

STUDY OF PHOTON-AXION- LIKE PARTICLE OSCILLATIONS AND THE POTENTIAL SIGNAL IN OBSERVATIONS WITH THE CHERENKOV TELESCOPE ARRAY

FAPESP/BAYLAT Workshop "High-energy
astrophysics in the multi-messenger era"

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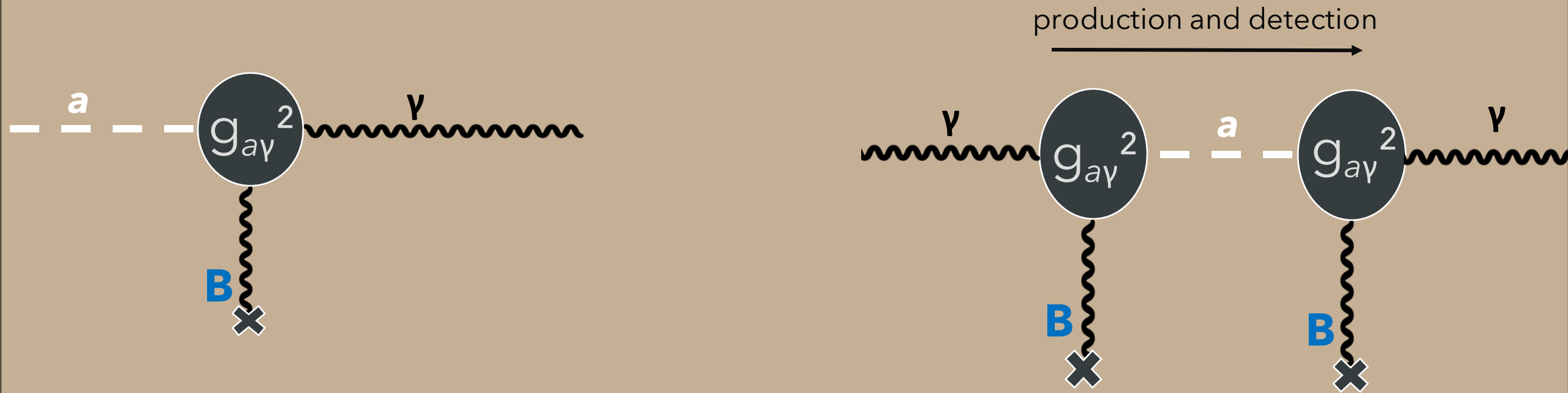
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Objective

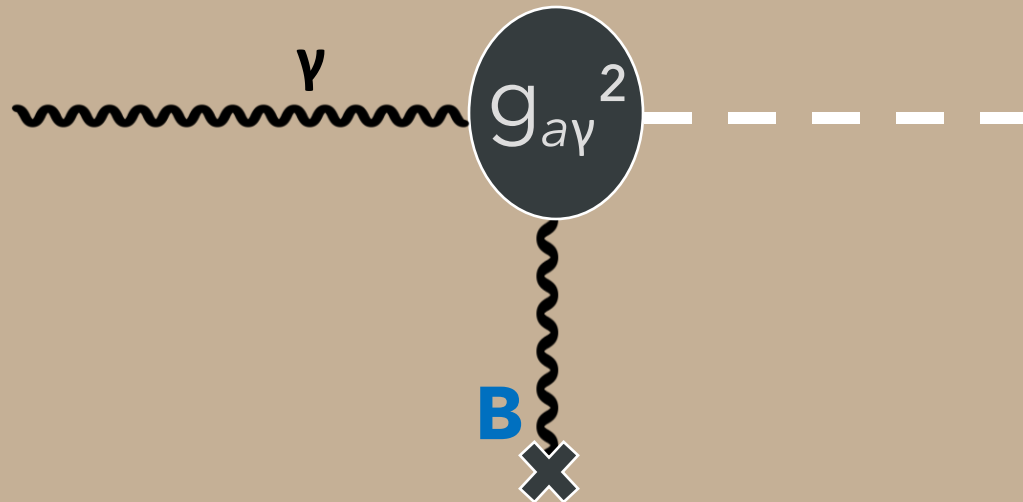
To obtain the influence of photon-ALP mixing on a gamma-ray source flux as well as a possible signature detected by the Cherenkov Telescope Array (CTA), regarding CTA sensitivity

