along the vortex axis.