Barium Ion Trapping

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Uses for Ion Trapping

- Bell’s Inequality tests
- Quantum Computing
Oscillating potential

Source: Oak Ridge National Laboratory

http://www.ornl.gov/info/press_releases/photos/Paul%20Trap%20pic.png
In order to load an ion trap we must:

1. Heat the barium oven
2. Ionize a barium atom
3. Cool the ion
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Loading the Trap

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Problem

- Barium atoms are not making it into the chip trap
- The hole that the atoms should be traveling through is blocked
- The oven is producing large barium chunks while it heats up. These chunks block the hole and prevent any trapping.
Movable Shield

- Actuated using a bimetal strip
Movable Shield

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- Tested in vacuum
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Detecting the Ions

PMTs detect photons emitted by the ions

For entanglement experiments, we want to be able to detect single emitted photons
Therefore, we need a very high sensitivity and a very low noise level
Detecting the Ions

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- For entanglement experiments, we want to be able to detect single emitted photons
  - Therefore, we need a very high sensitivity and a very low noise level
Lowering the noise level

- Dark counts are false positive readings from the PMT
- They constitute a significant fraction of our noise level
Summary

Improvements to ion trapping system:
- Movable shield
  - Prevents blockage of the hole that allows ions into the trap
  - Allows repeated re-loading of trap
- Lowered noise from PMT
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Questions?