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Nonlinear Optical Studies and Acoustic Characterization of an Underwater Laser Plasma Acoustic Source[1] M. HORNSTEIN, T.G. JONES, A. TING, Plasma Physics Division, Naval Research Laboratory, Washington, DC 20375, D. KAPOLKA, J. MCGHEE, Naval Postgraduate School, Monterey, CA, J. HANEY, Z. WILKES, Research Support Instruments, Inc., Lanham, MD, D. LINDWALL, Marine Geosciences Division, NRL, Stennis, MS — Utilizing nonlinear optical effects, an appropriately tailored laser pulse can propagate many meters underwater at moderate intensity, then quickly converge to an intense focus within a few centimeters at a controlled remote location. Laser-induced breakdown (LIB) at the focus creates an expanding plasma region, thereby generating an acoustic shock. We are investigating intense underwater laser propagation and LIB to develop a remote underwater laser acoustic source. Lens-focused acoustic generation near the water surface, approximating nonlinear optical compression, has been comprehensively characterized, including measurements of power spectrum, directivity, and distance dependence. Acoustic pulses with up to 189 dB have been generated using femtosecond laser pulses with up to 12 mJ. The optical nonlinear index of refraction of water has been experimentally measured. An experimental study of optical filament evolution in water will also be presented.

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