Highly Anisotropic Materials for Tailored Nonlinear Optical Responses

PI: Adam D. Dunkelberger, U.S. Naval Research Laboratory

MURI Collaborators: Prof. Joshua Caldwell, Vanderbilt University and Prof. Tony Heinz, Stanford University

Low-symmetry materials like twisted layered structures and triclinic or monoclinic crystals have highly anisotropic optical properties that can support the propagation of unusual polariton modes with high potential for enabling new photonic devices. Modulating these optical properties with an external stimulus adds another critical degree of control to these novel systems. This LUCI program seeks to unravel the fundamental physics of photoexcitation in two highly anisotropic materials: beta-gallium oxide and black phosphorus to enable ultrafast control of light propagation within the materials. This goal will be pursued with time-resolved infrared spectroscopy targeting the dynamics of photoexcited carriers and the effects of these carriers on the materials' optical properties. These experiments will lay the foundation for nanophotonic device designs that offer unprecedented control of propagation.