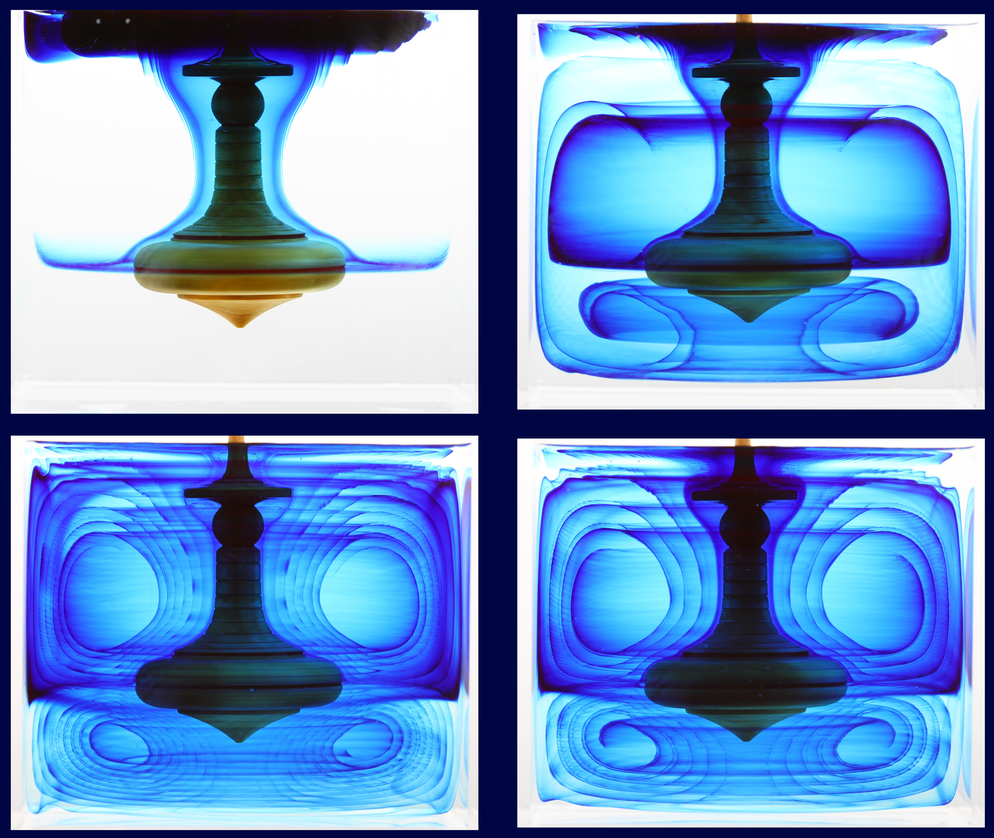
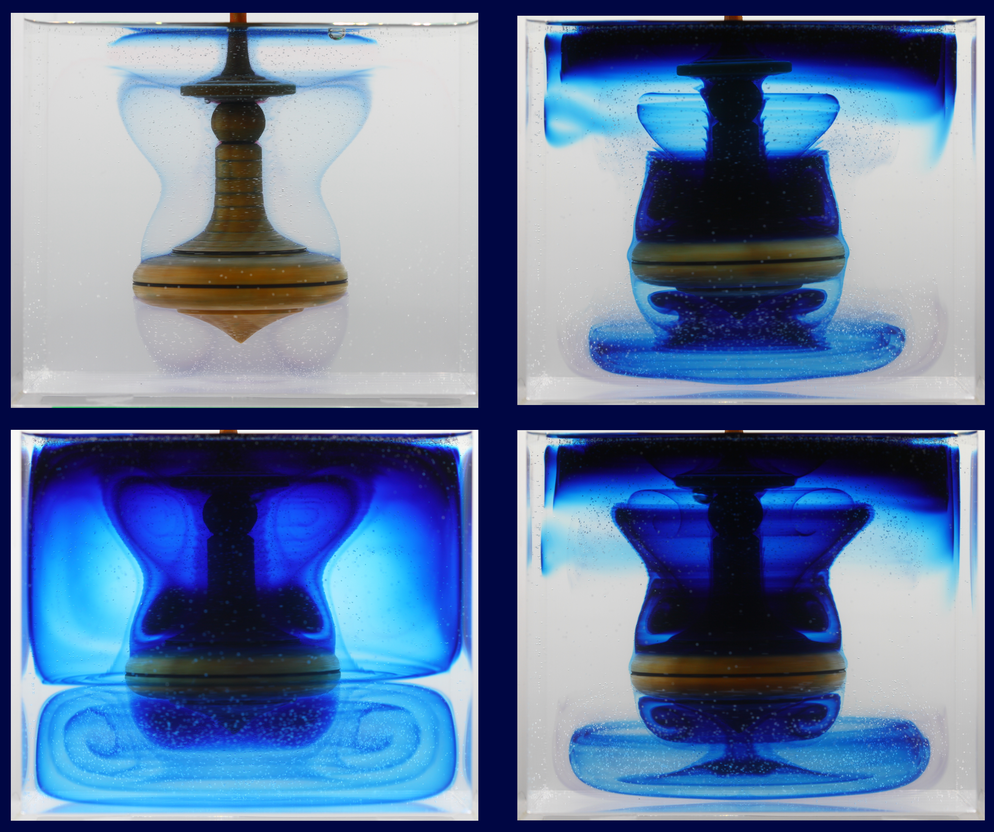
Newtonian



