Detecting axions

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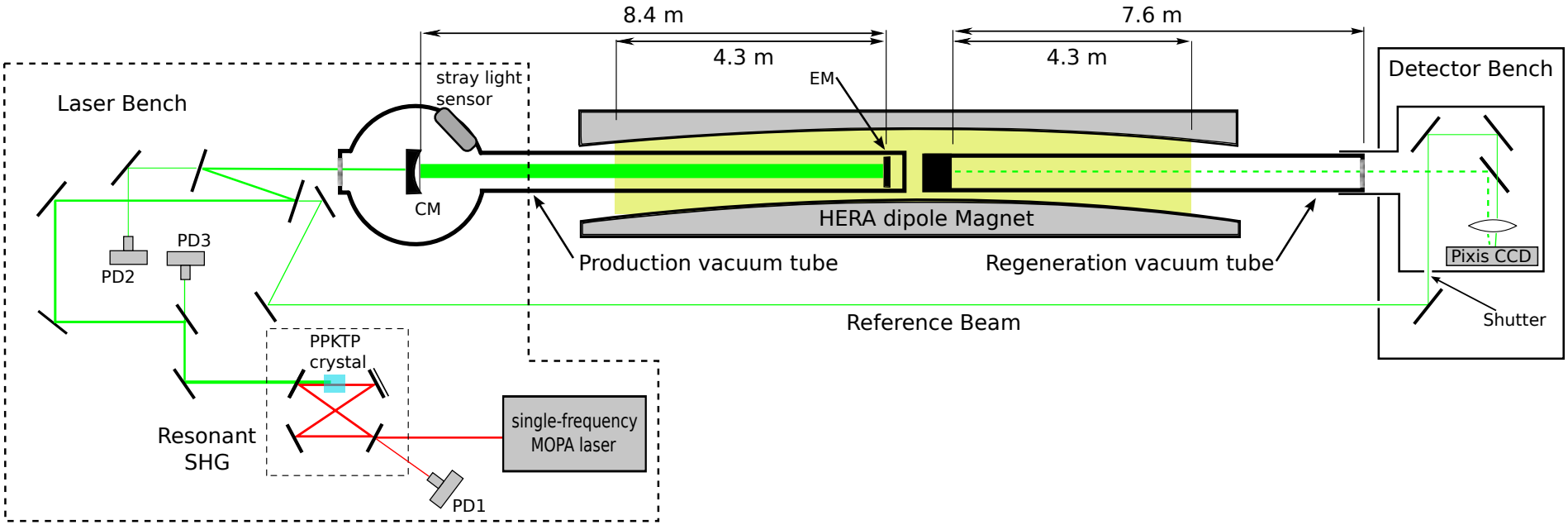
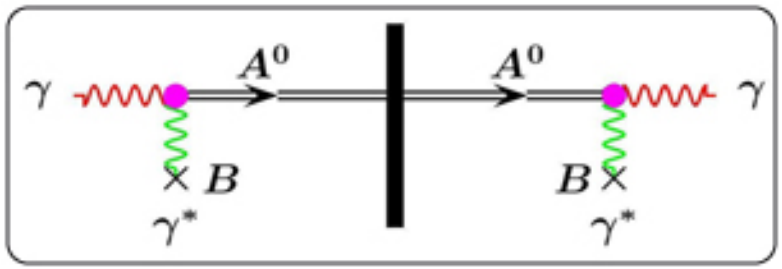
Light shining through walls

