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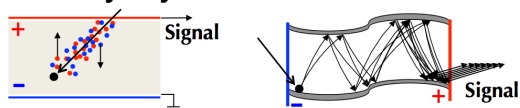
# Optical Method for Detecting and Analyzing Energetic Particle Radiation

Build an ultrafast phonon detector to measure single energetic particles that is immune to x-rays and gammas

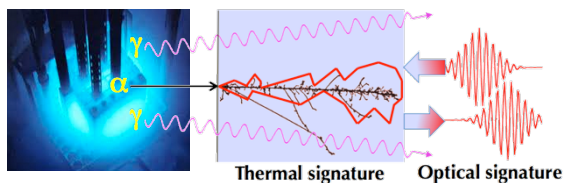


## BACKGROUND & MOTIVATION

All room temperature particle detectors ultimately rely on electrons for detection.



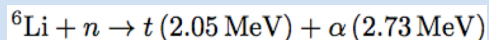
A fast particle detector that responds to phonons would be insensitive to gamma, x-ray, and beta radiation environments.



## INNOVATION

Using time resolved optical interferometry, detect the refractive index change due the thermal energy deposited by particle radiation

- This is a novel type of radiation detector method that has never been tested before.
- Fast particle detection method
- Radiation hardened sensor
- Sub-picosecond time resolution
- Precision dosimeter for particle radiation
- Future studies can involve imbedding  ${}^6\text{Li}$  compounds directly into the active detection region.



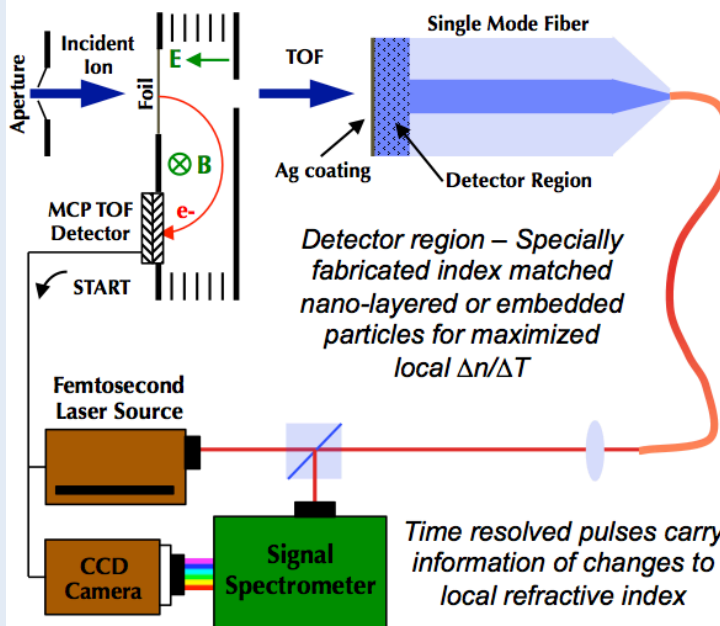
This neutron detector would be insensitive to x-rays, gamma rays, and beta particles.

## DESCRIPTION

### Approach

- Apply the technique of time resolved optical interferometry to detect penetrating particle radiation into matter.

### Experimental Set Up



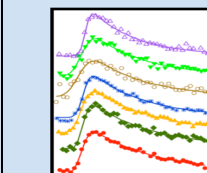
### Current Technology Readiness Level (TRL) TRL 1-2

- There are no known theoretical obstacles
- Practical merits far outweigh any risk; it is also very likely others will try similar techniques in the near future

## ANTICIPATED IMPACT

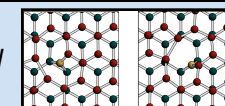
This detector technology will enable or improve

Nuclear forensics – EM insensitive alpha particle detector



Measurement of thermalization times of radiation impacts

Characterization of material damage and defect aggregation



## PATH FORWARD

- Procure materials, build detector setup
- Measure ions (Au to He) with energies (15 MeV to <1 MeV)
- Characterize timing and energy resolution
- Modify detector region materials and geometries for improved sensitivity
- TRL 4 by end of ER
  - For use as ultrafast alpha detector
  - Test against EM radiation background
- Future Science
  - Neutron detector capabilities
  - Study non-equilibrium phonon events
  - Material defect analyzer capabilities

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