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An Experimental Study of a Nonlinear Acoustic Lens Interfaced with Water CARLY DONAHUE, PAUL ANZEL, THOMAS KELLER, CHIARA DARAIO, California Institute of Technology, Graduate Aerospace Laboratories — Acoustic waves are routinely used in imaging and excitation applications such as in ultrasonic imaging or hyperthermia surgery. However, current acoustic technology is limited by focal resolution and maximum amplitude. In this work, we have constructed a nonlinear acoustic lens, which is composed of an array of chains of steel spherical particles supported by a matrix. The nonlinearity of the system originates from the contact interaction between the particles, which enables the formation of solitary waves in the chains. The acoustic lens can be designed and interfaced with a target medium such that when the solitary waves exit the chains, the waves coalesce at a focal point. The highly compact acoustic waves at the focus are called "sound bullets." Additionally, since the solitary wave speed increases as the pre-compression between the spheres increases, the focal point can be controlled mechanically. In this work, we use water as our target medium. Measurements are taken using a hydrophone that is scanned over an area to produce a two dimensional pressure map. The chains are separated from the water using cover plates, the choice of which strongly influences the transmission of the solitary wave into the host medium.

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