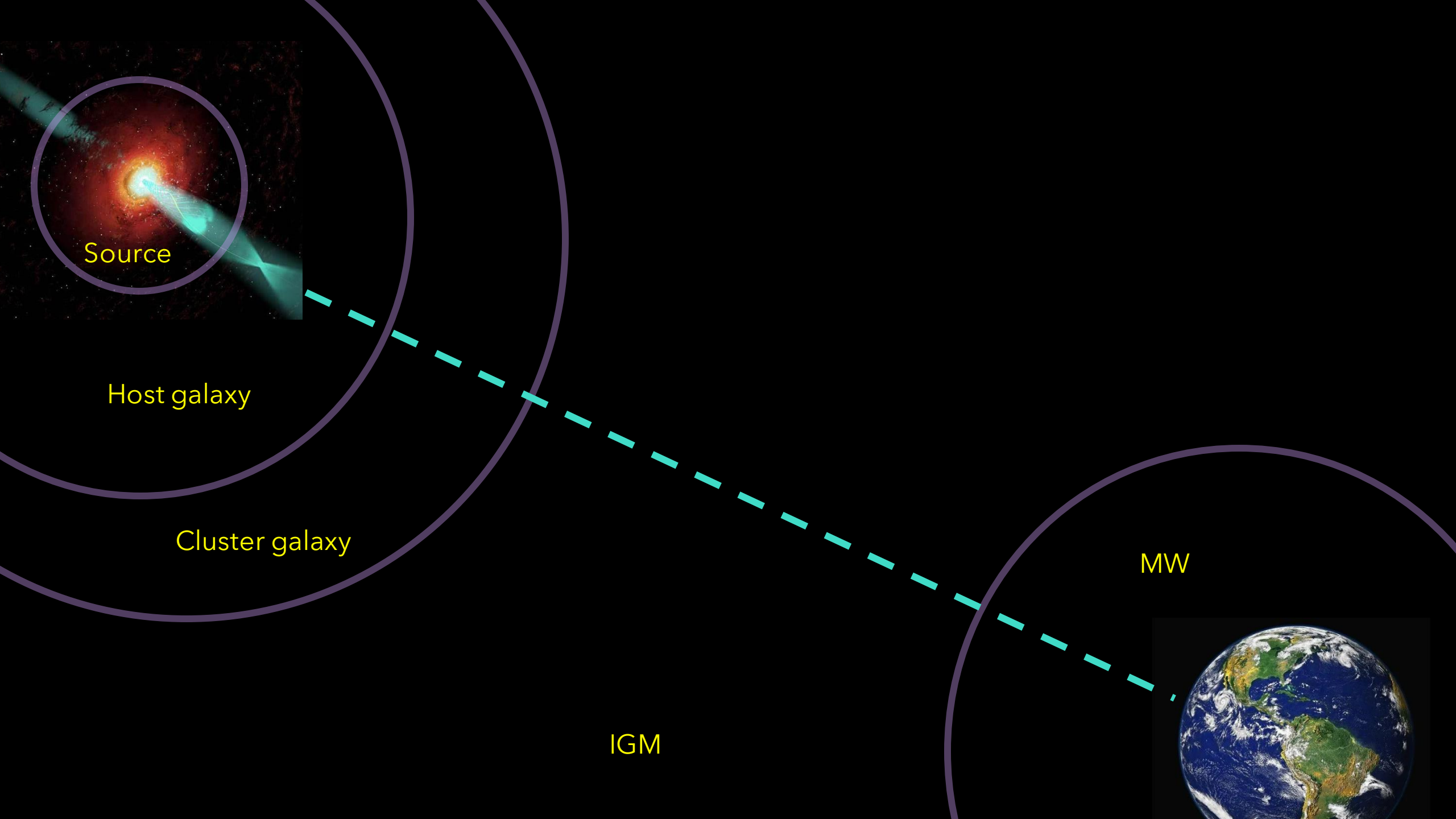
Axion and Axion-Like Particles



Axion and Axion-Like Particles

Here: Indirect detection through disappearance





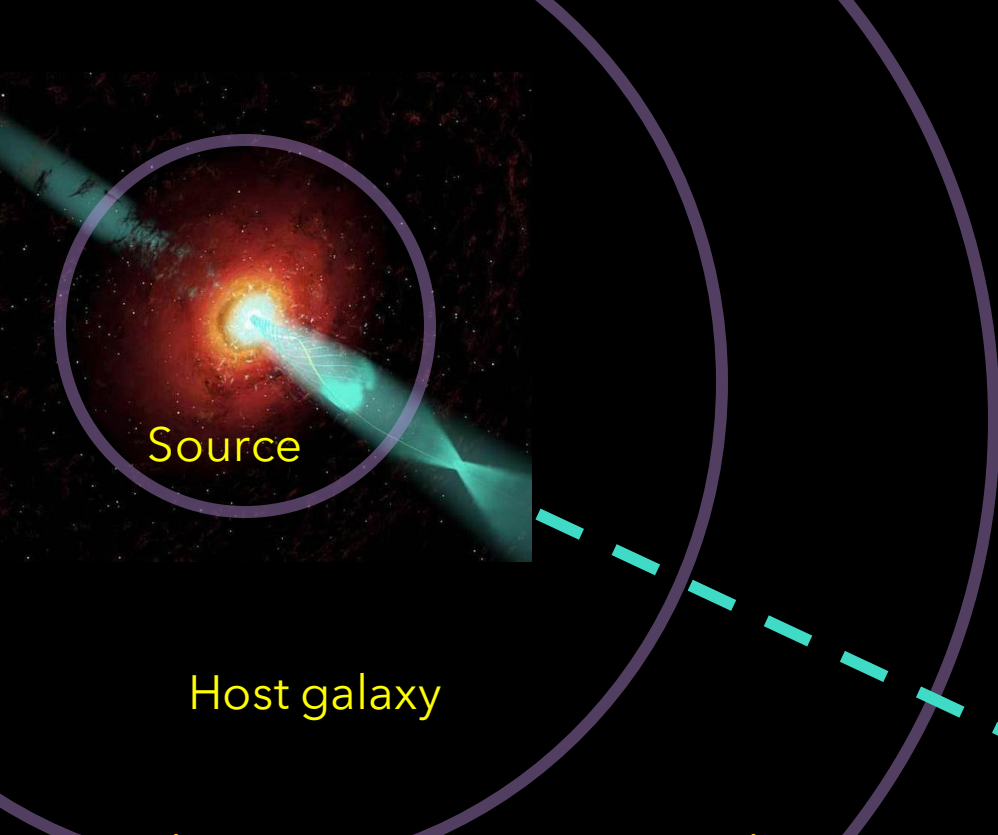
