

# Bayesian Hierarchical Inference for **D**ark **M**atter Detection from Overheated Exoplanets

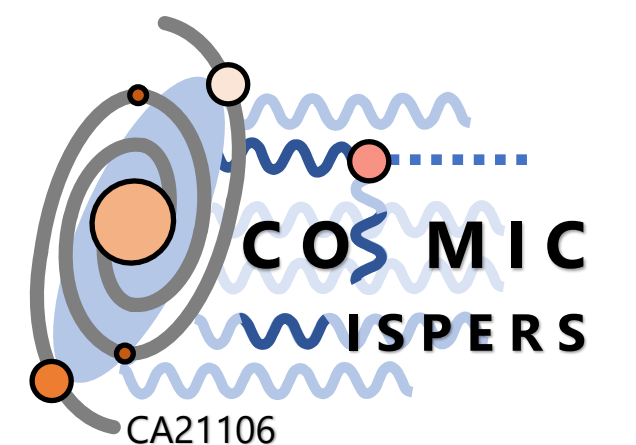
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EuCAIFCon 2024



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Tartu Observatory



# Dark Matter particle landscape



Primordial Black Holes

$$10^{-17} - 50 M_{\odot}$$

$$10^5 M_{\odot}$$

$$10^{71} \text{ eV}$$

Must fit inside  
dwarf galaxies

$$m_{\text{DM}} \lesssim 10^{71} \text{ eV}$$

WIMPs ♡

$$10 \text{ GeV} - 10 \text{ TeV}$$

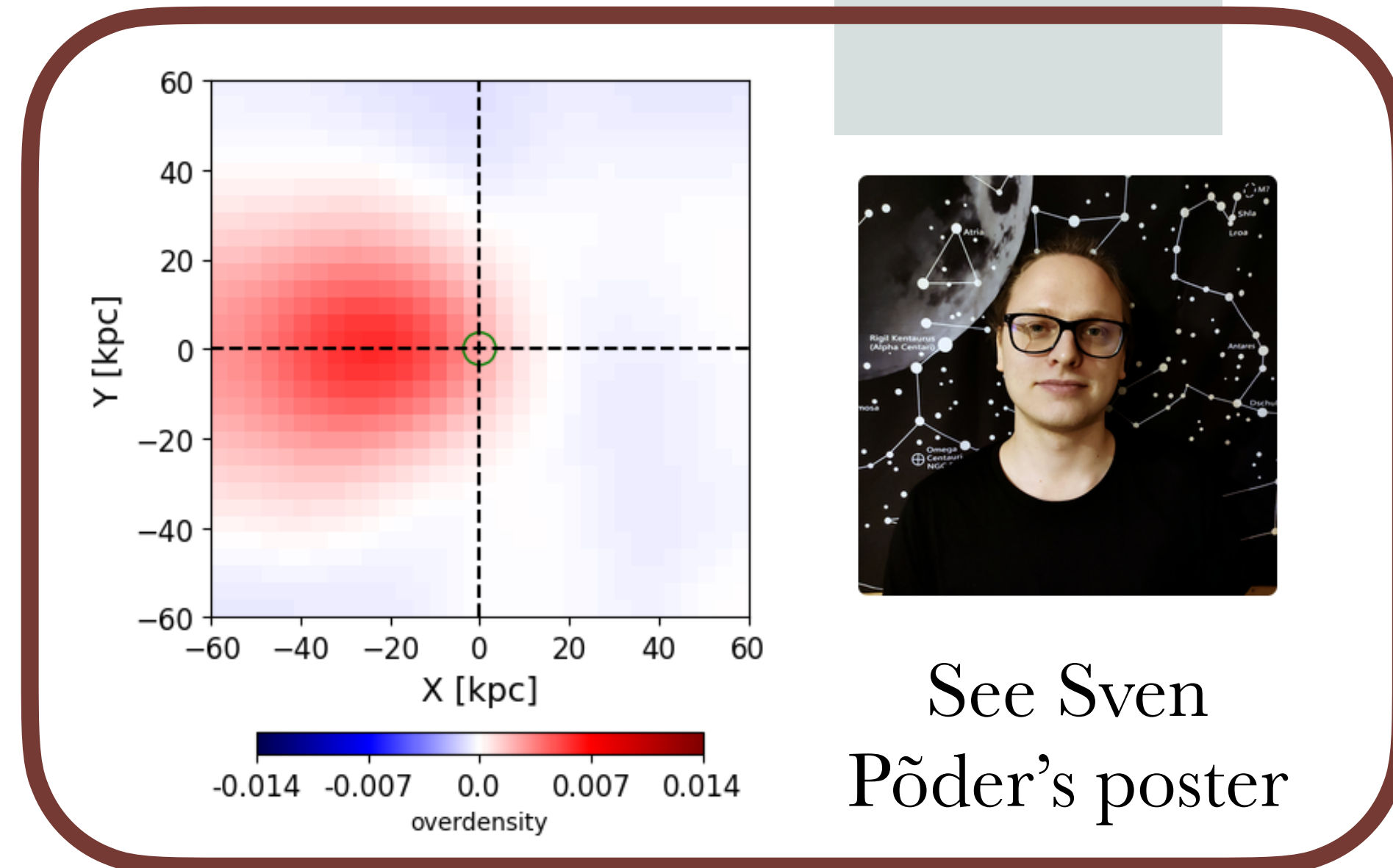
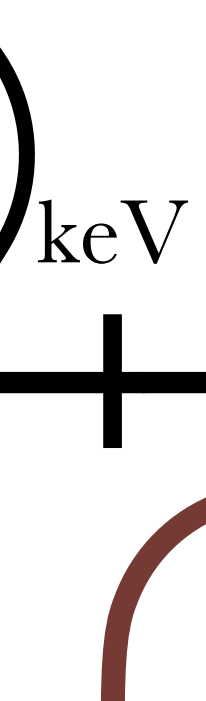
sub-GeV DM

