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Laser Tweezer Deformation of Giant Unilamellar Vesicles CORY POOLE, University of Maryland, JOZSEF MESZAROS, KUMAR SENTHIL, WOLFGANG LOSERT, University of Maryland — In an aqueous solution phospholipid bilayers self-assemble to form a closed surface which is called a vesicle. Vesicles have been studied extensively due to their relevance as a model for biomembranes as well as their practical uses for chemical containment and transport. We use a holographic optical tweezer array to study the mechanical response of giant unilamellar vesicles to applied stresses. By producing vesicles with encapsulated silica microspheres we use the tweezers to indirectly manipulate vesicled. Two or more spheres are used to stretch the vesicle membrane and subsequently the vesicle relaxes back to an equilibrium shape. These deformations are imaged at millisecond temporal resolution with spatial resolution on the order of 20 nm, and characteristic time and length scales of the relaxation are calculated. Further we are able to directly deform the membrane by pulling on the fluid utilizing an index of refraction mismatch between the inside and outside of the vesicle. We image the vesicle and extract the vesicle shape. Fourier analysis is used to track the vesicle as it returns to equilibrium after being stretched. We compare these deformations to preliminary data on deformations due to polymerization induced on both the inside and outside of vesicles.

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