Search for WIMPs

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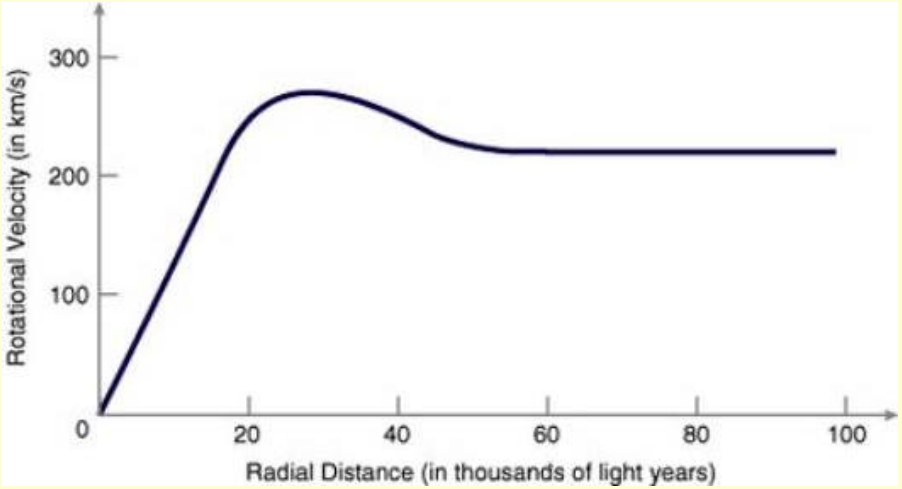
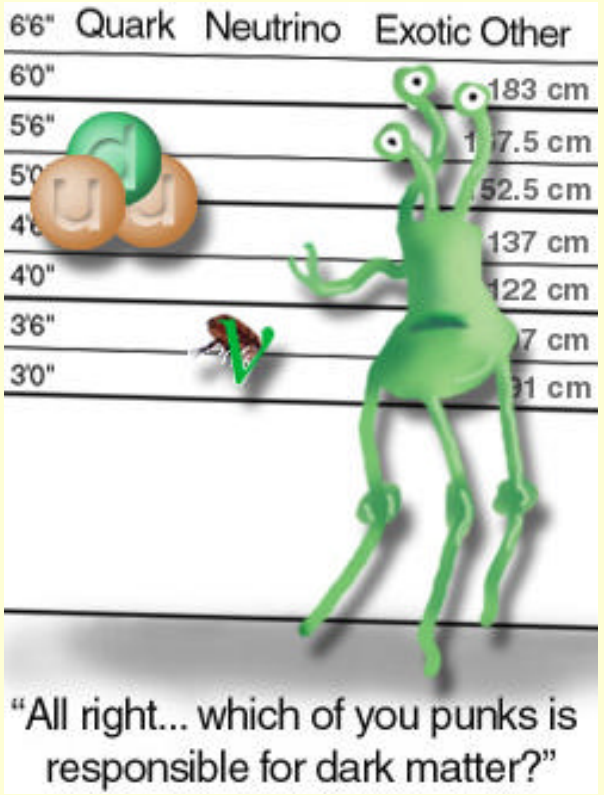
The dark matter problem