$$1 \text{ MeV} - 10 \text{ GeV}$$

$$\text{TeV}$$

$$\text{GeV}$$

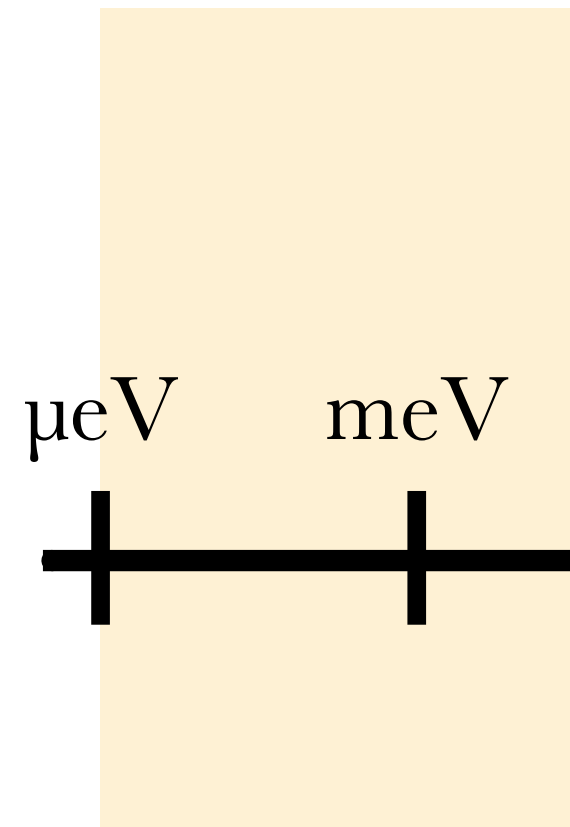
$$\text{MeV}$$



See Sven  
Põder's poster

QCD axion

$$10^{-6} - 10^{-4} \text{ eV}$$



$$10^{-21} \text{ eV}$$

$$\text{zeV}$$

$$\mu\text{eV}$$

$$\text{meV}$$

$$\text{eV}$$

$$\text{keV}$$



Macroscopic  
quantum effects

$$m_{\text{DM}} \gtrsim 10^{-22} \text{ eV}$$

# Dark Matter particle landscape



Primordial Black Holes

$10^{-17} - 50 M_{\odot}$

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$10^{71} \text{ eV}$

Must fit inside  
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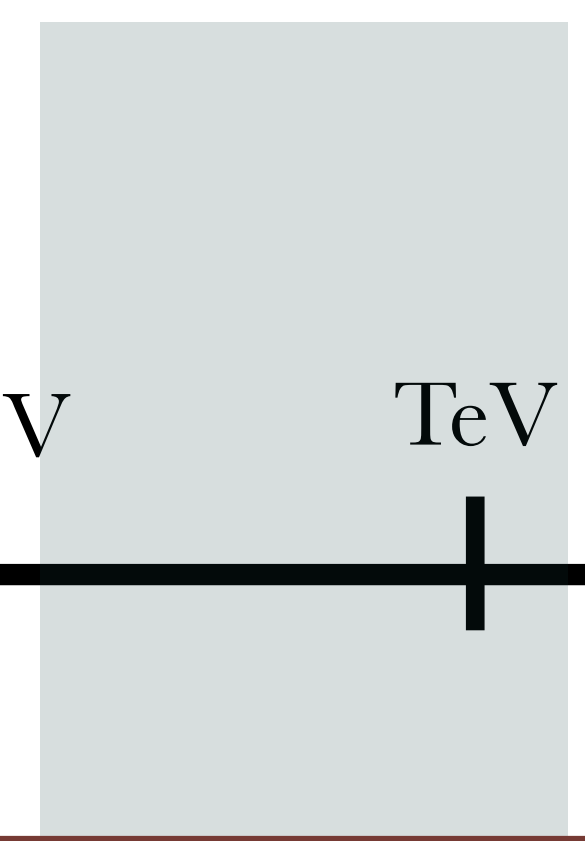
$m_{\text{DM}} \lesssim 10^{71} \text{ eV}$

WIMPs ♡  
 $10 \text{ GeV} - 10 \text{ TeV}$

sub-GeV DM &  
below



$10 \text{ GeV} - 10 \text{ TeV}$



MeV

GeV

TeV

**Exoplanets & Brown**

**Dwarfs** are new, excited and  
powerful detectors of DM

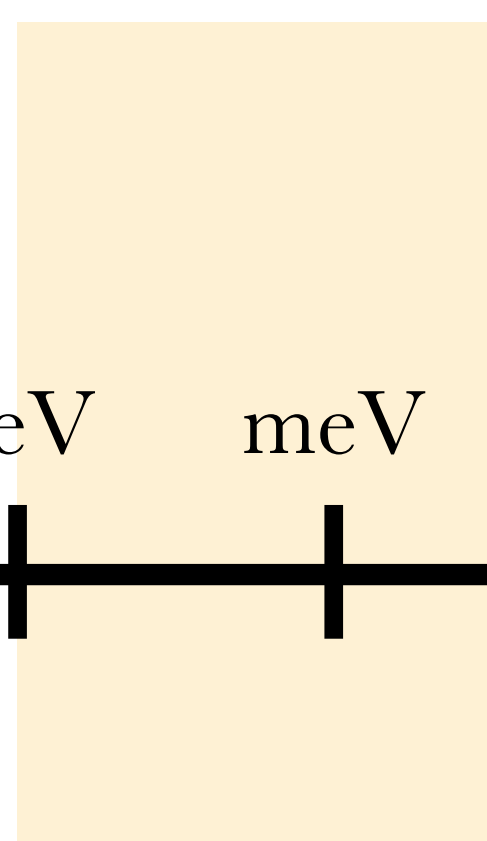
Leane & Smirnov [2010.00015]

Acevedo et al. [2303.01516]

Benito et al. (very soon to appear on arXiv)

