Knotted highly elastic fibers in shear flow

8:26 am – 8:39 am
Presenter: Agnieszka M Słowicka (Institute of Fundamental Technological Research Polish Academy of Sciences)
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In this work, we report the existence of knots in a highly elastic fibers with open ends in shear flow at zero Reynolds number. A previous study (Kuei at al., New J. Phys., 17, 053009, 2015) has shown that initially knotted structures - open trefoils - can untie and tie again even multiple times under shear flow. In the present work, the spontaneously formed knots are found in numerical simulations for more simple initial conditions - different straight orientations, within a range of aspect ratios and bending stiffnesses. This range has been chosen by rescaling a range where double helix shapes have been experimentally and numerically observed and reported by Slowicka et al., New J. Phys. 28, 073011, 2024. In the present work, different topological types of knots have been found. Some knots untie and retie again. The knots with a loose structure untie relatively fast. Compact knots are typically long-lasting. The presence of a double helix shape close to a compact knot often prevents it from untying.

Contributed Session: Microscale and Nanoscale Flows: Particles, Drops, Bubbles I
Time and date: 8:00 am – 9:18 am, Sunday November 23
Location: Session A26 // George R. Brown Convention Center, 362CF
Chair: Thomas Cubaud, Stony Brook University (SUNY)