

# ARTIFICIAL MATERIALS WITH ENHANCED NONLINEARITY

---

[Ironsides, Daniel, Shen, Jung-Tsung](#)

[Maland, Brett](#)

T-011141

**Background:** Advances in nonlinear materials give rise to a multitude of optical phenomena that have important applications as switches and modulators in telecommunications and optical computing industry. The degree of optical nonlinearity in a material depends upon the strength of the optical field and varies across different materials. Intense laser light is typically needed to observe nonlinear optical phenomena, limiting the application of nonlinear optics. Optoelectronic devices have continued to be limited by speed, size, loss and efficiency.

**Technology Description:** Researchers at Washington University in St. Louis have developed metamaterials with a nonlinear response to light greater than that typically found in naturally occurring materials. The stronger nonlinearity of these artificially manufactured materials has the potential to decrease the amount of source power needed in nonlinear optical applications. Additionally, tight spatial confinement of the optical signal allows for ultrafast operation in non-linear optical devices. The enhanced nonlinearity is controlled by the geometry of the metal-dielectric array. Furthermore, the configuration of the array can be applied to form three dimensional structures which also have an enhanced nonlinear response to light.

## Key Advantages:

- Efficient – reduces input power required
- Faster speed (<1 picosecond)
- Mini size
- Reduces cost