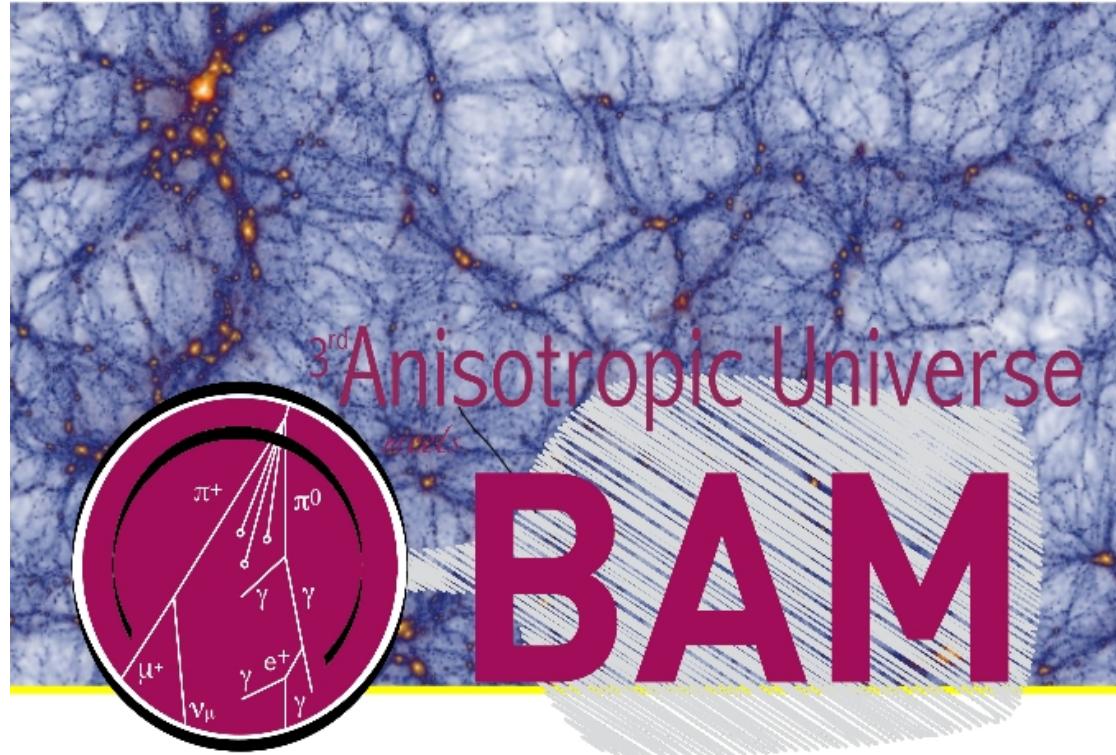


A



in the

**Anisotropic Universe**



# Barolo Astroparticle Meeting

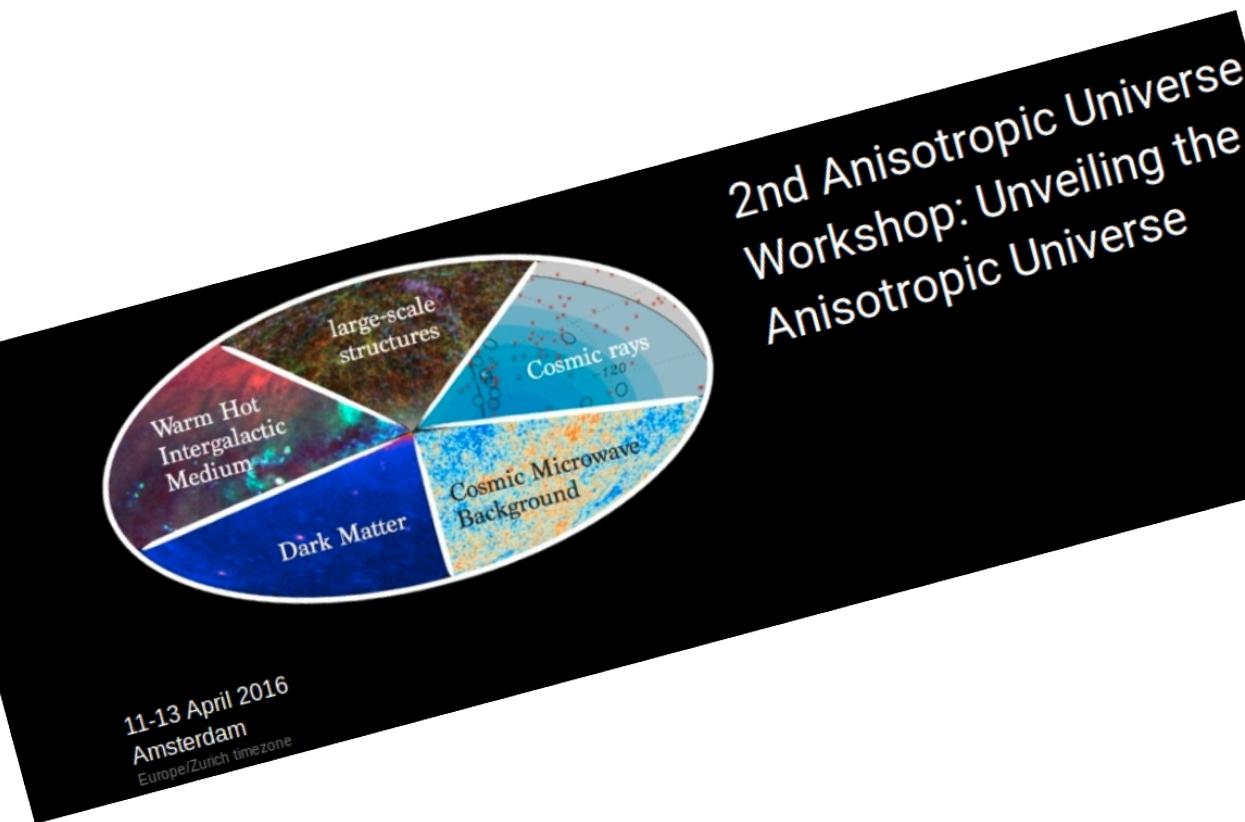
2-5 September 2018

## Organizing Committee

S. Ando (GRAPPA Amsterdam and Kavli IPMU Tokyo)  
F. Donato (University of Torino and INFN)  
N. Fornengo (University of Torino and INFN)  
M. Regis (University of Torino and INFN)  
C. Weniger (GRAPPA Amsterdam)  
F. Zandanel (GRAPPA Amsterdam)  
H. Zechlin (INFN)