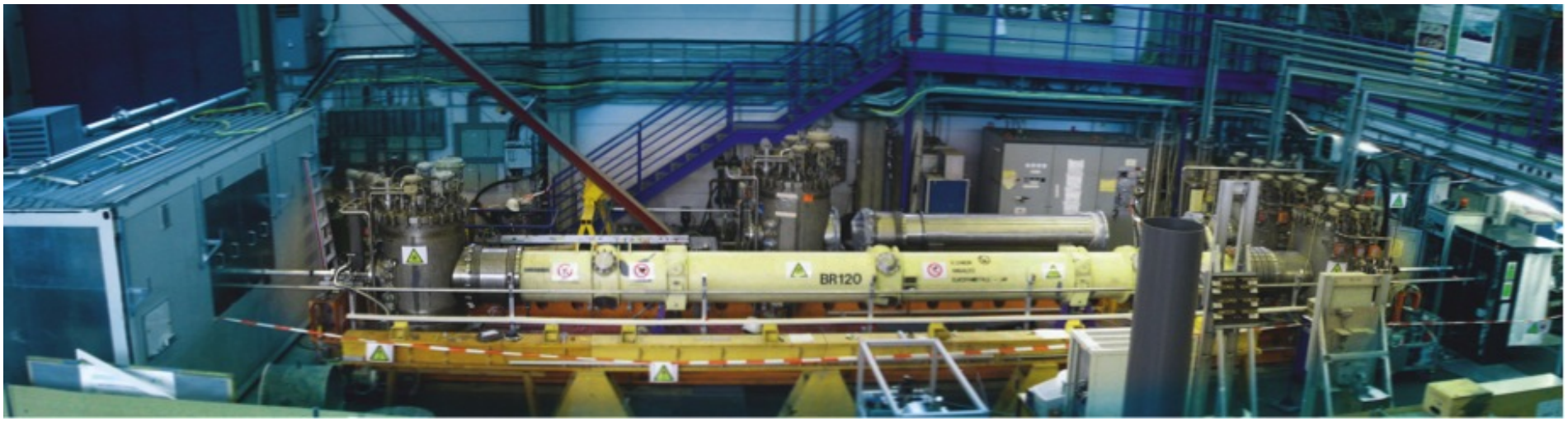


- Intense laser
- Resonant cavity in $\vec{B}$-field
  - Further amplification
  - Photons travel through $\vec{B}$-field multiple times ($\rightarrow$ higher conversion probability)
- 2nd resonator behind an opaque wall
  - Back-conversion of axions
- CCD photon detector



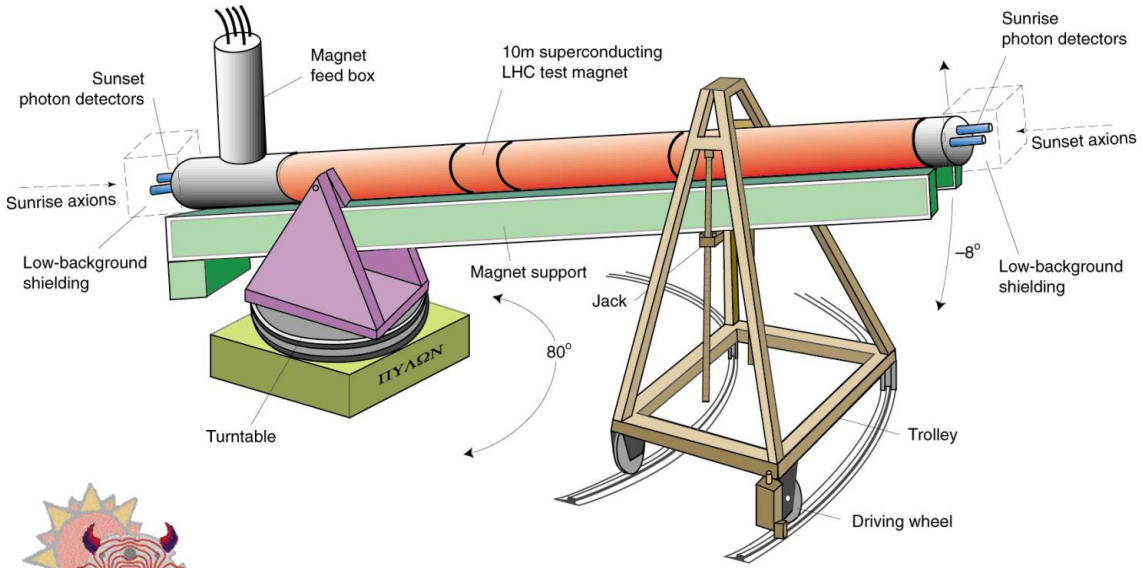
ALPS experiment @ DESY, arXiv:1004.1313

The ALPS (Any Light Particle Search) Experiment



Axion helioscopes

- Photons can convert into axions in the Sun
  - Expect axion flux from the Sun
- Point a large, optically shielded, magnetized cavity at the Sun
- Look for photons appearing inside



