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Keeping Our Sheet Together: Dynamics and Fragmentation in Yield-Stress Fluid Sheets CARLY GALVIN, BRENDAN BLACKWELL, MICHELLE DRISCOLL, Northwestern University — The two-dimensional geometry of an expanding fluid sheet presents a unique opportunity to explore material instabilities. The behavior of these sheets and the ways in which they fragment have been examined for several centuries, but the vast majority of this research has centered around Newtonian fluids. We are working toward an analogous understanding of complex fluid sheets, focusing specifically on yield-stress fluids. In our experiments, we generate the sheets via the collision of two liquid jets and film their dynamics using high-speed photography; the behavior of the sheet is set by the rheology of the fluid and the velocity of the impinging jets. Our findings indicate that quickly-expanding sheets (created by faster jets) are less stable than slowly flowing sheets. We will show that fragmentation can be categorized into different regimes based on jet velocity, jet diameter, and concentration of polymer. Furthermore, we use a suite of different fluids to determine which fluid parameters (such as yield stress, infinite-shear viscosity, surface tension, and elasticity) control the stability of the sheet.

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