Abstract Submitted
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Taylor-Aris dispersion of droplets (point concentrations) SØREN VEDEL, EMIL HOVAD, HENRIK BRUUS, Technical University of Denmark — The effective axial diffusion of solute concentrations advected in channel flows known as Taylor-Aris dispersion is caused by the transverse fluid velocity variations present in any channel flow [1,2]. Using our previously developed general theory [3], we study the dispersion of droplets (point concentrations) in steady and unsteady flows. Since the droplet will eventually fill the entire channel, only the transient phase leading up to complete filling requires investigation. Irrespectable of whether the flow is time-dependent or steady, the transient dispersion exhibits a strong dependence on the initial release position, "anomalous" temporal scaling, and surprisingly also shortly exceeds the Taylor-Aris limit. We will show that all these effects, which are unlike the dispersion for transverse uniform initial distributions, are easily understood as being results of variations in the velocity gradient about the release position. This emphasizes that the transient dispersion is caused by the advective stretching of the solute powered by the lateral diffusion, and provides new insight to the underlying mechanisms of Taylor-Aris dispersion for any initial distribution.

[1] Taylor, *Proc. Roy. Soc. Lond. A* **219**, 186 (1953)
[2] Aris, *Proc. Roy. Soc. Lond. A* **235**, 67 (1956)
[3] Vedel and Bruus, *J. Fluid Mech.* **691**, 95 (2012)

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