Source

Host galaxy

Cluster galaxy

IGM

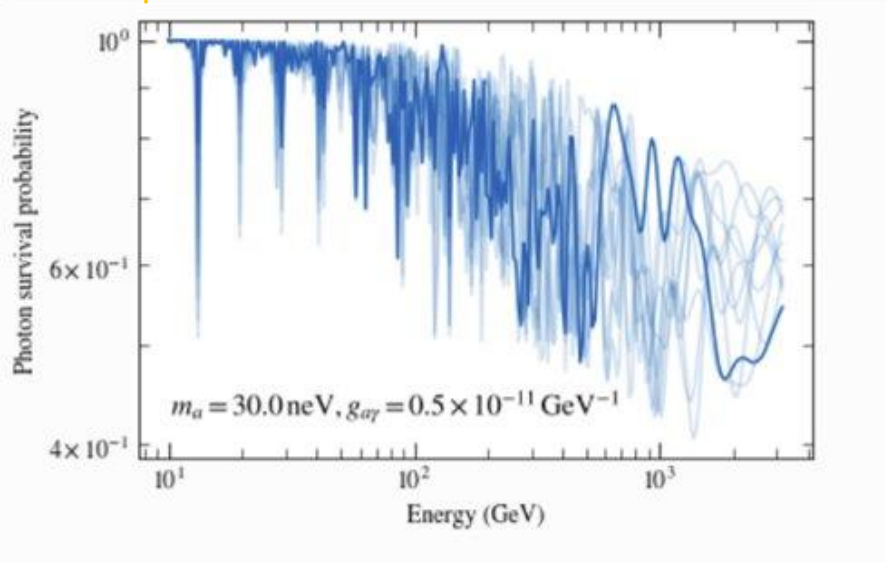
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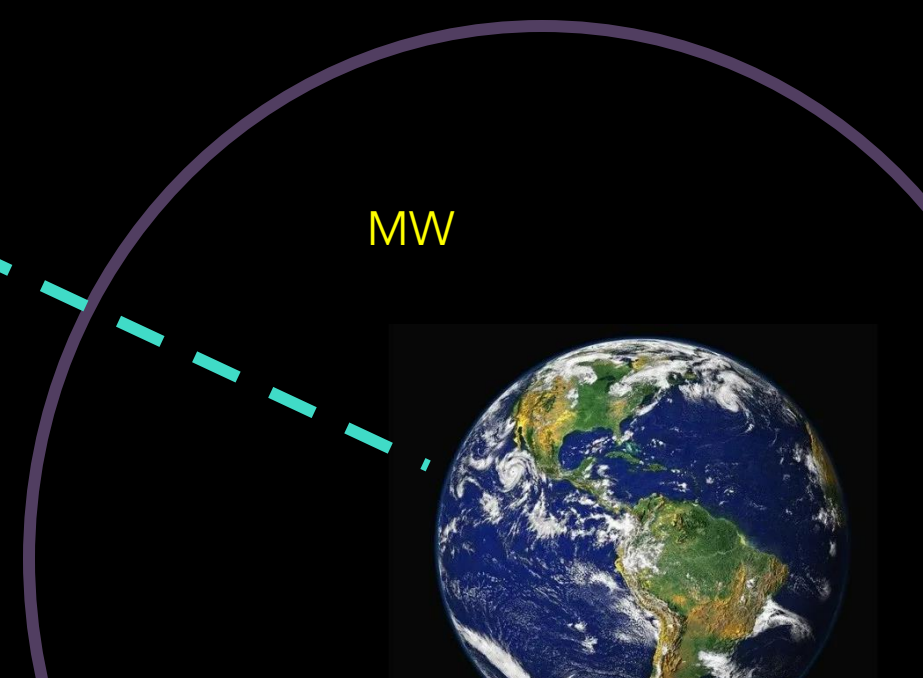
Source