# Anisotropic Universe workshop



**Anisotropic Universe**  
from microwaves to ultrahigh energies

Workshop 25-27 September 2013  
GRAPPA Institute, University of Amsterdam

The diagram features a large circle divided into four quadrants, each representing a component of the universe: 'Warm Hot Intergalactic Medium' (top-left), 'Dark Matter' (bottom-left), 'Cosmic Microwave Background' (bottom-right), and 'Large-scale structures' (top-right). Arrows point from each quadrant to specific observational probes:

- From 'Warm Hot Intergalactic Medium': 'soft x-rays tracers of the cosmic web and the missing baryon problem'
- From 'Dark Matter': 'gamma-rays as tracers of dark matter distribution and signature of annihilation'
- From 'Cosmic Microwave Background': 'probing fluctuations of the content of the Universe through space and time'
- From 'Large-scale structures': 'galaxy distributions and probes of cosmology'
- From the bottom right of the circle: 'arrival directions and connection with magnetic fields'

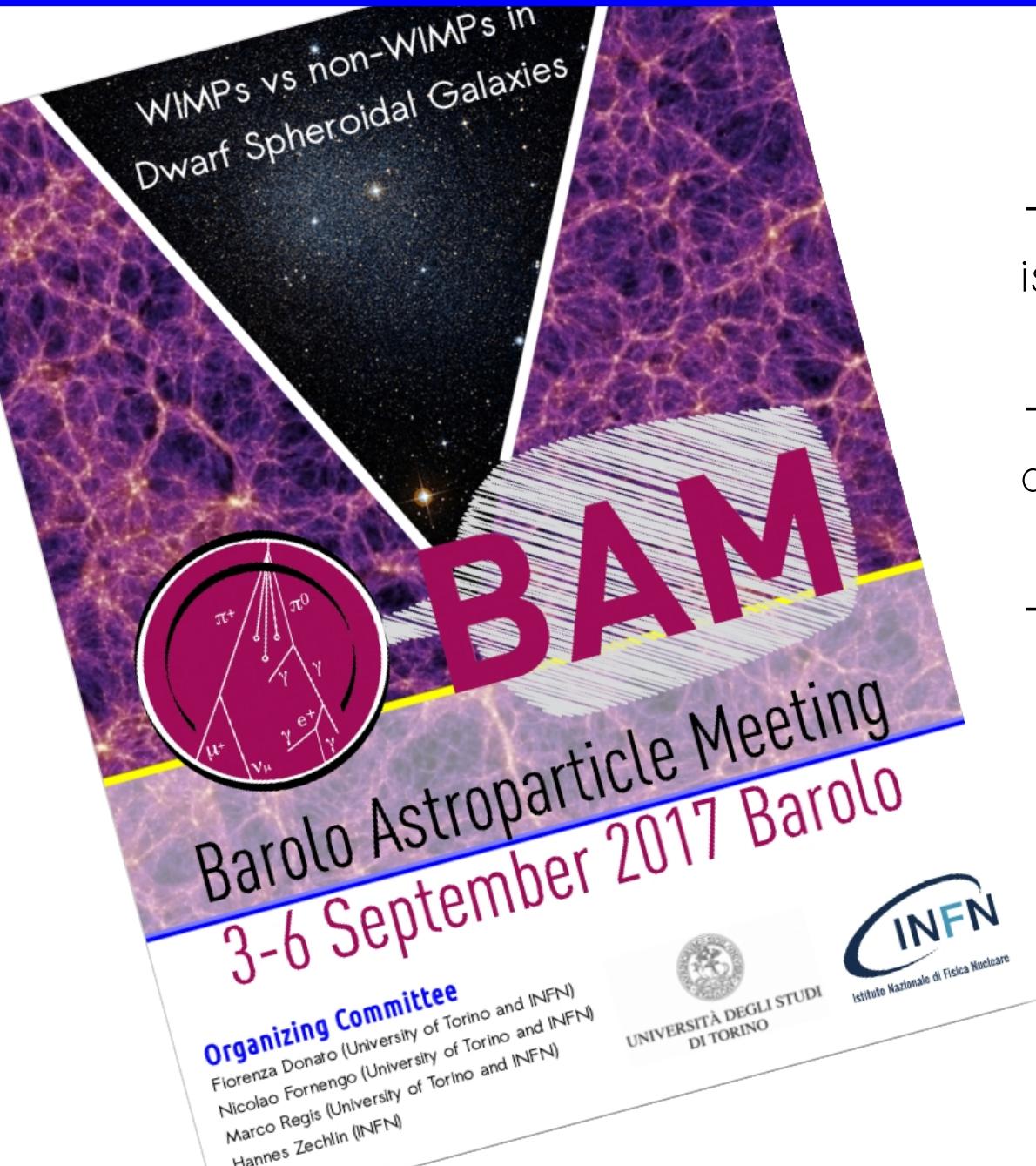
**Organizing Committee**

Shin'ichiro Ando, *GRAPPA Amsterdam*  
Kumiko Kotera, *IAP Paris*  
Jacco Vink, *API & GRAPPA Amsterdam*  
Fabio Zandanel, *GRAPPA Amsterdam*

<http://grappa.science.uva.nl/anisotropies/>

image credit: Planck Coll. Fermi Coll. ROSAT 2MASS Auger Coll. compton K. Kotera

# Barolo Astroparticle Meeting



- aims at discussing topical open issues in Astroparticle Physics
- informal structure to stimulate discussions
- every 2 years (next one in 2020)

# Program / Talks

## MONDAY

“Old” and “New” techniques to unveil the unresolved gamma-ray sky  
+ Debate on the Galactic Center

## TUESDAY (morning)

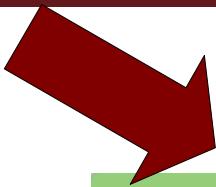
The multi-wavelength / multi-messenger view

## WEDNESDAY (morning)

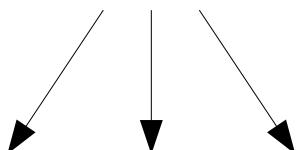
Future perspectives

# Program / Discussions

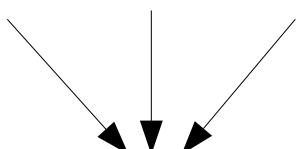
Brainstorming/Wine discussion



Plenary discussion (moderators: S. Camera / F. Donato)



Splinter group meetings



Wrap-up of splinter discussions (moderator: N. Fornengo)

