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Front Propagation in Laminar Cellular Flows: an Experimental Study

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We experimentally address the propagation of reaction fronts in laminar flows. This issue, which may be relevant to microfluidic, biophysical media or chemical engineering, raises the question of the interplay between the mixing property of flows and the propagative property of reactions. It is modeled experimentally here in a set-up which allows front propagation in a channel that involves cellular flows. Reaction is provided by an autocatalytic oxydo-reduction chemistry and flows are generated by thermal convection or by electroconvection. It is found that reaction propagates not as a wave (i.e. not as a global object) but as particles (i.e. as local front parts) and in a way that is very sensitive to the flow geometry. As a result, reaction ever finds the most efficient way to propagate, possibly by narrow paths. This picture is at a variance with the current statistical models of effective front properties.

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