http://www.geocities.com/newastronomy/Chapter13.htm



http://physics33.creighton.edu/faculty/duda/dark_matter.htm

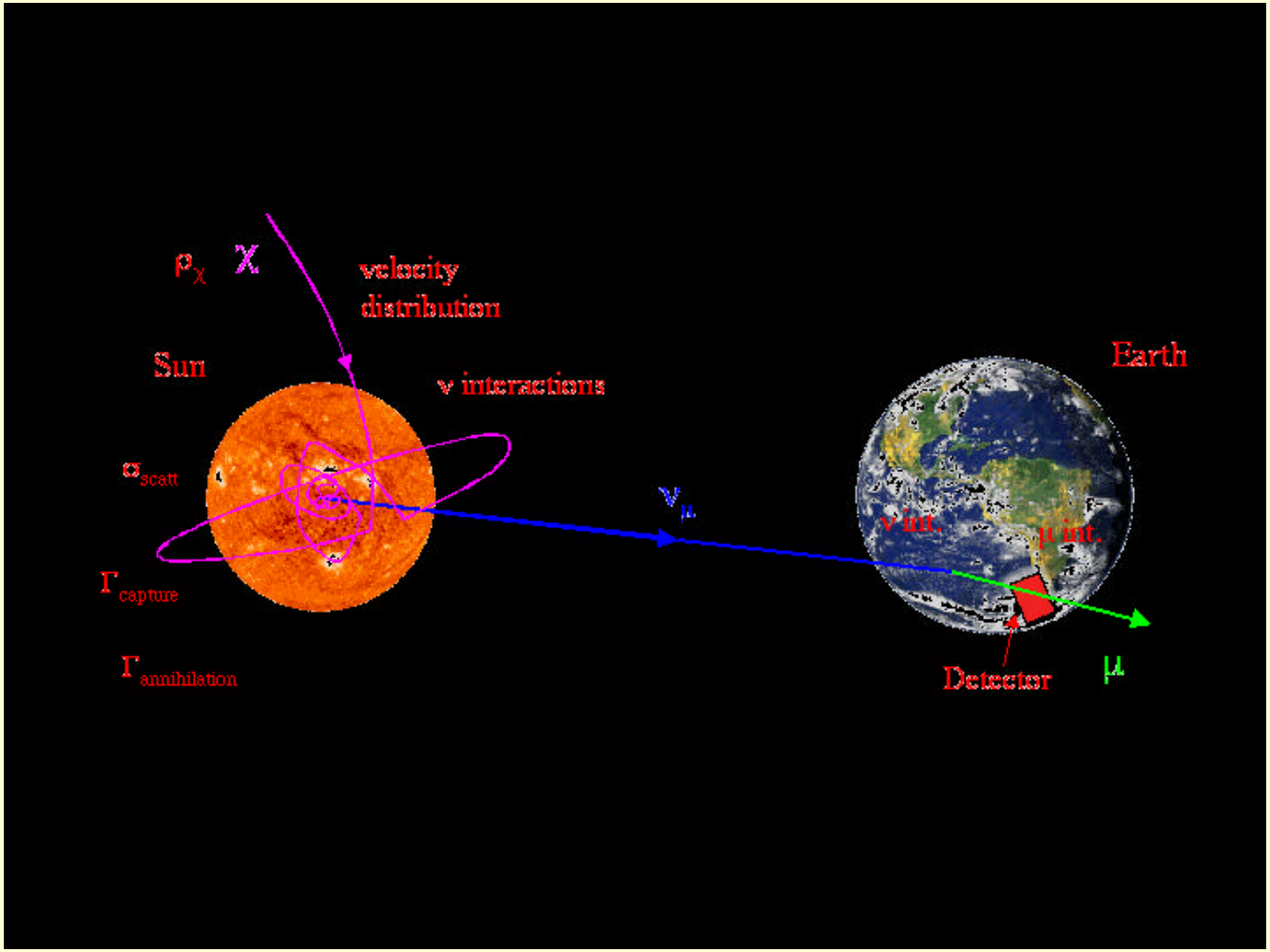
What are WIMPs?

- Weakly Interacting Massive Particles
- Massive – because we have not seen them in our particle accelerators yet
- Weakly interacting – in agreement with galaxy formation
- Most popular candidate:
  - Neutralinos

How do we plan on detecting them?

- Indirect methods
  - Detect products (neutrinos, gammas) of WIMP decay that happens in the sun
- Direct methods
  - Detect signature WIMP interaction with matter, or
  - Detect signature annual modulation due to WIMP halo presence