# Program / Social Events

## MONDAY

Aperitivo (with discussion)

Hotel terrace @ 7.30pm

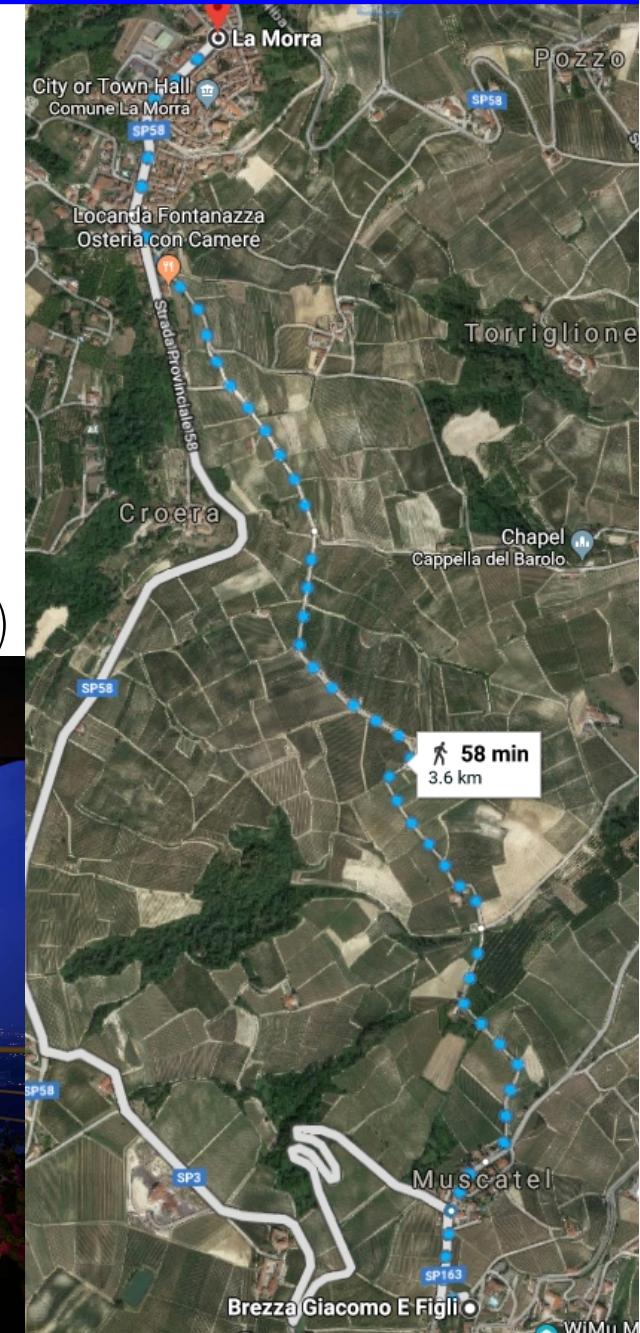
## TUESDAY

Walk @ 7pm

(for interested people)

Social dinner @ 8.30pm

(Ristorante Bovio, La Morra)