***C**ern **A**xion **S**olar **T**elescope*

CAST (CERN Axion Solar Telescope) experiment

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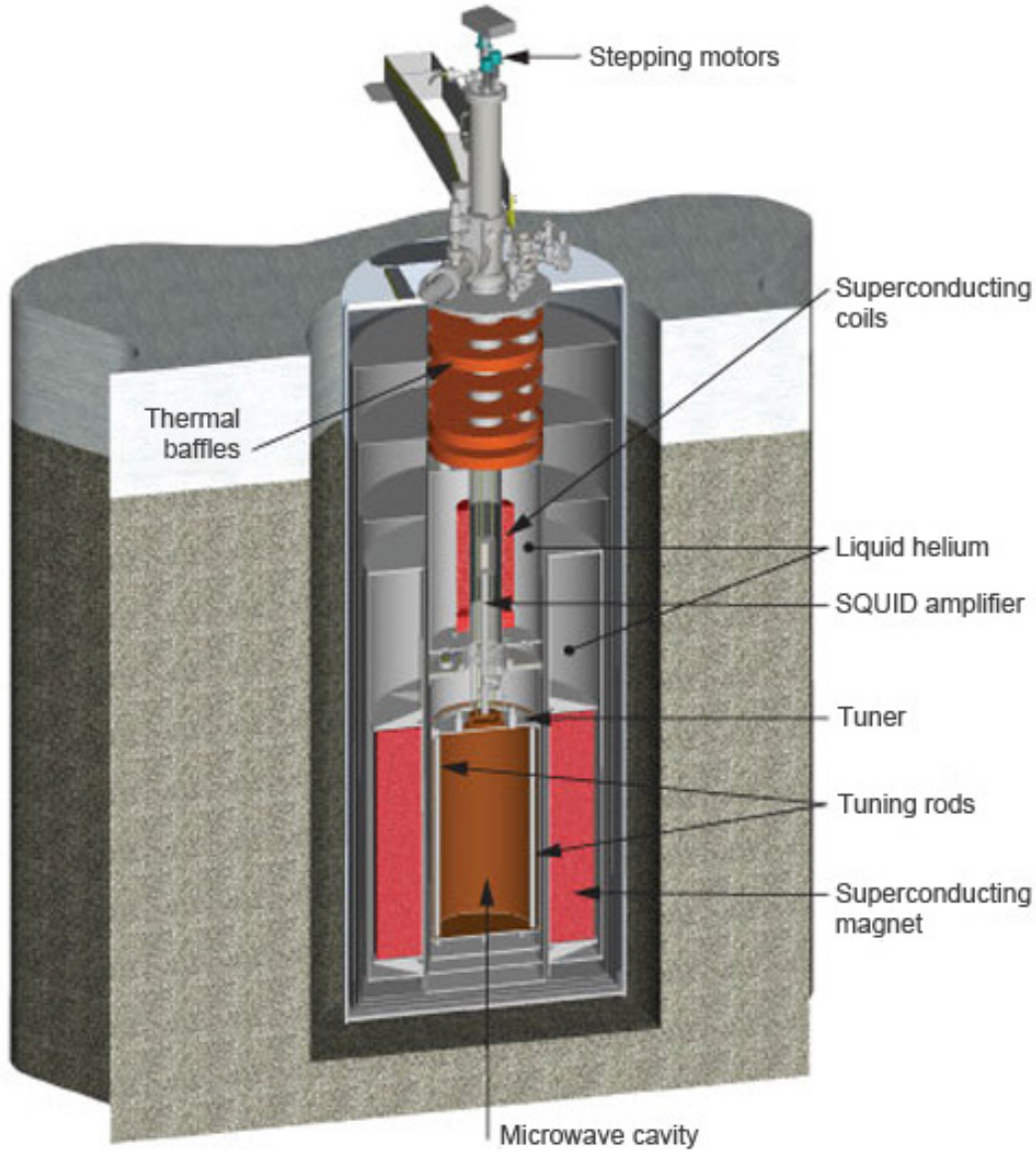
CAST (CERN Axion Solar Telescope) experiment

Microwave cavities

- Magnetized microwave cavity
- Conversion of a dark matter axion into a photon injects $\lesssim 10^{-24}$ W
- Need ultra-sensitive microwave detector
- Reonance frequency of cavity must be tuned to the axion mass

