

# CAST (CERN Axion Solar Telescope)



# Strong CP Problem

- CP Symmetry (Laws of Physics should be the same for + and - particles)
- QCD predicts a CP violation, however it is unobserved experimentally
- QCD Lagrangian contains a  $\theta$  term (chiral quark mass phase), but experimentally this is unobserved

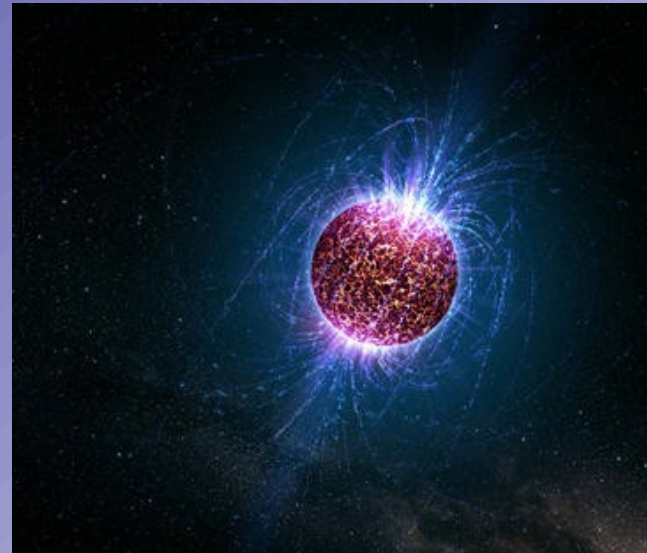
# Axion Particle

- Possible answer to the strong CP Problem suggested by Peccei-Quinn theory
- Adds global symmetry that instantly breaks, forming the axion particle to account for the unobserved degree of freedom
- Pseudo-Goldstone Boson



# Axion Particle

- Weakly interacting, neutral particle
- Mass in 1–10's of MeV Range



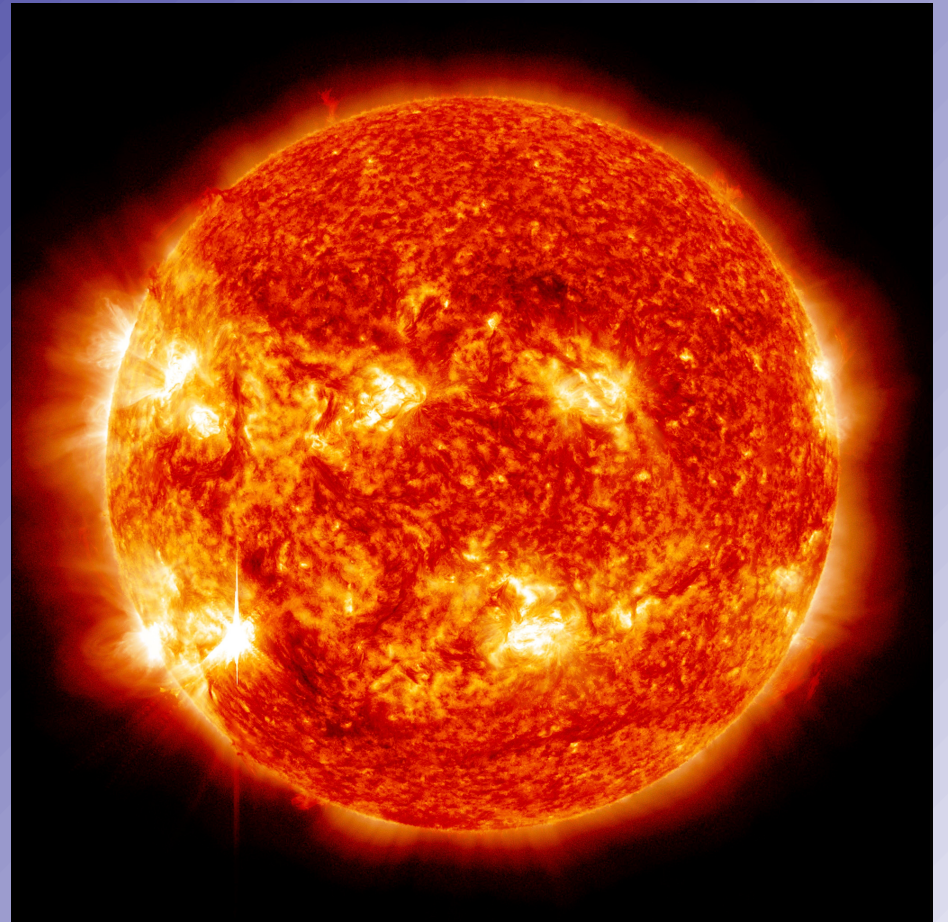
# Chameleon Particle

- Hypothetical Particle with a variable mass that could explain dark energy
- Photons couple with chameleons and oscillate between two states in the presence of a magnetic field