Host galaxy

Example: NGC 1275 in Perseus Cluster



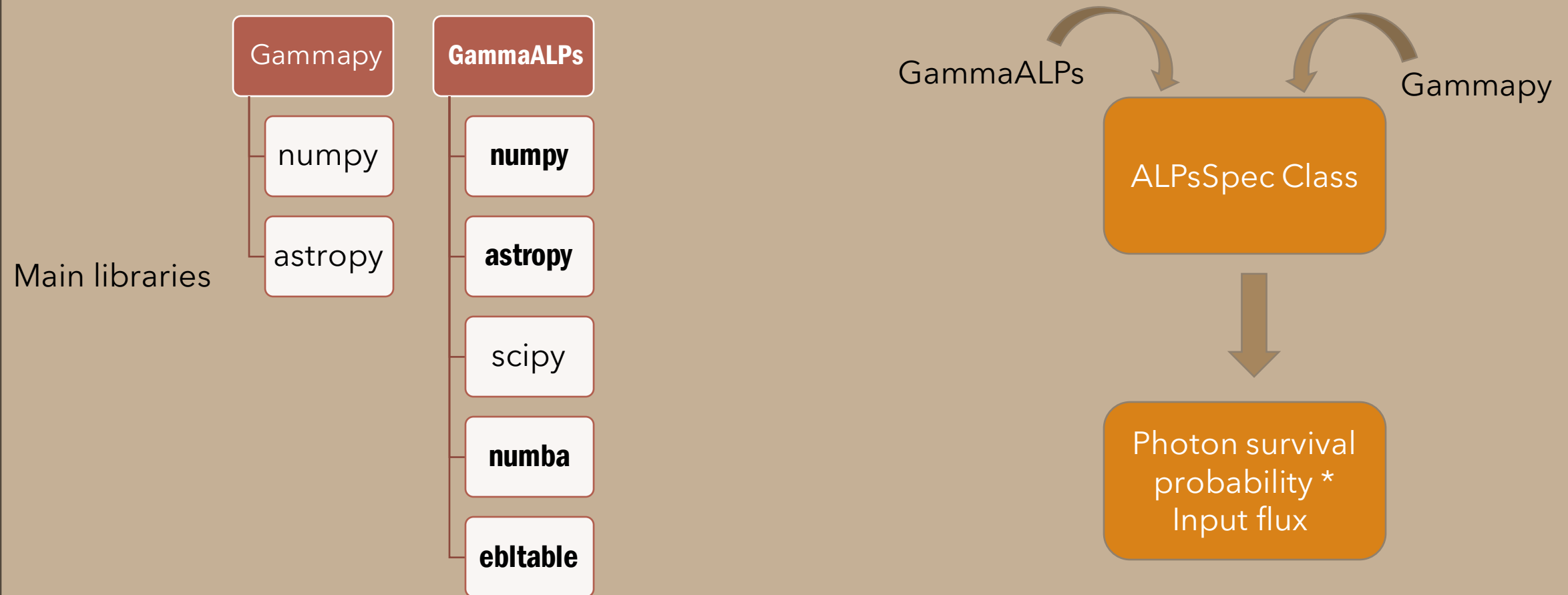
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MW