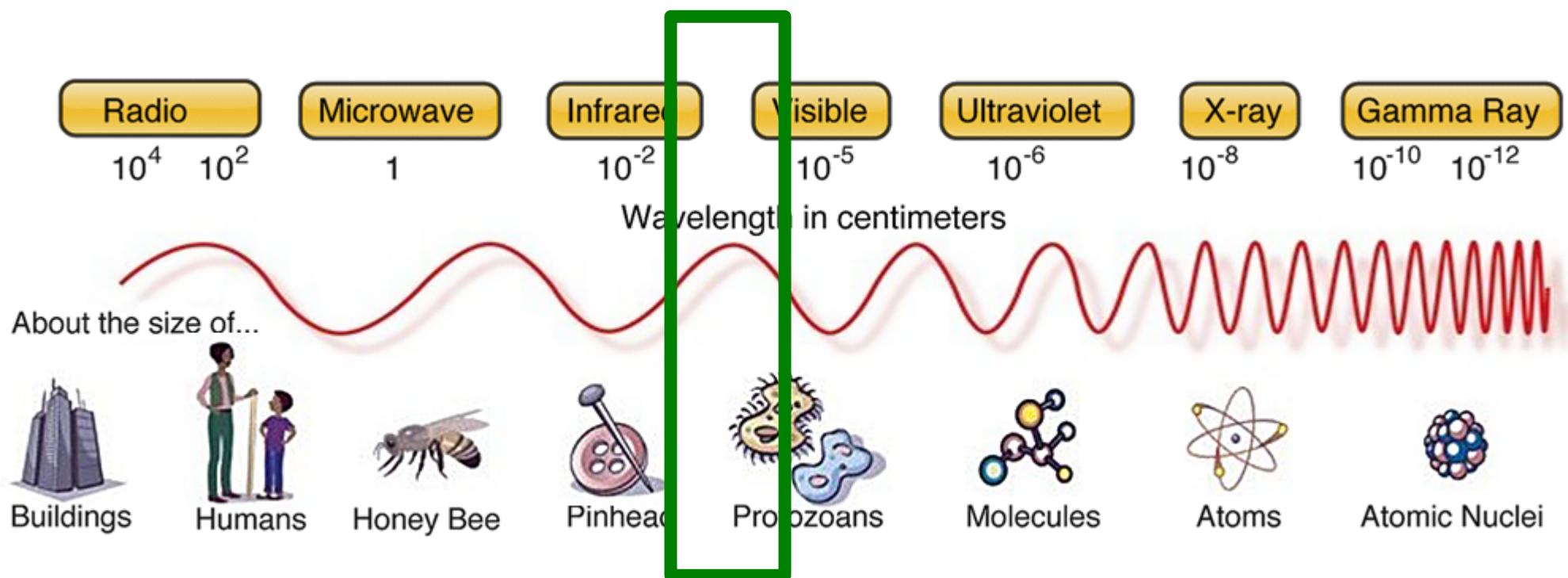
# Driving question



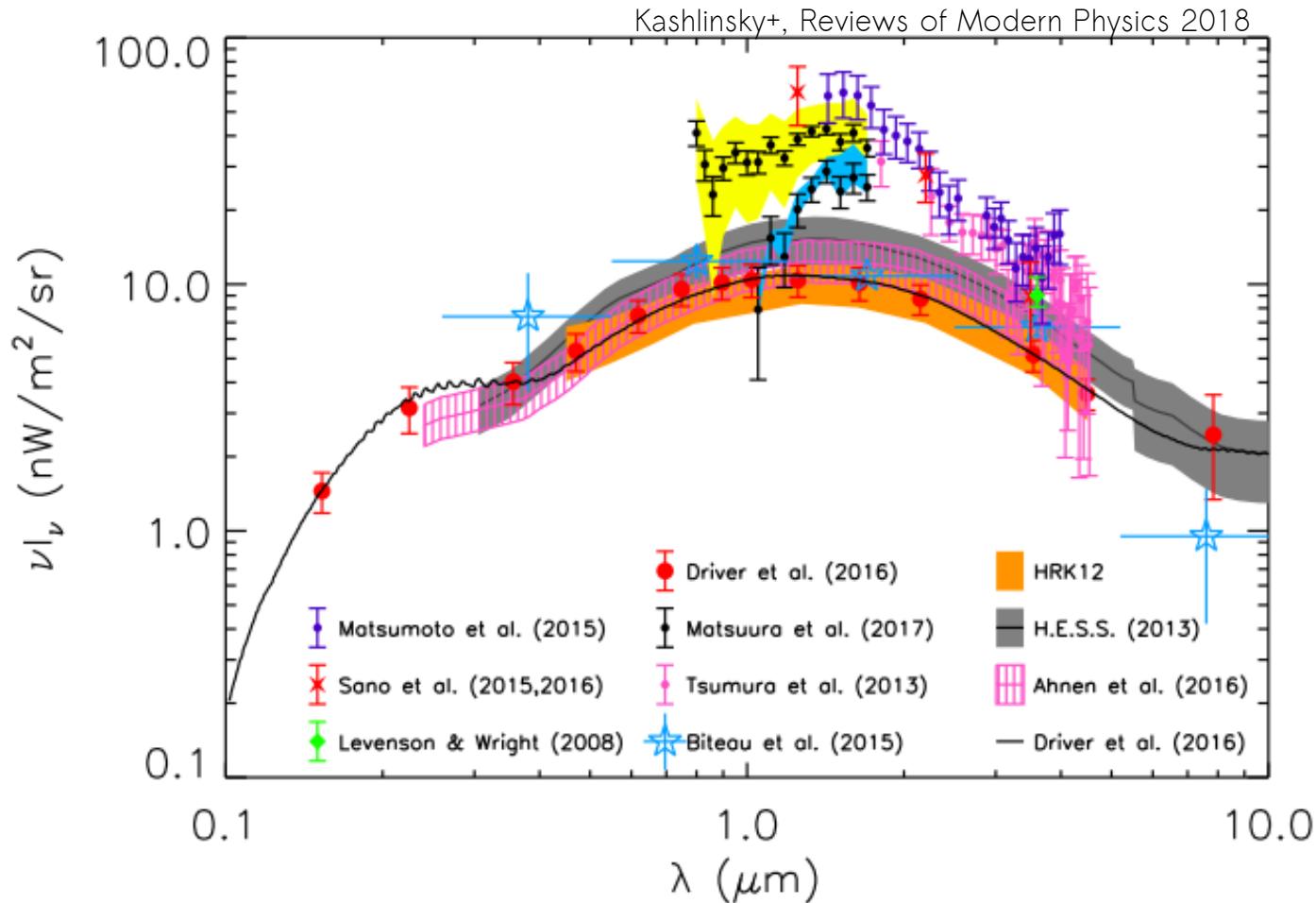
**How to infer the  
nature of unresolved  
backgrounds by  
studying their  
anisotropies?**

Millennium XXL simulation

# The Near InfraRed case



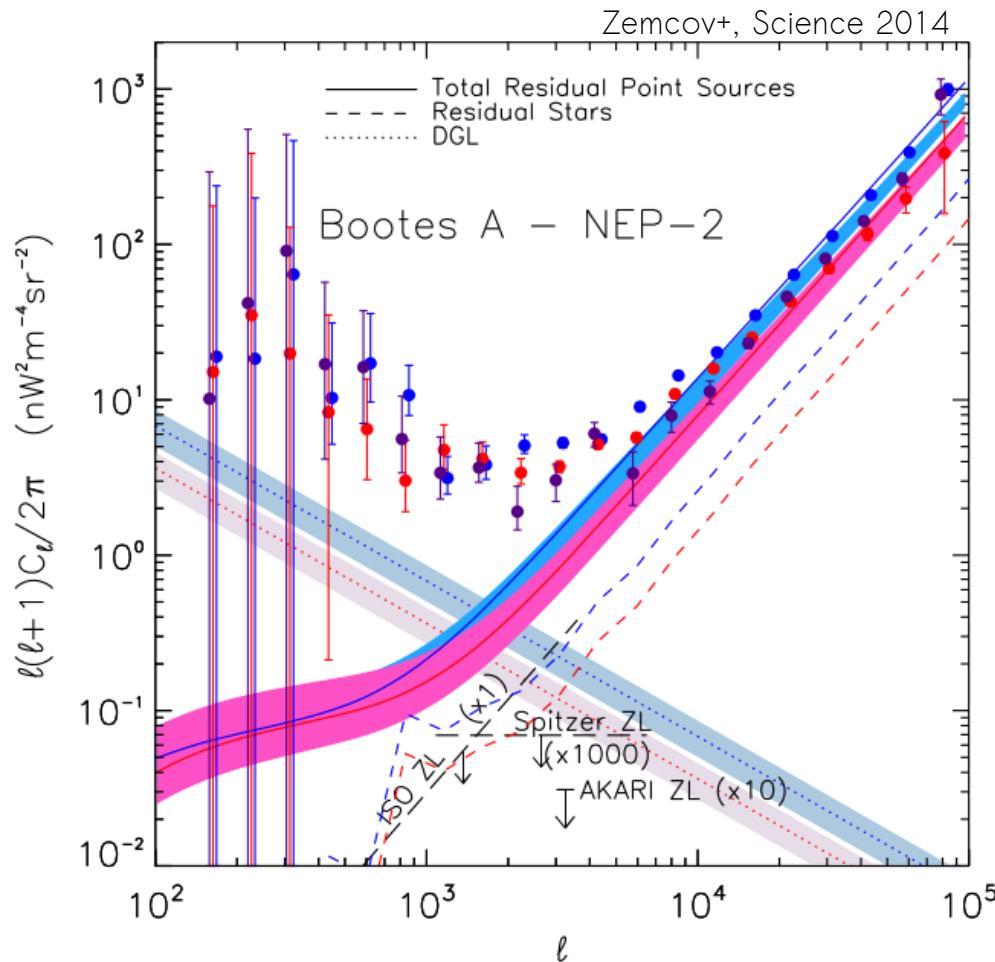
# The Near InfraRed Background (NIRB)