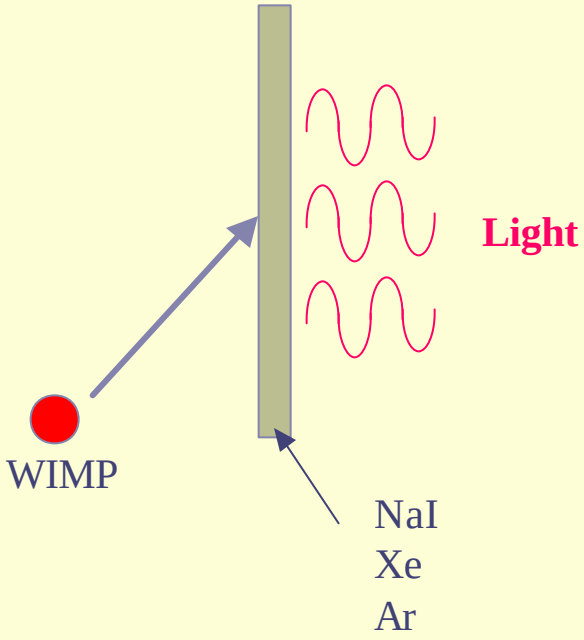
Solar capture



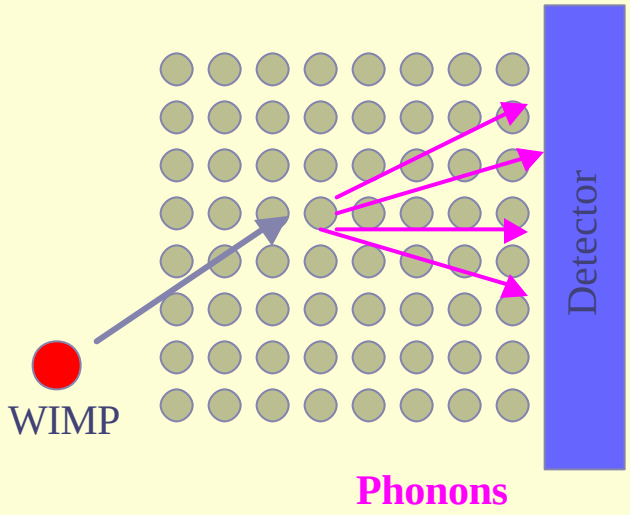
http://amanda.uci.edu/results.html

Direct detection methods

- Scintillating materials

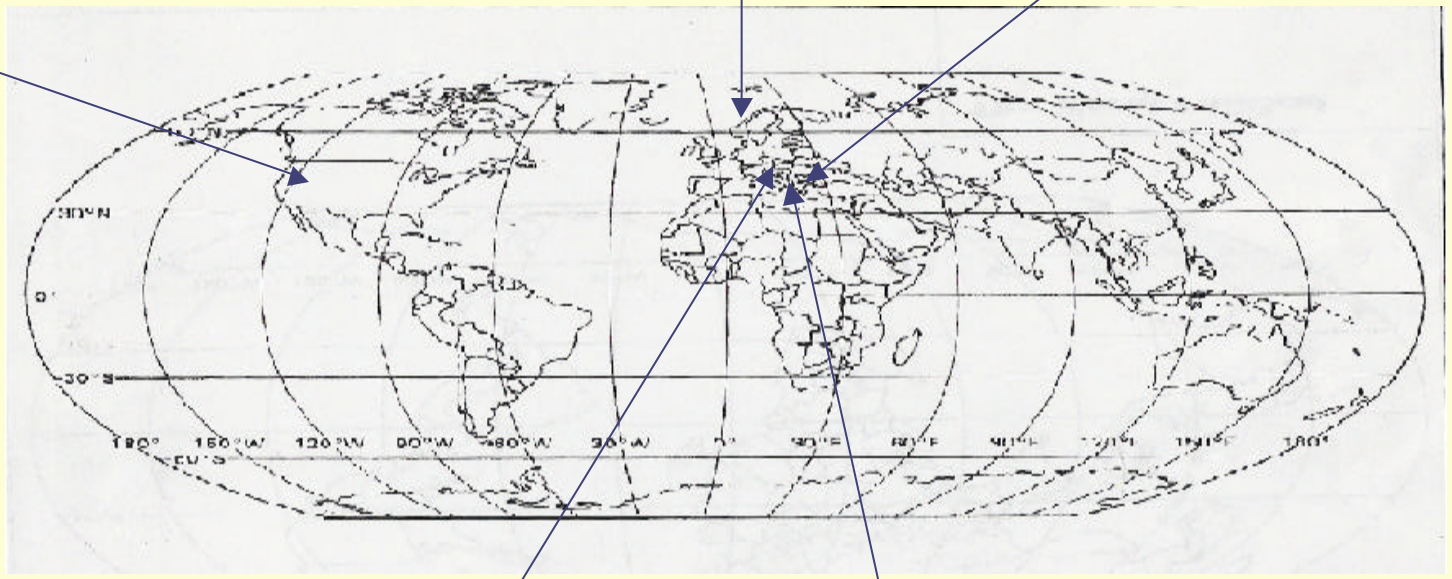


