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Nonlinear optical field sensors in extreme electromagnetic and acoustic environments ANTHONY GARZARELLA, DONG HO WU, Naval Research Laboratory — Sensors based on electro-optic (EO) and magneto-optic (MO) crystals measure external electric and magnetic fields through changes in birefringence which the fields induce on the nonlinear crystals. Due to their small size and all-dielectric structure, EO and MO sensors are ideal in environments involving very large electromagnetic powers. Conventional antennas and metallic probes not only present safety hazards, due to their metallic structure and the presence of large currents, but they can also perturb the very fields they intend to measure. In the case of railguns, the large electromagnetic signals are also accompanied by tremendous acoustic noise, which presents a noise background that the sensors must overcome. In this presentation, we describe extensive data obtained from fiber optic EO and MO sensors used in the railgun of the Naval Research Laboratory. Along with the field measurements obtained, we will describe the interactions between the acoustic noise and the nonlinear crystals (most notably, photoelastic effects), the noise equivalent fields they produce, and methods they could be suppressed through the optical and geometrical configurations of the sensor so that the signal to noise ratio can be maximized.

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