Direct measurement limited by the presence of bright foregrounds, such as the zodiacal light



# NIRB anisotropies



Excess in the NIRB autocorrelation angular power spectrum

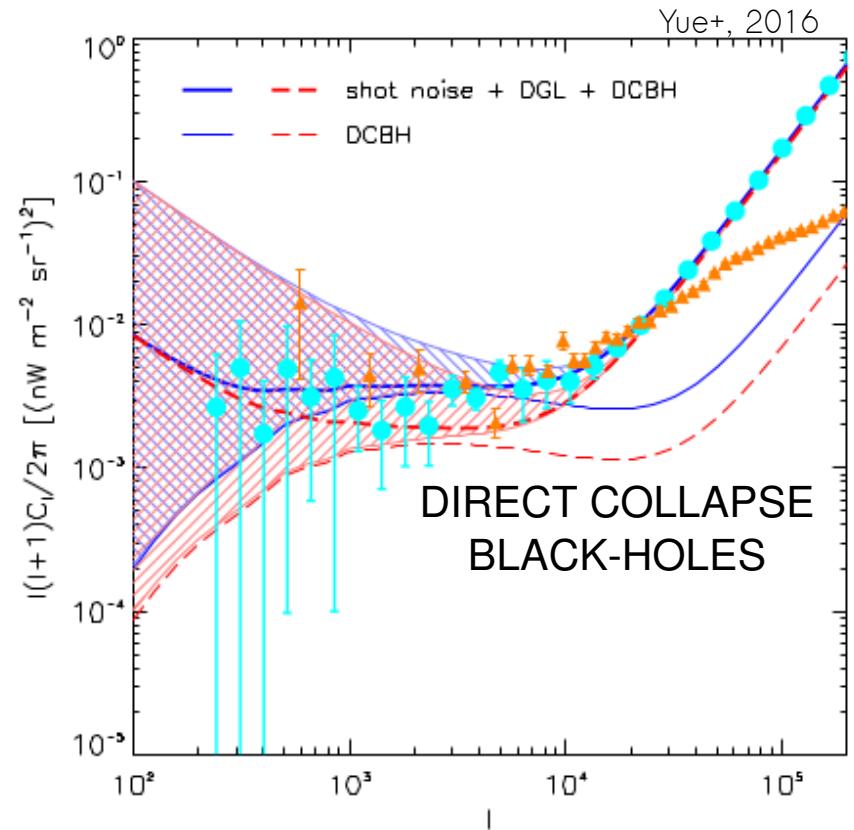
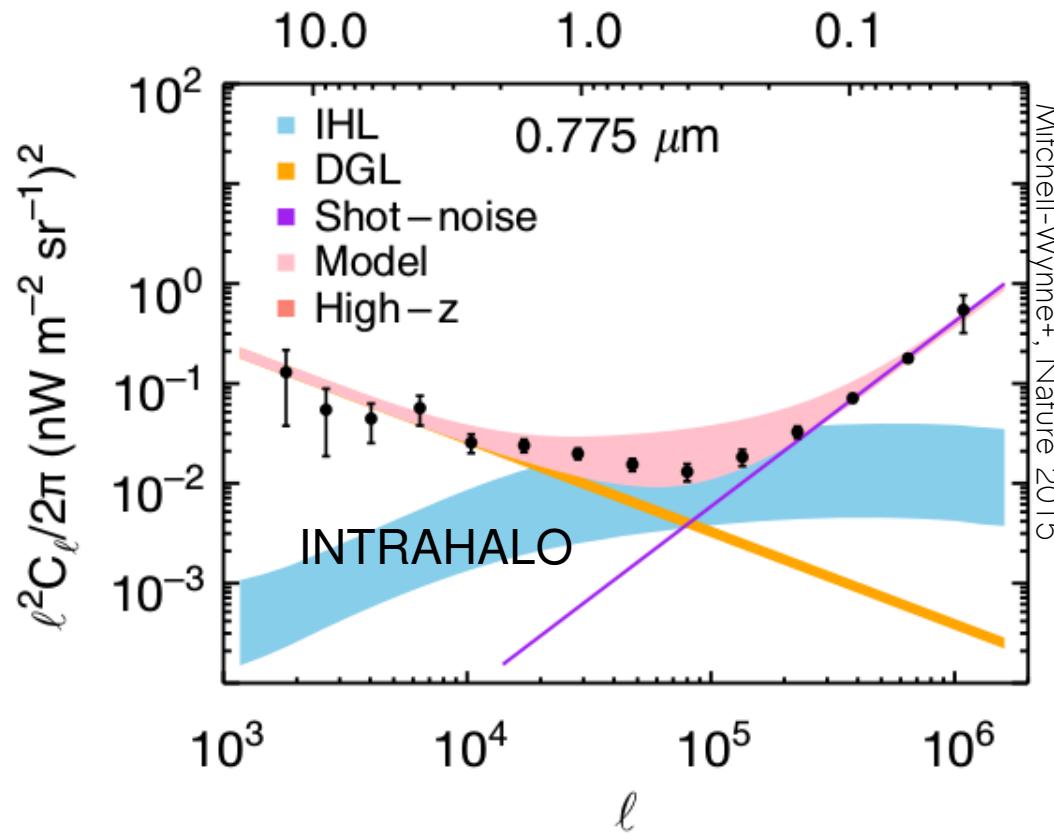
# NIRB anisotropies

Proposed explanations:

- Intra-halo light
- Early ( $z > 13$ ) black holes
- Decay of ALPs of few eV

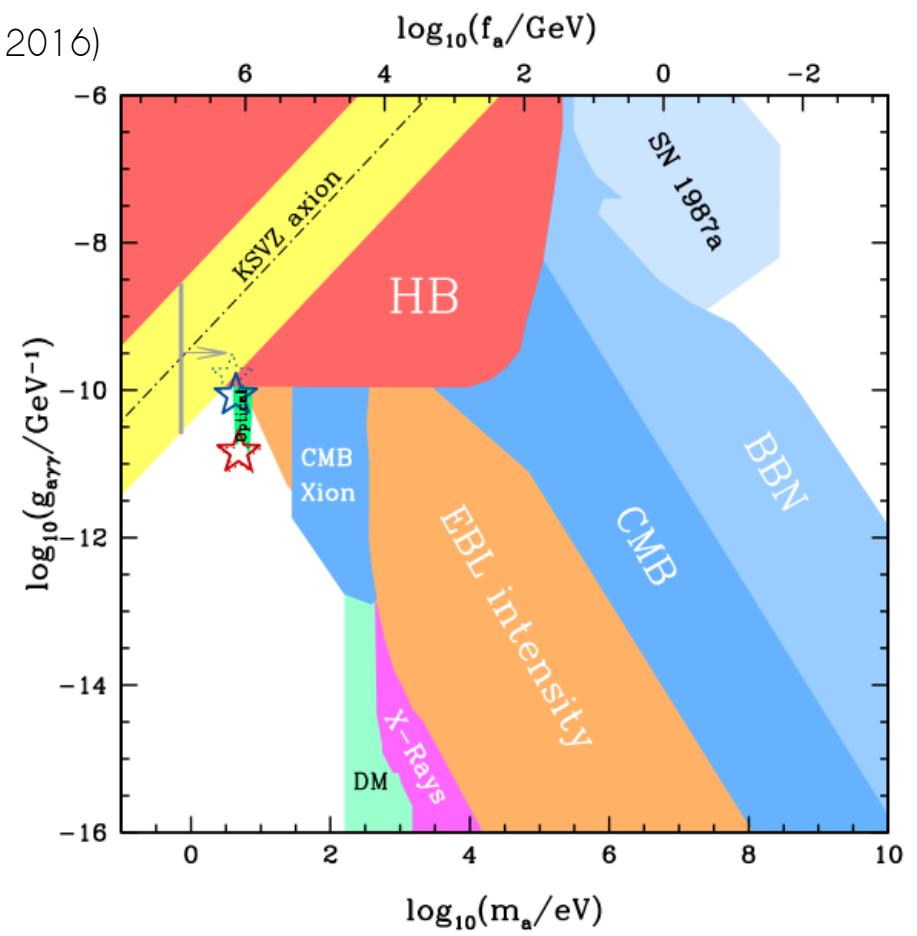
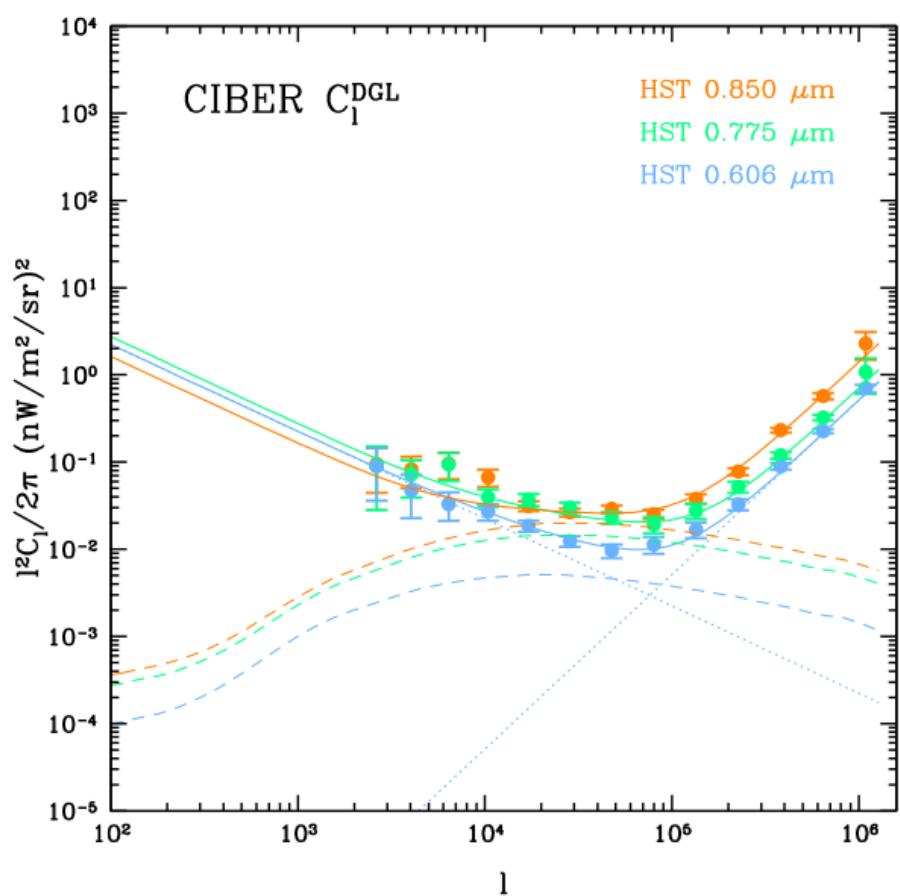
**b**

Arcmin



# NIRB and Axion Like Particles

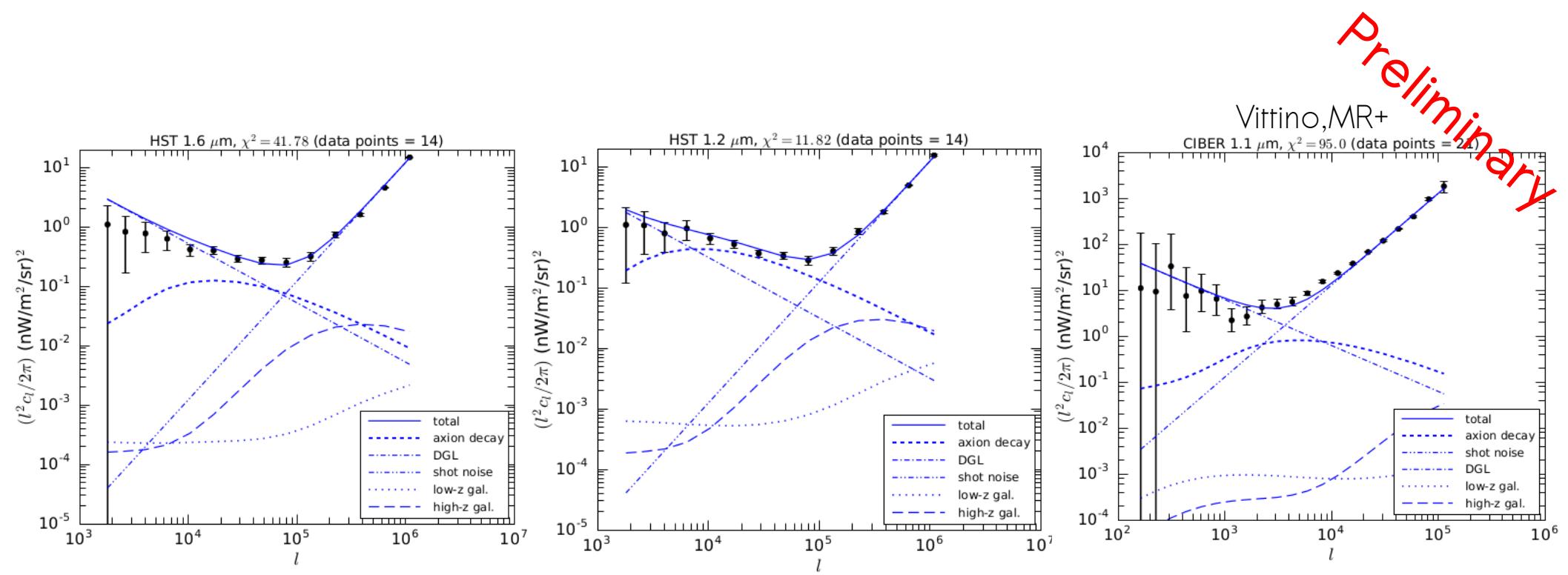
Excess in the NIRB autocorrelation angular power spectrum  
→ decay of ALPs of few eV?