# Why the Sun ?

- Sun is a source of weakly interacting particles (solar neutrinos, etc)
- Axions predicted to form due to photon scattering from electric charges



# The Telescope

- Uses an LHC Magnet (9 T Field) that would convert solar Axions to X-Rays for detection
- Contains several X-Ray detectors
- Has been taking data since 2003 in various energy ranges with the hopes of detecting particles
- Also could detect chameleons



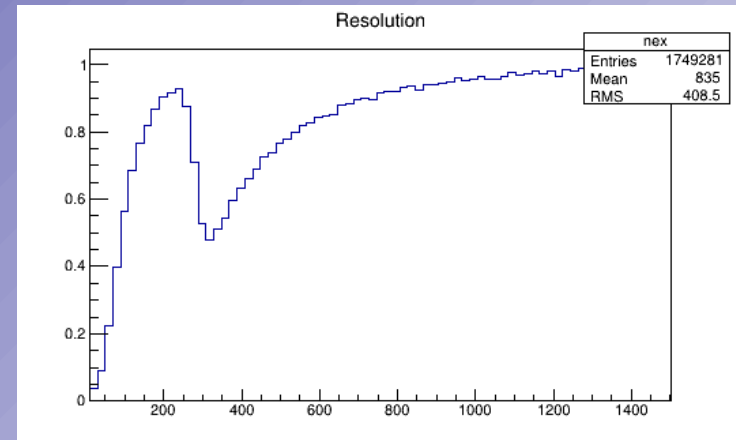
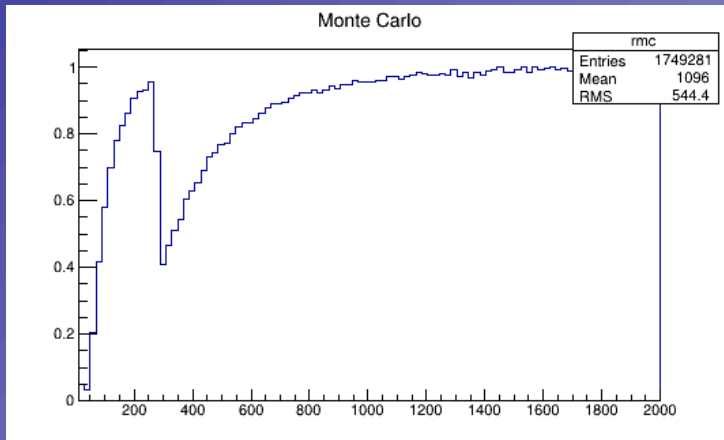
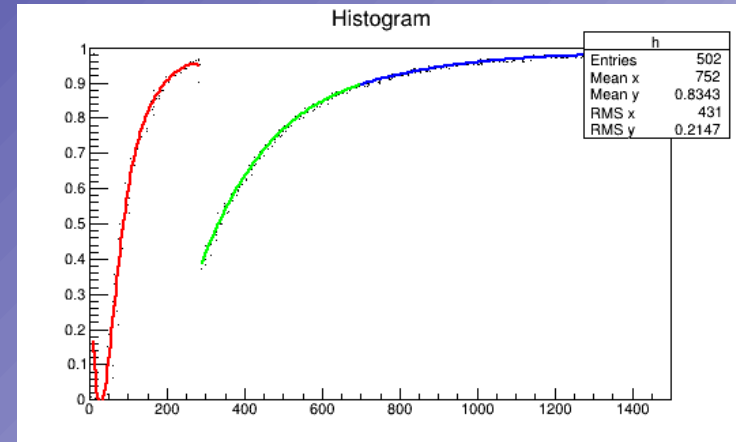
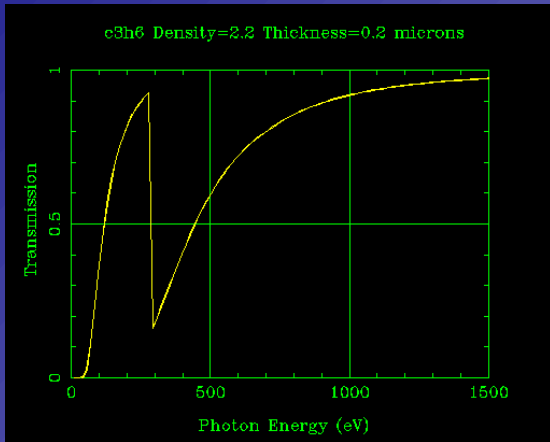
# SDD (Silicon Drift) Detector