- Phonons in Ge or Si



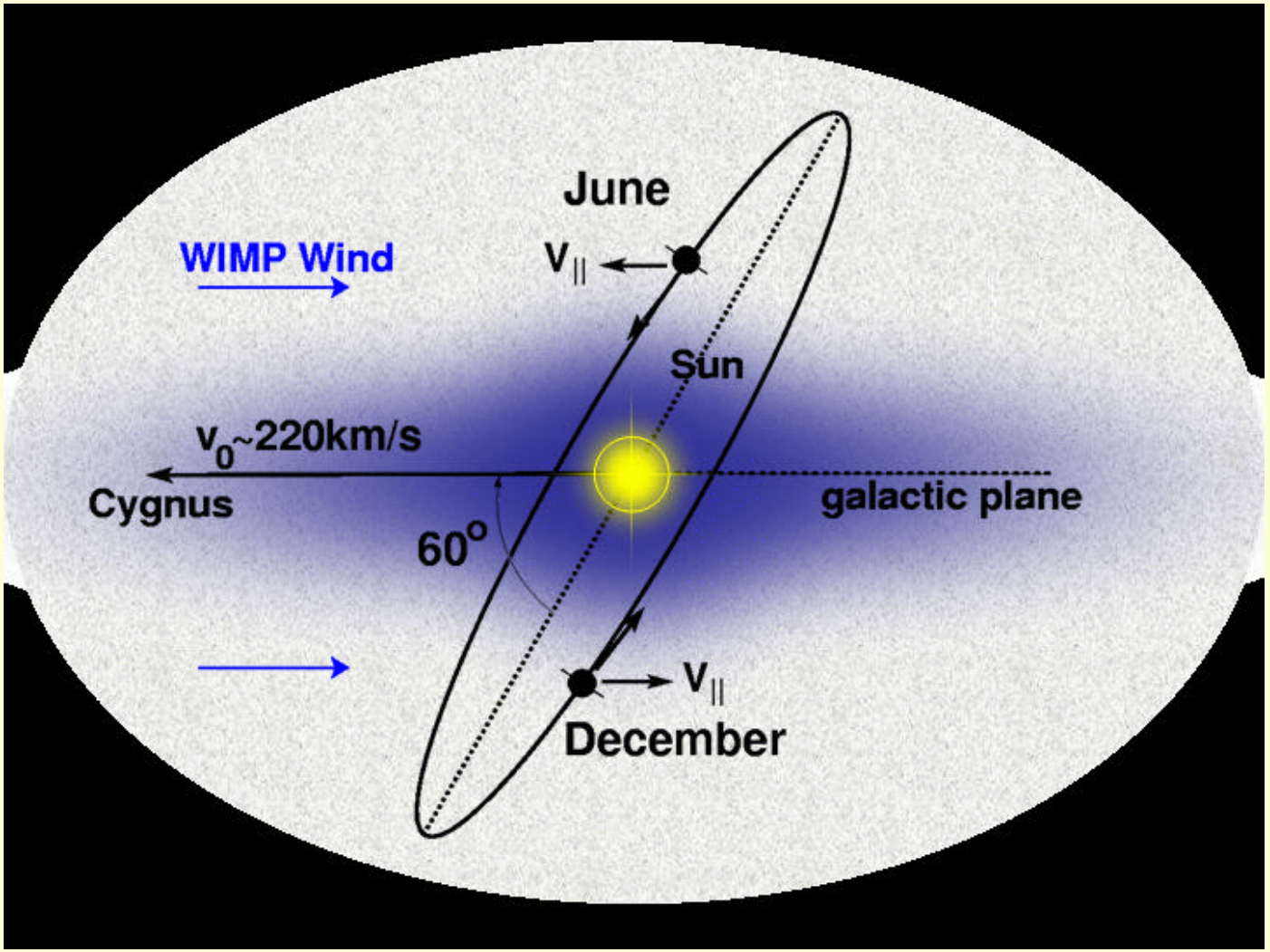
Experiments around the world

CRESST
DAMA
WARP
ZEPLIN
CDMS
COUPP



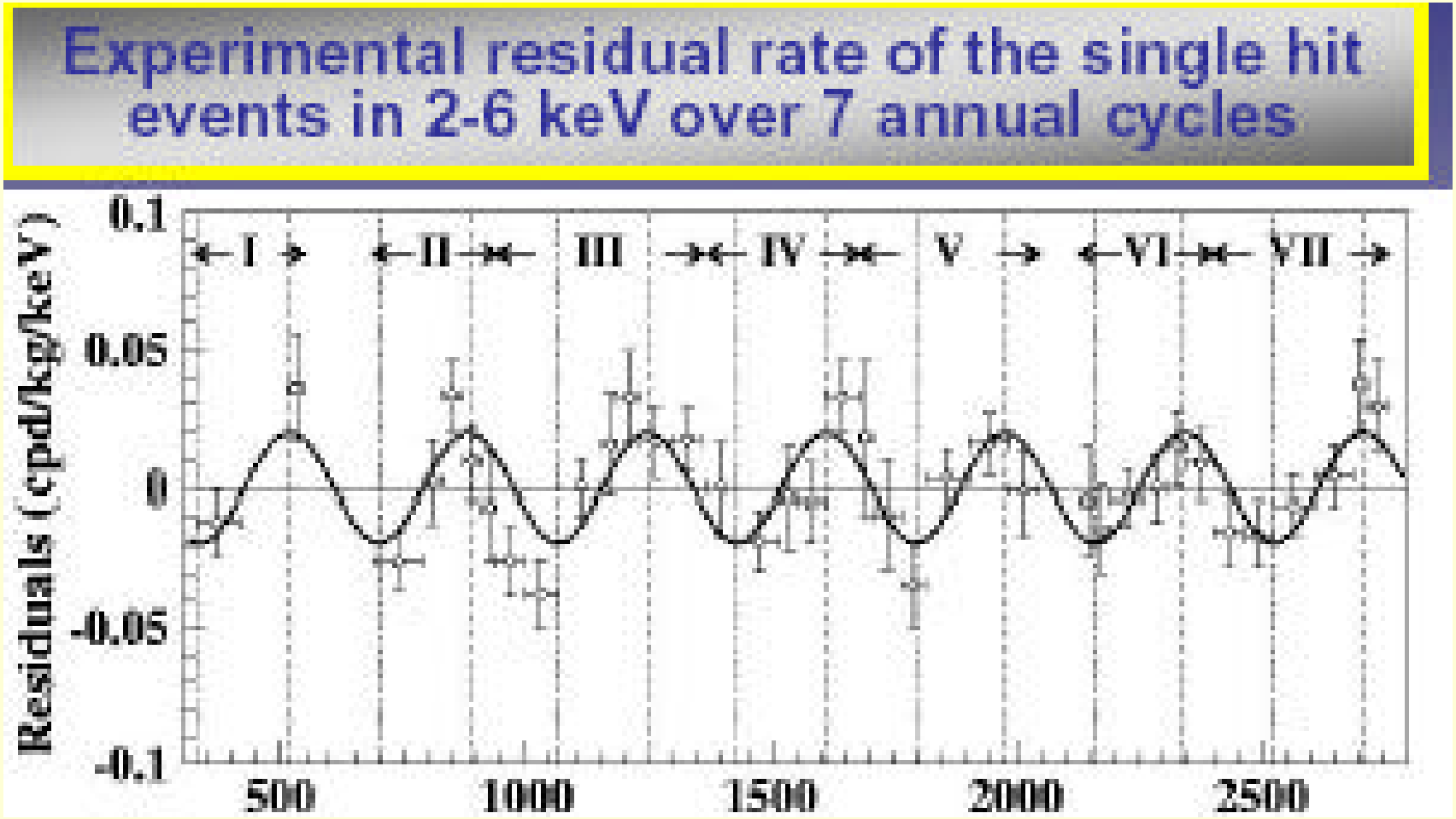
HDMS
EDELWEISS

Annual modulation