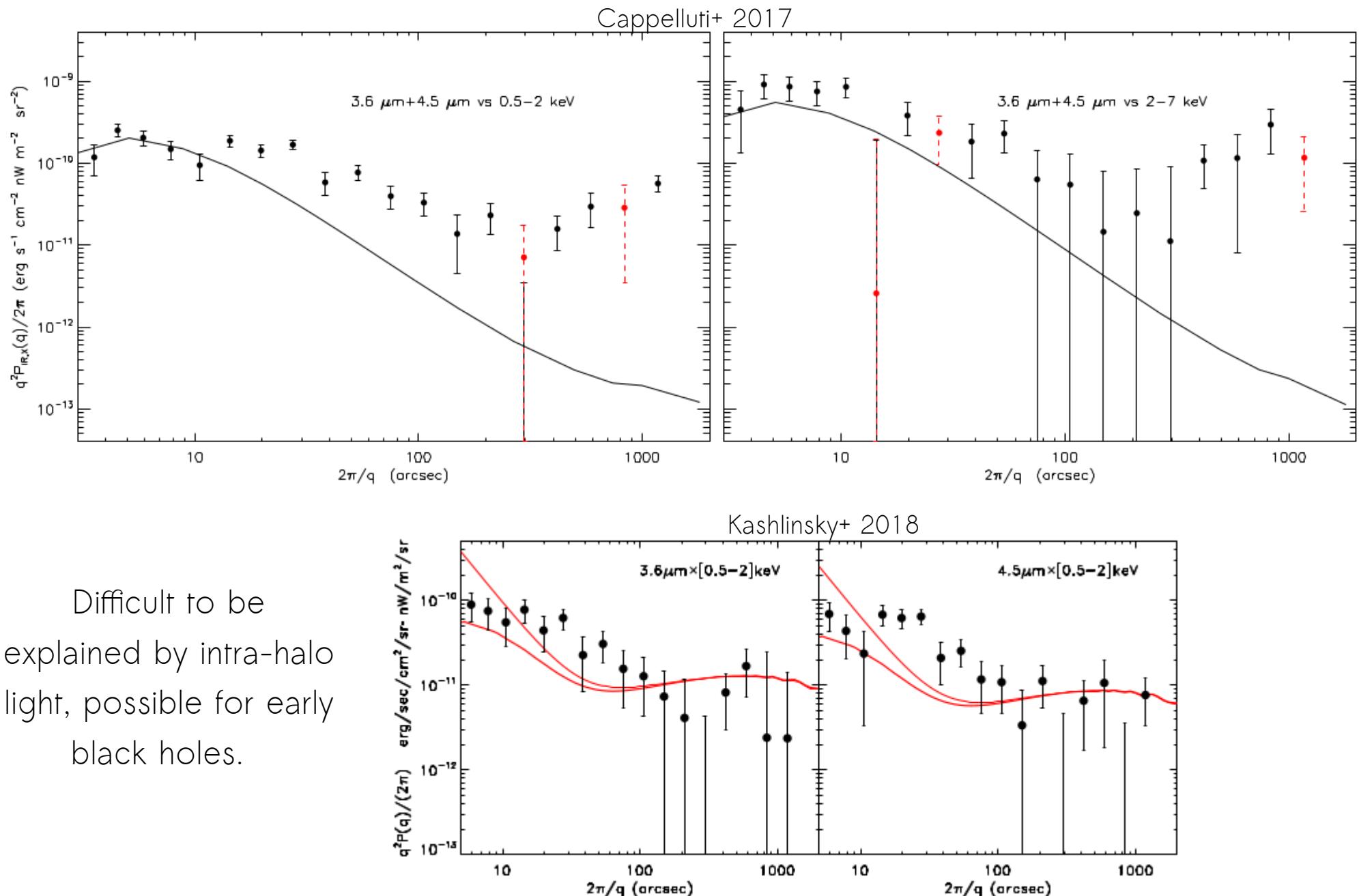
# NIRB and Axion Like Particles

To be checked:

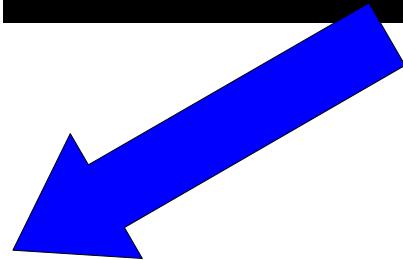
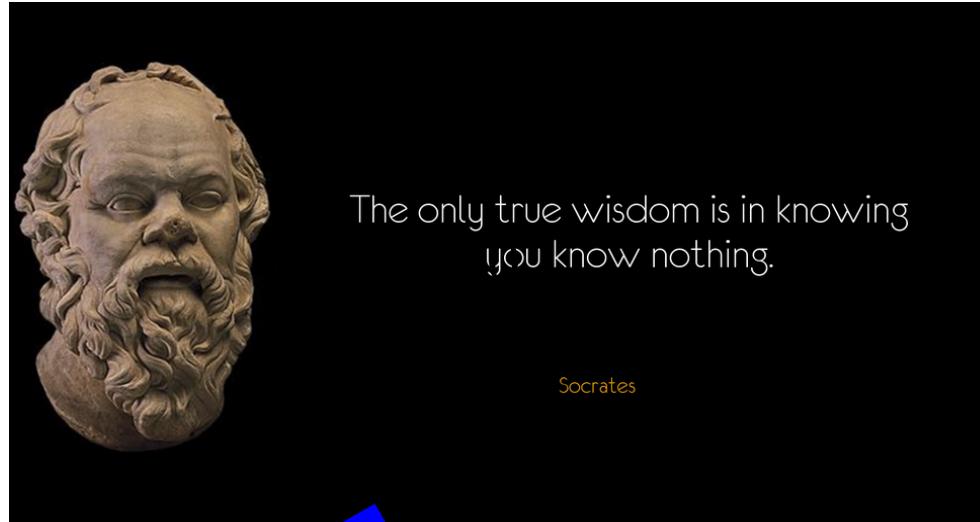
- Determination of the energy spectrum
- Cross correlation between different NIRB bands
- Cross correlation between NIRB and X-rays.



