

# Measure Nonlinearity Parameters of Graphene Via Z-Scan



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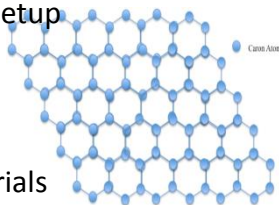
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Major Professor: Dr. Gregory J. Salamo

Nanoscience & Engineering

## Background

- Nonlinear optical (NLO) properties play significant roles in optical communication and other optical signal applications.
- Graphene has illustrated excellent NLO properties, including reverse saturable absorption, two-photon absorption, four-wave mixing, and saturable absorbers.
- Z-Scan is a standard technique to define the sign and the magnitude of nonlinear properties due to its setup simplicity, data sensitivity, and analysis easy.

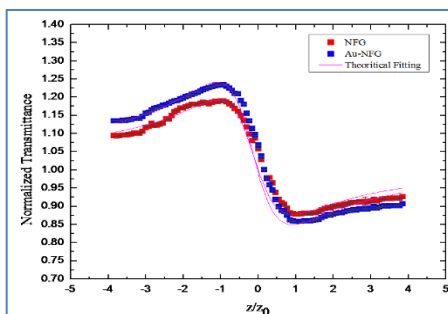
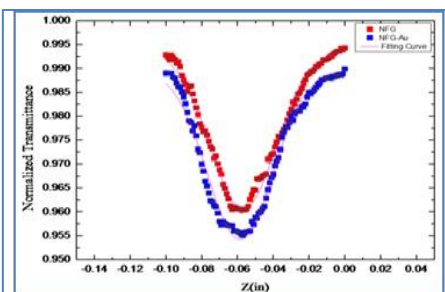


## Innovation

Develop high efficient nonlinear optical coating devices, based on reduced graphene oxide materials

## Key Results

- The value of  $(\beta)$  for nonfunctionalized graphene is around  $5.58 \times 10^{-2}$  and  $6.42 \times 10^{-2}$  cm/W when deposited with gold nanorods.
- Thermo optical coefficient for NFG was found to be  $0.772 \times 10^{-6}$  /C while for Au-NFG was  $4.04 \times 10^{-4}$  /C.



## Approach

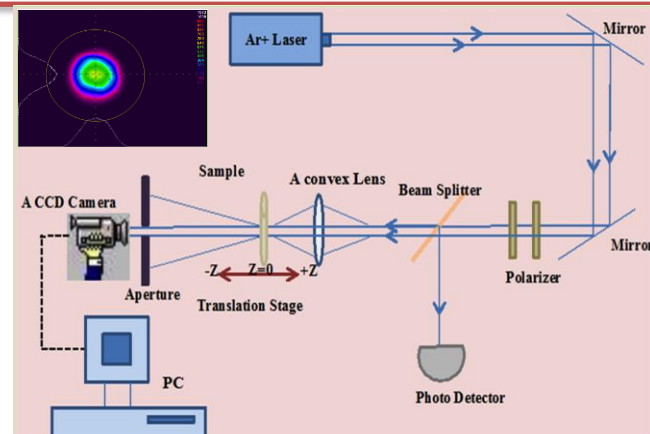
- Build Z-scan setup** Using BBO crystal to test and calibrate the system.

- Graphene Thin Films**

Collaboration with Dr. Alex at U of A in Little Rock.

- Linear & Nonlinear Optical measurements**

- UV-1700 Shimadzu spectrometer, AFM, and Raman Spectroscopy are used to define the sample morphology.
- Measure nonlinear refractive index, thermo optical coefficient, and nonlinear absorption coefficients of Graphene samples with and without gold nanorods.



## Conclusions & Future Work

- Demonstrate amazing nonlinear thermo-optical properties.
- Graphene has potential for broad nonlinear optical applications, such as optical communication, optical limiting, and optical data storage.
- Explain the result and publish NLO experimental data.
- Decorate graphene with gold nanorods, measure the NLO, and understand the physics.
- Decorated graphene with gold particles enhances the NLO properties.