

Vortex flows in the Stokes regime in wall-less fluidic devices

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It has been demonstrated that the presence of solid walls affects the flow profile, decreasing the velocity in the layers next to the wall due to its friction. To decrease friction at the solid-liquid interphase, we recently developed a liquid-in-liquid tube technology (Fig. 1).¹



Figure 1. Wall-less liquid tube technology: a) permanent magnets (red, blue) in an inplane quadrupolar configuration creating a lowfield zone at the center where a tube of water (yellow) is stabilized inside of a magnetic immiscible liquid; b) contour plot of the magnetic field.

In this study, we analysed the flow profiles inside liquid tubes. Different devices have various types of obstacles inside the magnetic liquid were studied. We found a counter-intuitive "conveyor belt motion" with both forward and backward flows inside the same antitube even at ultra-low Reynolds numbers. Overall, we show that liquid-in-liquid confinement can lead to novel flow profiles not otherwise possible using conventional microchannels.

References.

1. Dunne, P. et al. Liquid flow and control without solid walls. Nature 581, 58–62 (2020).