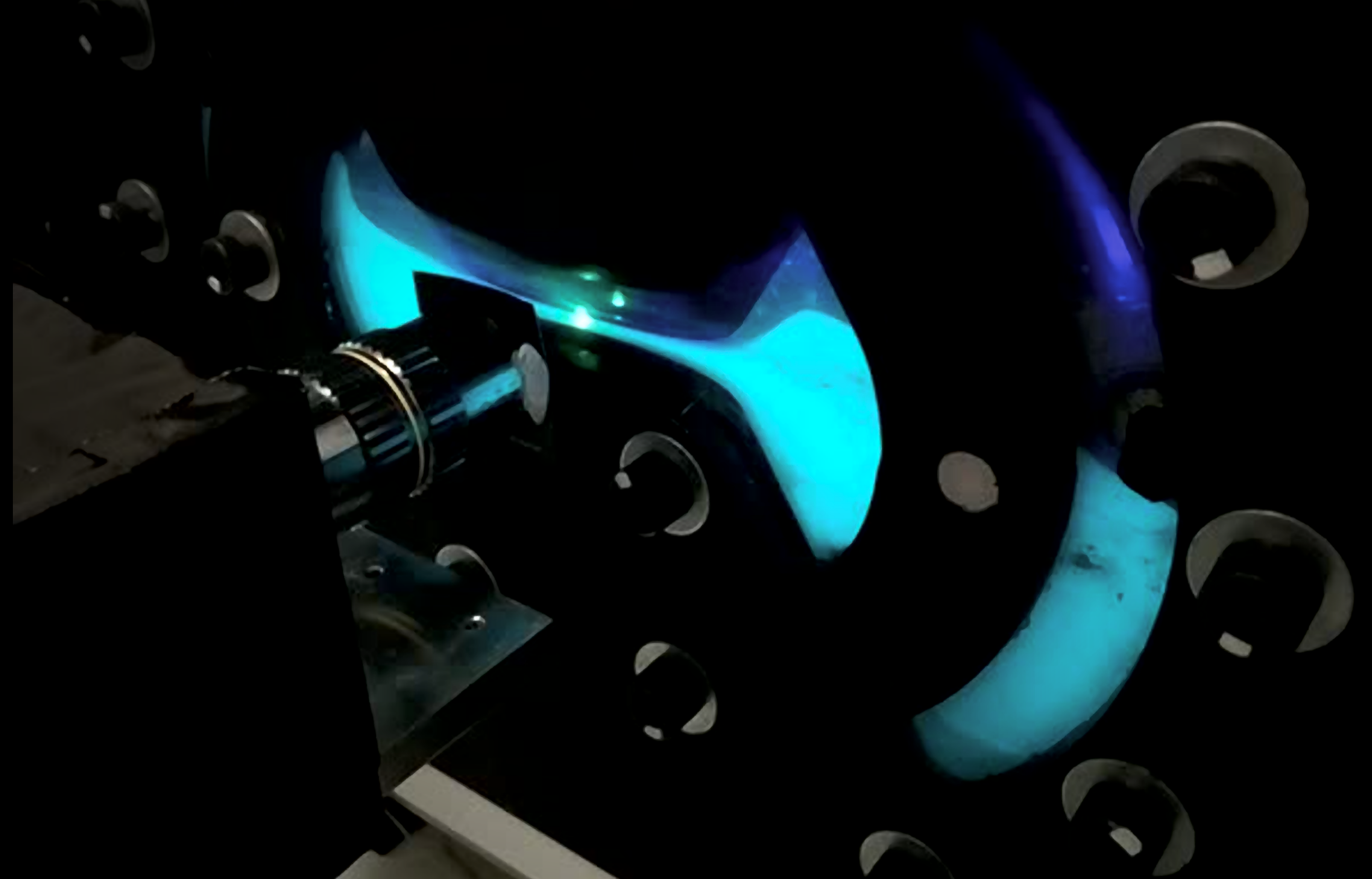
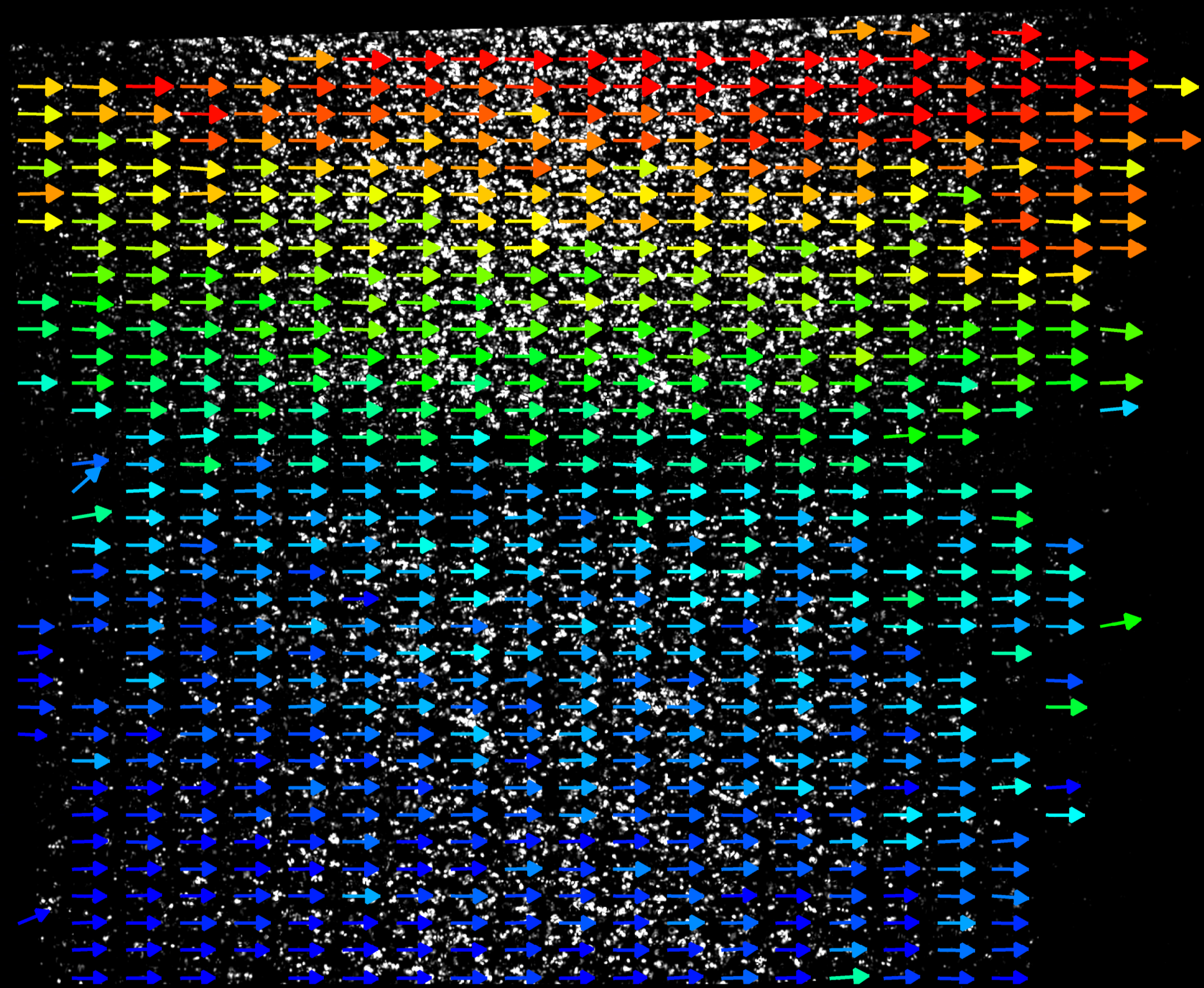


# Learning complex rheology from imaging multiphase flows

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In this experiment, we learn how complex fluids behave under so called “kinematically mixed” rheological flows – flows with shearing and stretching – which we know little about. These flows are present in examples from when toothpaste is squeezed out of a tube, to the injection moulding of everyday plastic objects.

This new "ToPSREF" (Two Phase Shear Rheology under Extensional Flow) technique consists of flowing a fluid with simple, known behaviour alongside (here, above) one with a unknown, complex behaviour (top photo).

The fluids stretch as they pass through a profiled contraction, whilst simultaneously shearing against each other. Here, a dye in the complex fluid is made to fluoresce to mark the interface. Particle image velocimetry with a laser and camera (e.g. right photo) allows us to measure their relative flow behaviour locally across the interface (left photo). Since both fluids are subject to the same stresses, we can use the known rheological behaviour of the simple fluid to thus infer the behaviour of the complex fluid under a simultaneously shearing and stretching flow.



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Experimental evidence and comparison to models

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