The Problem of Persistence
(In HgCdTe Detectors)

Joel Xu
University of Michigan, LSA Physics
July 28th, 2010
What is persistence?

- After exposure to light, a faint image remains on the detector
  - Signal decays rapidly, but persists for ~10 minutes
  - Higher fluxes in illumination generate higher signals
  - Higher well-fills also produce higher signals
- Analogous to viewing bright objects with eye
  - Eye's lingering image due to continued nerve impulses; reason for detector is slightly unclear
Why is this a problem?

- When looking at especially faint stars, persistence interferes heavily
  - Can obscure and overshadow faint sources
  - Severity of persistence varies detector to detector
  - Is a source of systematic error in readout (detector reads out light in the absence of light)
  - Has a very significant effect on successive exposures (short timescales)
How do we fix it?

• Solution 1: better detectors
  • We think that persistence is caused by impurities
  • We can make many detectors and select for low persistence, but very expensive

• Solution 2: wait longer
  • How long do we have to wait for persistence to become negligible?
  • Maybe cooling the device to a lower temperature?
  • Or perhaps changing the voltage can help (reverse bias?)
What is being done?

- Method to characterize persistence:
  - Measure persistence, record and analyze the data
  - Check the physical model for the cause of persistence
What is yet to be done?

- Develop a comprehensive testing protocol that encompasses all relevant parameters in persistence
  - Requires 5-7 days to acquire data with our automated system
  - Will need a day to analyze data and apply various modifications (smoothing, curve-fitting, etc.)
  - Afterwards we'll sit down and discuss some ideas

- Hopefully then we can improve upon the model for persistence!
After persistence...

- I will be working on my quantum efficiency calibration project for my remaining weeks.
- Since I haven't started that yet, Ben will be giving the second part of the talk on quantum efficiency!