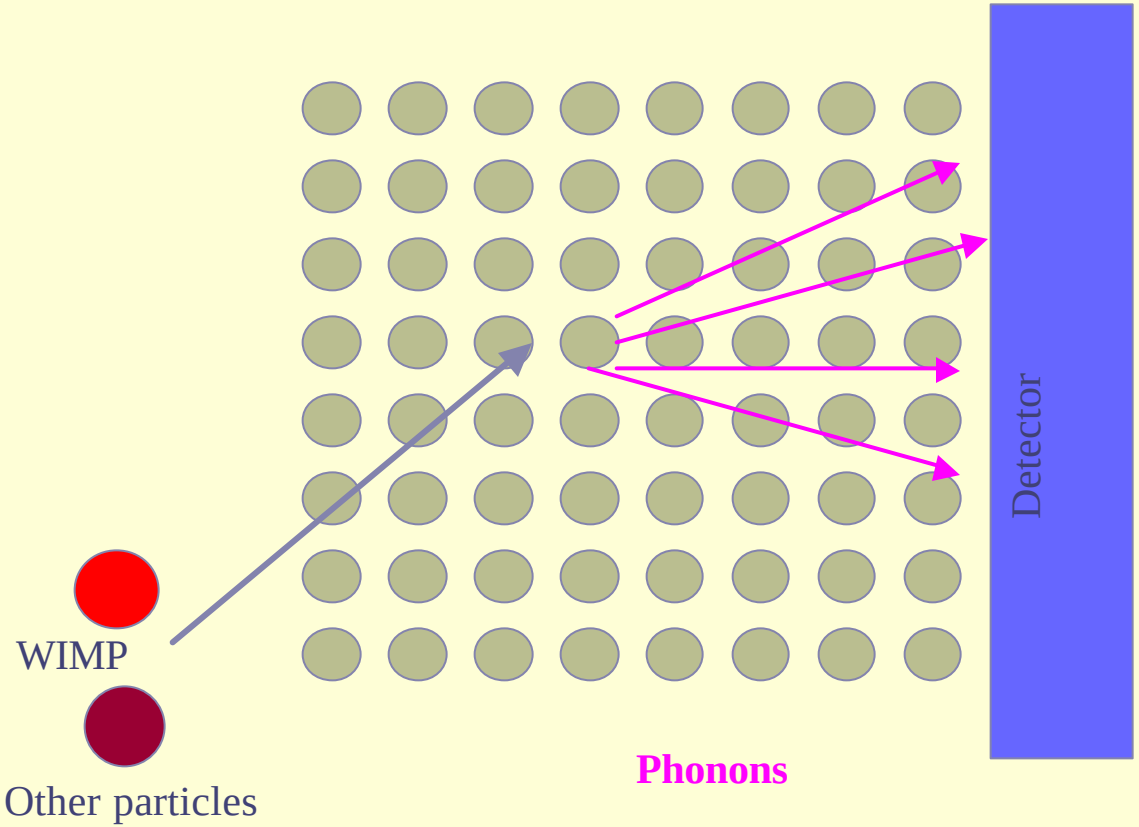


http://pppa.group.shef.ac.uk/dm/images/earth_in_galaxy.gif0

DAMA results

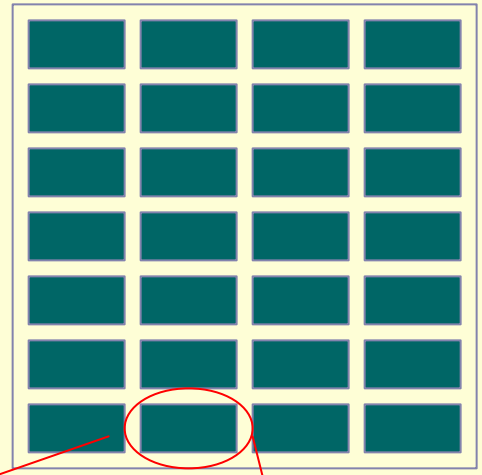


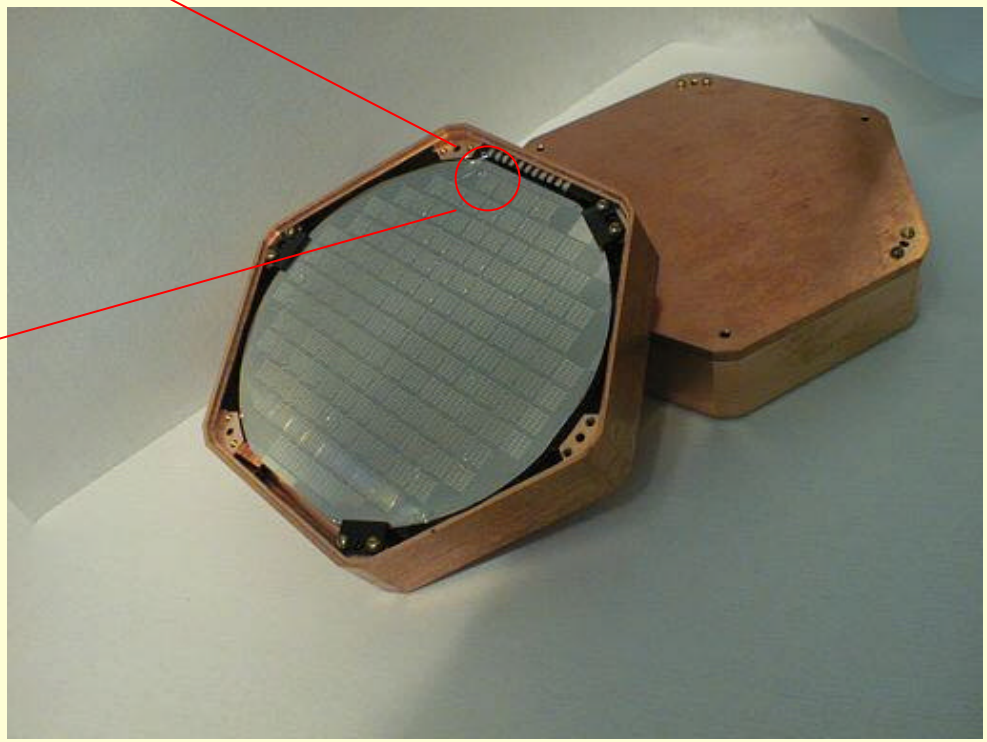
CDMSII

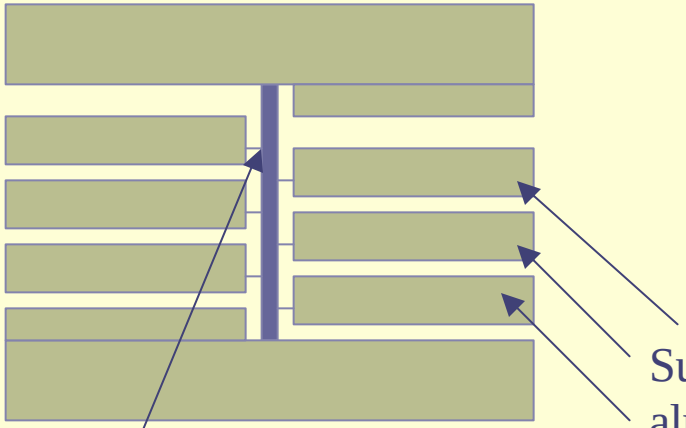