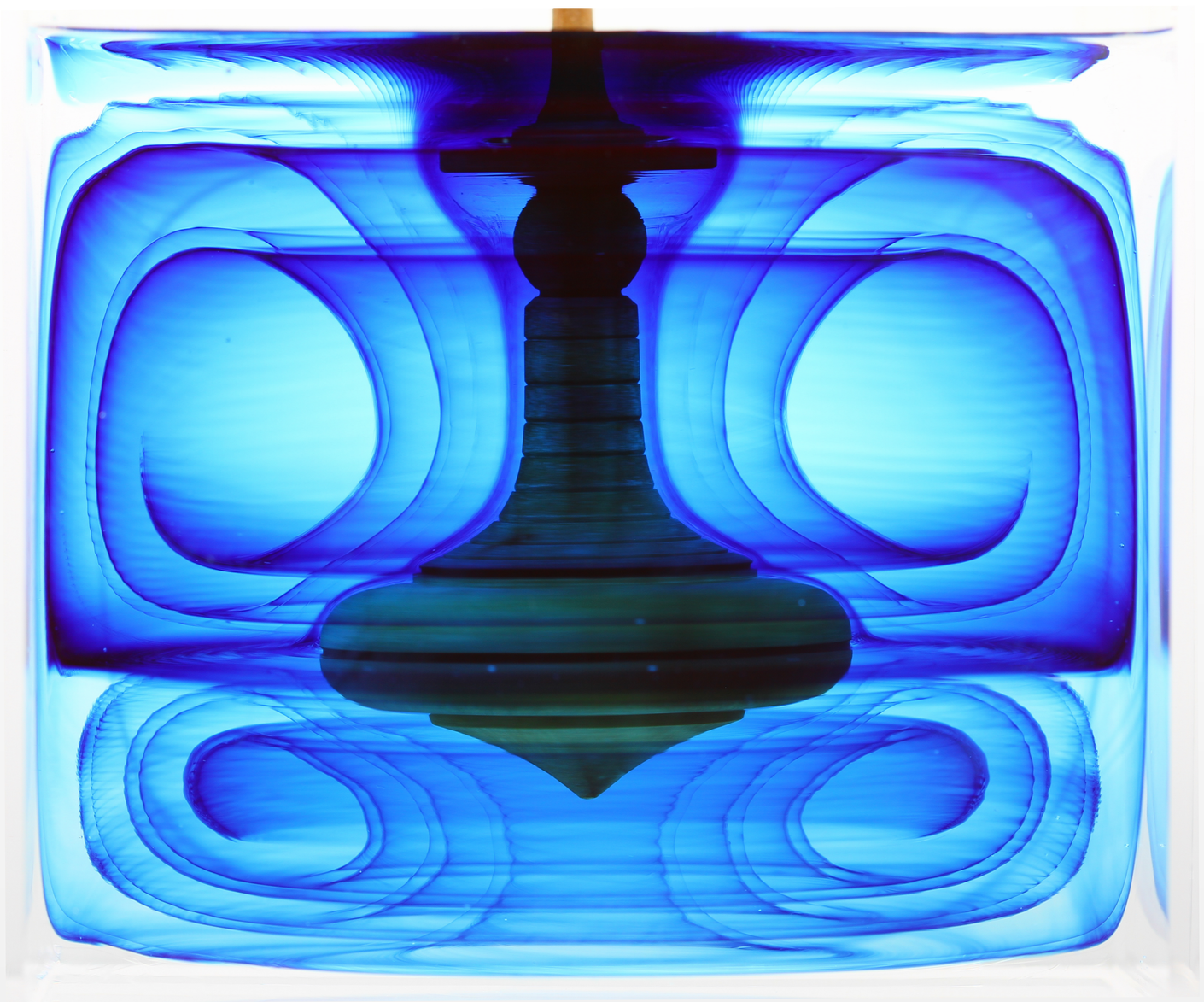
Rolling Around a Spinning Top

Using dye injection, we visualize the flow around a spinning top as it rotates in either Newtonian or viscoelastic liquids. In the Newtonian case, inertially-driven secondary flows generate toroidal vortices that roll around the geometry in an *ever-spinning spiral* (above). For viscoelastic liquids, presence of long macromolecules lead to normal stresses that defy inertial effects. Thus, the flow separates into viscoelastic and inertial zones, giving rise to a unique *butterfly pattern* that revolves around the spinning top (below). One may perform a rheological Rorschach test with these mesmerizing patterns.

by Bavand Keshavarz & Michela Geri, MIT



Viscoelastic



Like a circle in a spiral, Like a wheel within a wheel, Never ending or beginning,
On an ever-spinning reel, As the images unwind, Like the circles that you find,
In the windmills of your mind

by Allan and Marilyn Bergman