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**Development of a Nonlinear Acoustic Phased Array and its Interaction with Thin Plates**[1] PAUL ANZEL, CARLY DONAHUE, California Institute Of Technology, CHIARA DARAIO, ETH-Zurich, California Institute of Technology — Numerous technologies are based on the principle of focusing acoustic energy. We propose a new device to focus sound waves which exploits highly nonlinear dynamics. The advantages of this device are the capability of generating very highly powerful acoustic pulses and potential operation in high-temperature environments where traditional piezoelectrics may fail. This device is composed of rows of ball bearings placed in contact with a medium of interest and with an actuator on the top. Elastic spherical particles have a contact force that grows with their relative displacement to the three-halves power (Hertzian contact). When several spheres are placed in a row, the particles support the propagation of "solitary waves"—strong, compact stress-wave pulses whose tendency to disperse is counteracted by the nonlinearity of the sphere's contact force. We present results regarding the experimental operation of the device and its comparison to theory and numerical simulations. We will show how well this system is capable of focusing energy at various locations in the medium, and the limits imposed by pre-compression. Finally, the effects of timing error on energy focusing will be demonstrated.

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