The CDMSII detectors

148 arrays of
28 QETs each





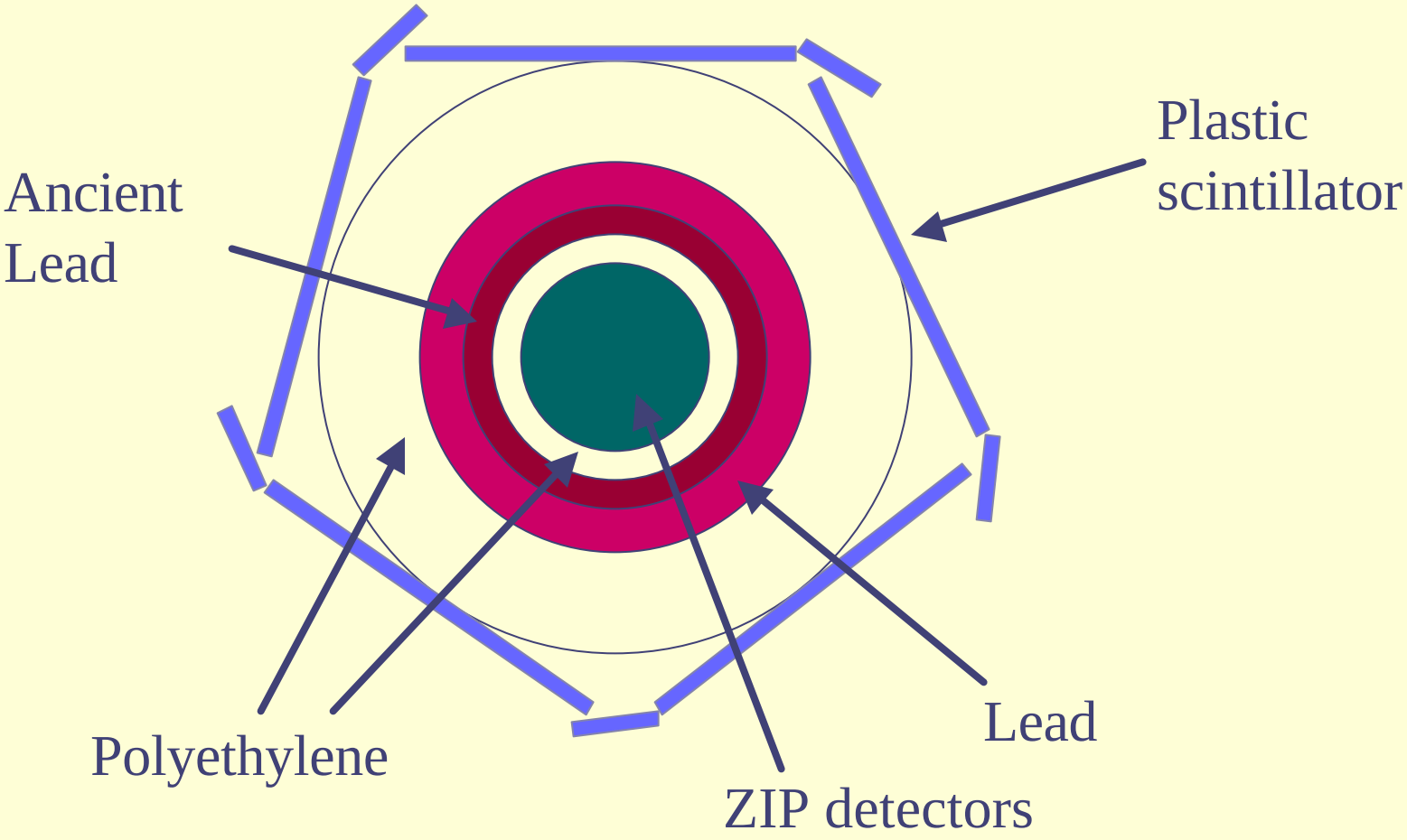


Tungsten

Superconducting
aluminum
collection fins

Ge or Si ZIP detector

The CDMSII veto system



Results (2004)

All events	968,680
Not random trigger	940,619
Analysis thresholds	79,460
Singles	20,907
Data quality	19,027
Pile up	17,793
Muon veto	17,339
Ionization threshold	14,835
Fiducial volume	7,615
Nuclear-recoil band	23
Phonon timing	1

Only one event in one of the 6 detectors could be a WIMP signal.

Unfortunately, this event is also consistent with expected misidentification due to electron recoils near the surface.

Where do we stand now?