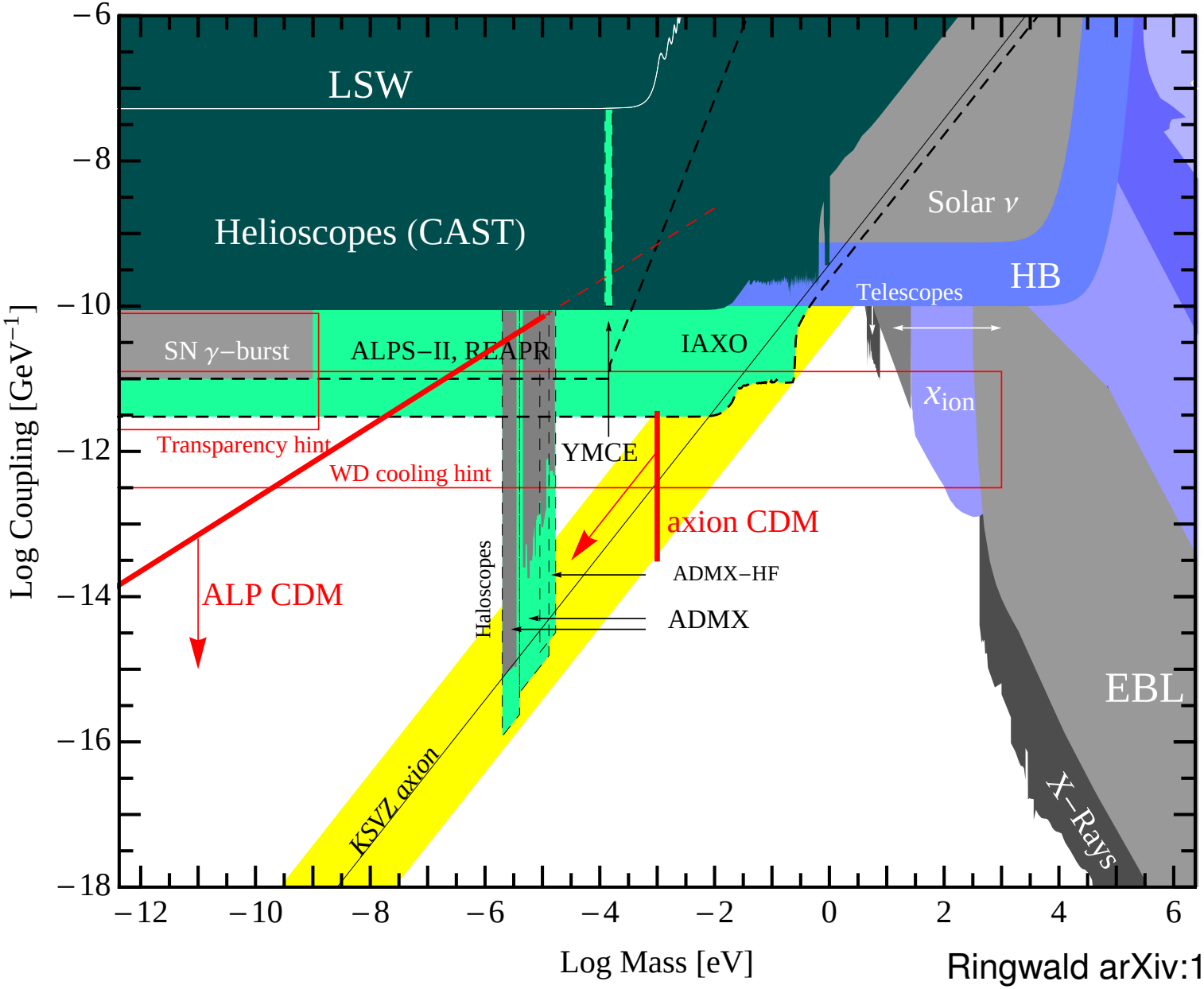


ADMX (Axion Dark Matter Experiment) @ U of Washington, Seattle

Astrophysical constraints

- Anomalous energy loss from stars and supernovae due to axion production

Axion limits — Summary



Ringwald arXiv:1210.5081