DARK MATTER TO ENERGETICS

Tricia Moravec
University of Michigan Physics REU
PandaX Background

- Dark Matter Exists
- Searching for WIMPS
  - Weakly Interacting Massive Particles
- PandaX located under 2400 meters of marble
  - Very little background
  - 20 muons/m²/100days
- Detection of WIMPS
  - Liquid Xenon
  - TPC detects light
MPanda

• Smaller Michigan PandaX prototype
  • Works like PandaX but with 4 PMTs
• Not large enough to detect WIMPs
  • Used to streamline PandaX
Flow control

- Needed an efficient way to control gas flow
- Flow controlled by turning valve
  - Change not known for a few hours
  - Inaccurate
- Flow meter/controller on gas panel
  - Needed to be programmed
Feed through

• Signals did not look as expected
• Need to test the PMTs
  • LED inside TPC
    • Take apart TPC to change LED
• Design fiber optic feed through
  • LED outside of TPC
  • Light diffused using Teflon sphere
Nitrogen Triiodide Explosion
Danger in Ports

- Over 8 million shipping crates through LA port yearly
- 5-6 million crates through Long Beach and NY each year
- Do we test each crate for explosives?
  - No, far too expensive

Current technology:
- Helium-3
  - Extremely expensive
  - Can only spot check crates
- Boron detectors
  - Expensive
- Lithium doped scintillators
  - Expensive
  - Bad S/B
Detection of Radioactive Sources

• New Idea: substance that can be detonated by neutrons
  • Cheap
  • Stable
  • Detonate from one neutron
• Two different energetics
  • Nitrogen triiodide
    • Detonated by touch of feather
  • Primary explosives
    • Stable with a high energy yield
Primary Energetics

- CL-20, DAAF, FOX7, HMX, HNFX, HNS, NTO, PETN, RDX, DADP, TATP, TNT

- Experiment:
  - Milligram amounts of 12 energetics placed on radioactive sources
  - Received between 40-96 million neutrons over night
  - None detonated
Nitrogen Triiodide

- Extremely sensitive
- Experiments in 1922 determined NI3 detonated by alpha particles
- Determining properties
  - Evaporation of NH3 fast
  - Explosive within 30 minutes of making
- Future experiment
  - Combine NI3 with lithium or boron compound
    - Li or B compound react with neutron
Thank you!

• I’d like to thank Tom Schwarz, Mike Schubnell, Curtis Weaverdyck, Greg Tarlé, Çağlayan Kurdak, and Myron Campbell.

Cheers!