Methodology - Simulation



Methodology - Simulation

Complete Observation

- Parameters
- Spectral model
- CTA IRFs

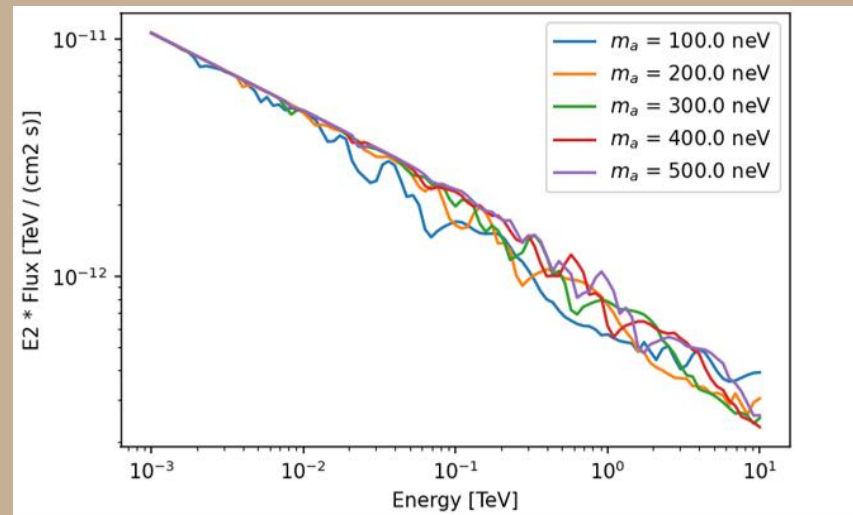
Model 1: without ALP

Model 2: with ALP

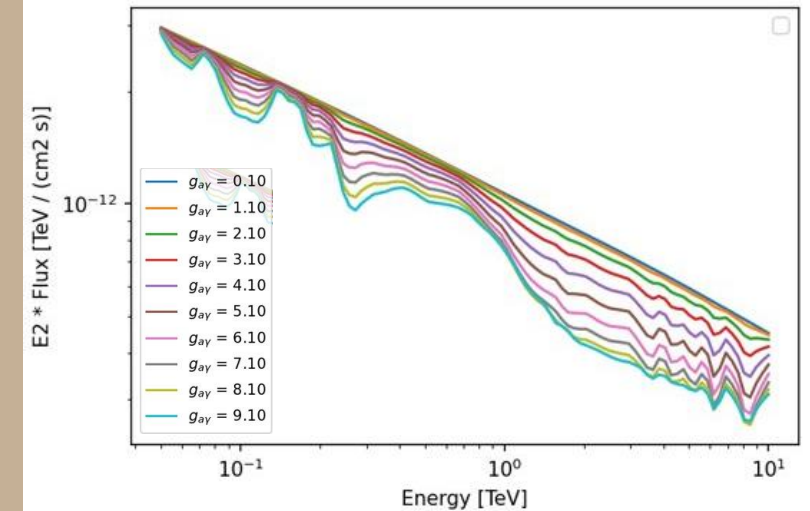
Likelihood ratio analysis leads us to sensitive detection regions of CTA where we possibly will be able to discard the null hypothesis and confirm a photon-ALP mixing experimental imprint.

Example using M87 data - 2010

ALP mass effect



Coupling constant effect*



(coupling constant in terms of $10^{-10} \text{ GeV}^{-1}$)

Prospects

- Review the code in order to investigate a bug which is leading to a misguided TS number for the fitting with no oscillation in 2005 data
- Perform a wider space-parameter sweep and create a more complete study of CTA sensitivity
- Apply a new analysis method which takes account a Bayesian statistic instead of a frequentist one, as used so far