- X-Ray detector
- High count rates
- High Energy Resolution (125 eV FWHM)



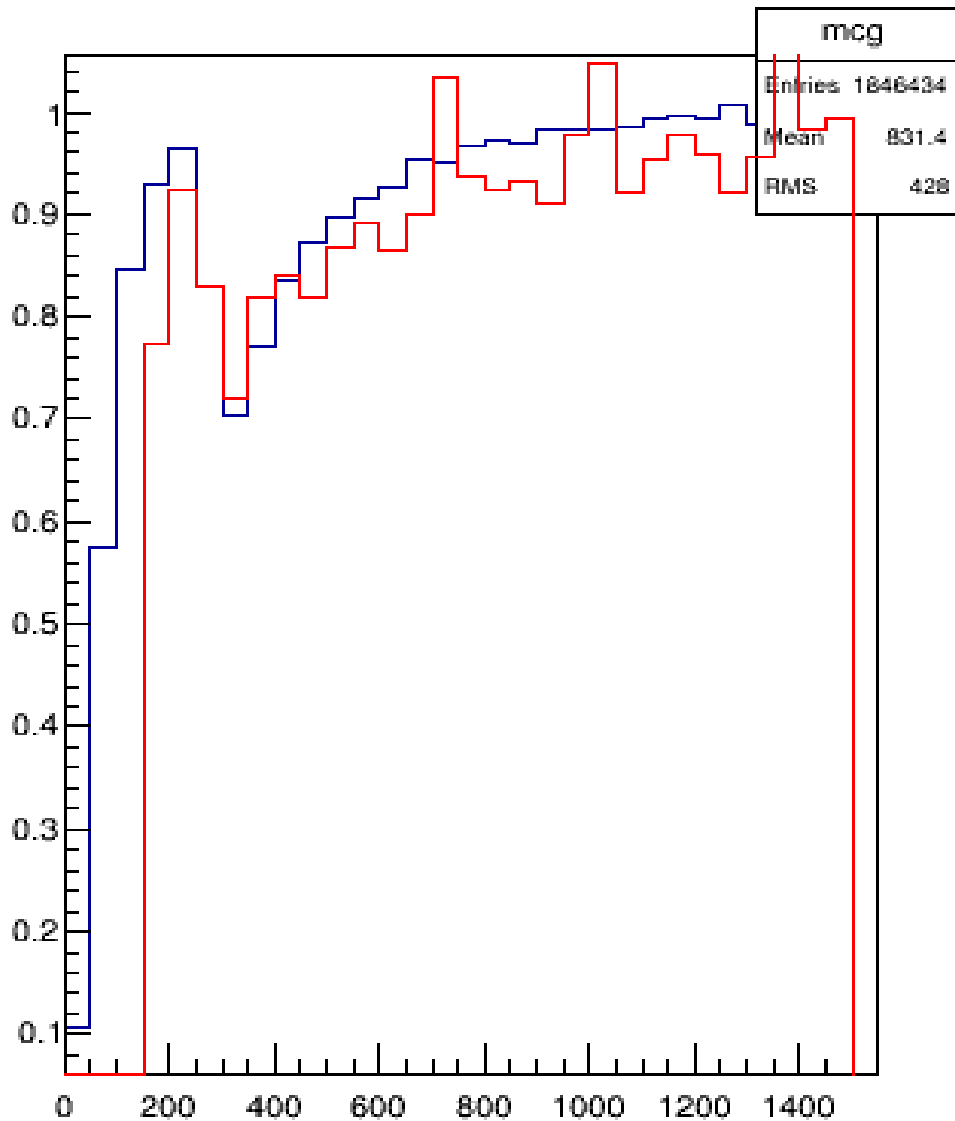


# My work so far



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3 Hours



18 Hours