# Cross correlation NIRB vs X-ray background

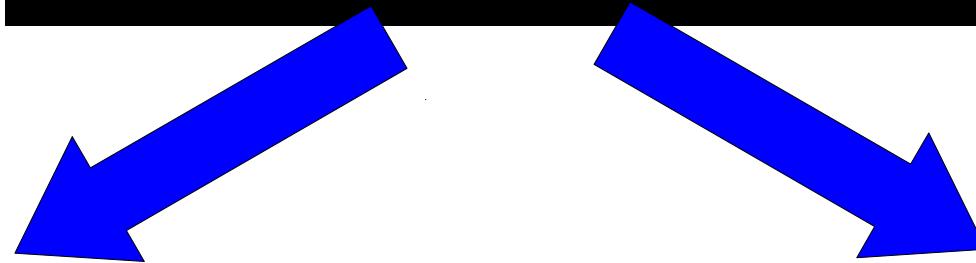
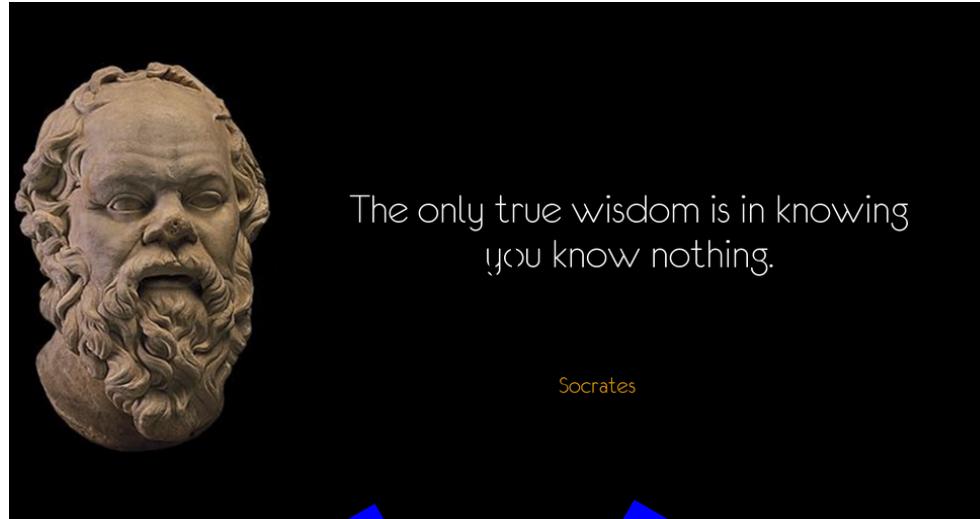


# Conclusions



Endless discussions to  
try to build a new  
(not-yet-falsified)  
theory

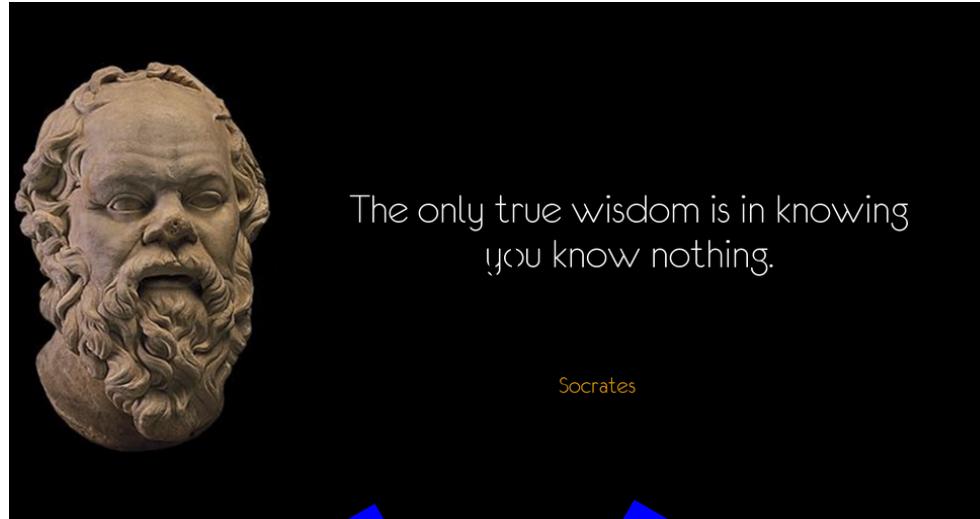
# Conclusions



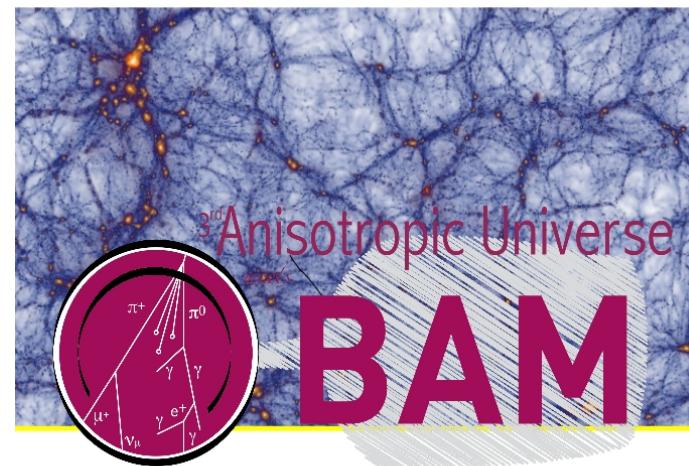
Endless discussions to  
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theory

Just give up and  
drink a good  
glass of wine

# Conclusions



Endless discussions to  
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theory



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2-5 September 2018

Just give up and  
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