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The mechanical properties of phase separated protein droplets LOUISE JAWERTH, MAHDIYE IJAVI, AVINASH PATEL, SHAMBADITYA SAHA, Max Planck Institute of Molecular Cell Biology and Genetics, FRANK JLICHER, Max Planck Institute for the Physics of Complex Systems, ANTHONY HYMAN, Max Planck Institute of Molecular Cell Biology and Genetics — In vivo, numerous proteins associate into liquid compartments by de-mixing from the surrounding solution, similar to oil molecules in water. Many of these proteins and their corresponding liquid compartments play a crucial role in important biological processes, for instance germ line specification in C. elegans or in neurodegenerative diseases such as Amyotrophic lateral sclerosis (ALS). However, despite their importance, very little is known about the physical properties of the resulting droplets as well as the physical mechanisms that control their phase separation from solution. To gain a deeper understanding of these aspects, we study a few such proteins in vitro. When these proteins are purified and added to a physiological buffer, they phase separate into droplets ranging in size from a few to tens of microns with liquid-like behavior similar to their physiological counterparts. By attaching small beads to the surface of the droplets, we can deform the droplets by manipulating the beads directly using optical tweezers. By measuring the force required to deform the droplets we determine their surface tension, elasticity and viscosity as well as the frequency response of these properties. We also measure these properties using passive micro-rheology.

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