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Intense Underwater Laser Propagation and Ionization at Visible and Ultraviolet Wavelengths[1] TED JONES, DMITRI KAGANOVICH, MIKE HELLE, TONY TING, JOHN PALASTRO, BAHMAN HAFIZI, DAN GORDON, JOE PENANO, Plasma Physics Div., Naval Research Laboratory, YU-HSIN CHEN, Research Support Instruments, Inc. — Intense underwater laser propagation, filamentation, and ionization are under investigation at NRL for applications including remote laser acoustic generation for low-frequency sonar. Time-resolved absorption spectroscopy of fs underwater laser ionization revealed hydrated electron density of 5.4 x 10^{18} cm^{-3} and lifetime of 350 ps. In addition, high-resolution fluorescence imaging of ns underwater laser propagation using two-photon absorbing dye, independently confirmed previous measurements of 100 micron diameter filament structures [Helle, et al., Appl. Phys. Lett. **103**, 121101]. A patented scheme for generating an elongated, meter-scale, high energy density underwater plasma [USP 9,088,123] is under study, in which such a filament structure could serve as a target for a second energetic "heater" laser pulse. Early experiments suggested improved ionization efficiency using the current configuration, with a 266 nm filament pulse, and a 532 nm heater pulse. 1- and 2-D simulations using a nonlinear laser propagation code are underway to predict beam envelope propagation, filamentation, and stimulated Raman and Brillouin scattering behavior. Results from recent experiments and simulations will be presented.

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