QCD axion

$10^{-6} - 10^{-4} \text{ eV}$



$10^{-21} \text{ eV}$

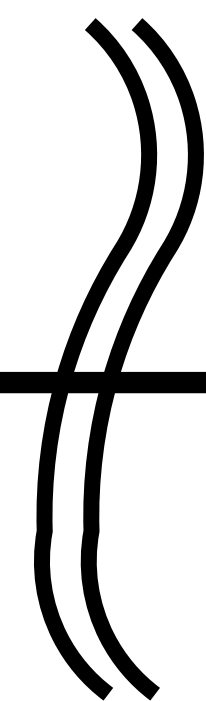
zeV

$\mu\text{eV}$

meV

eV

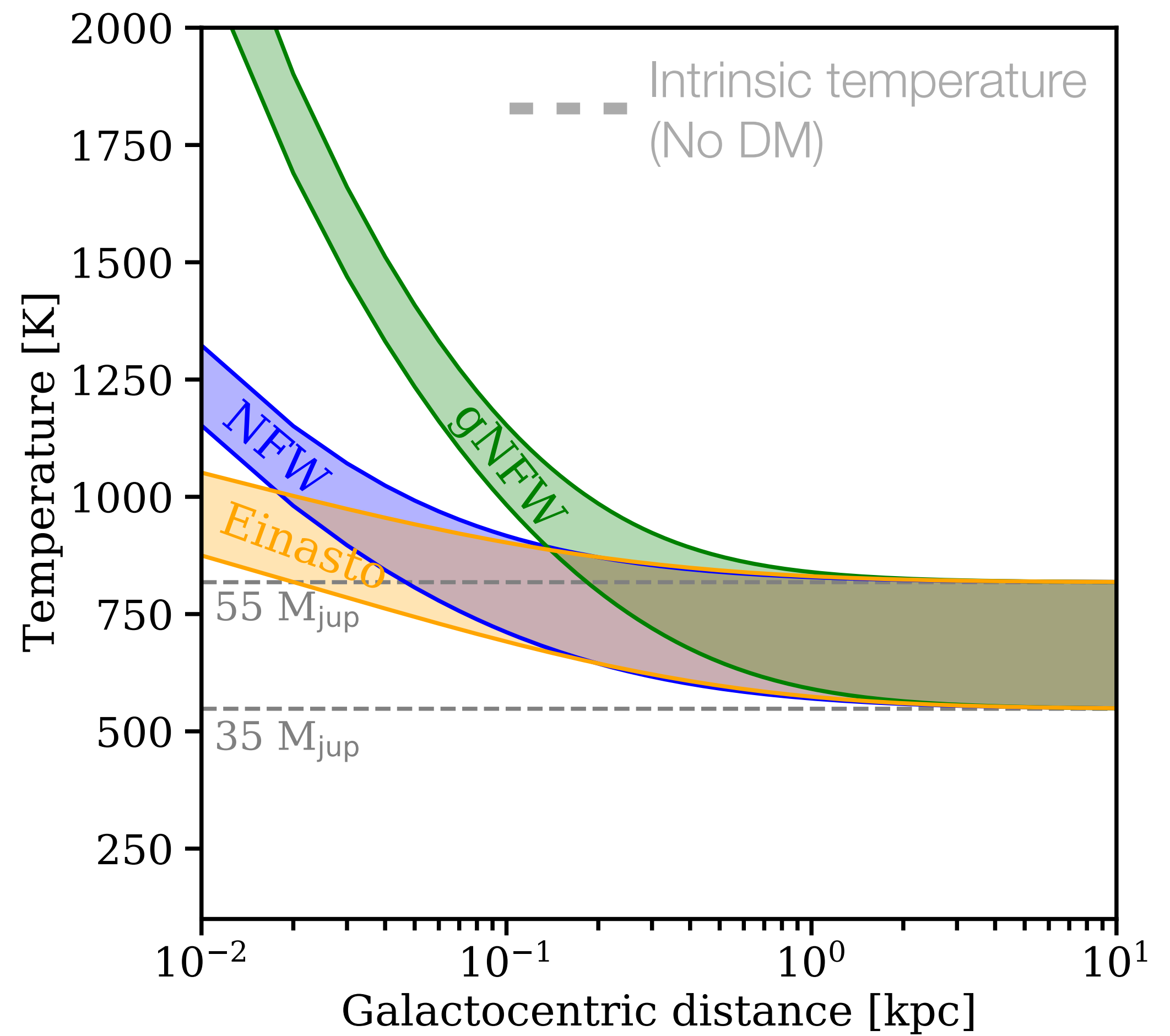
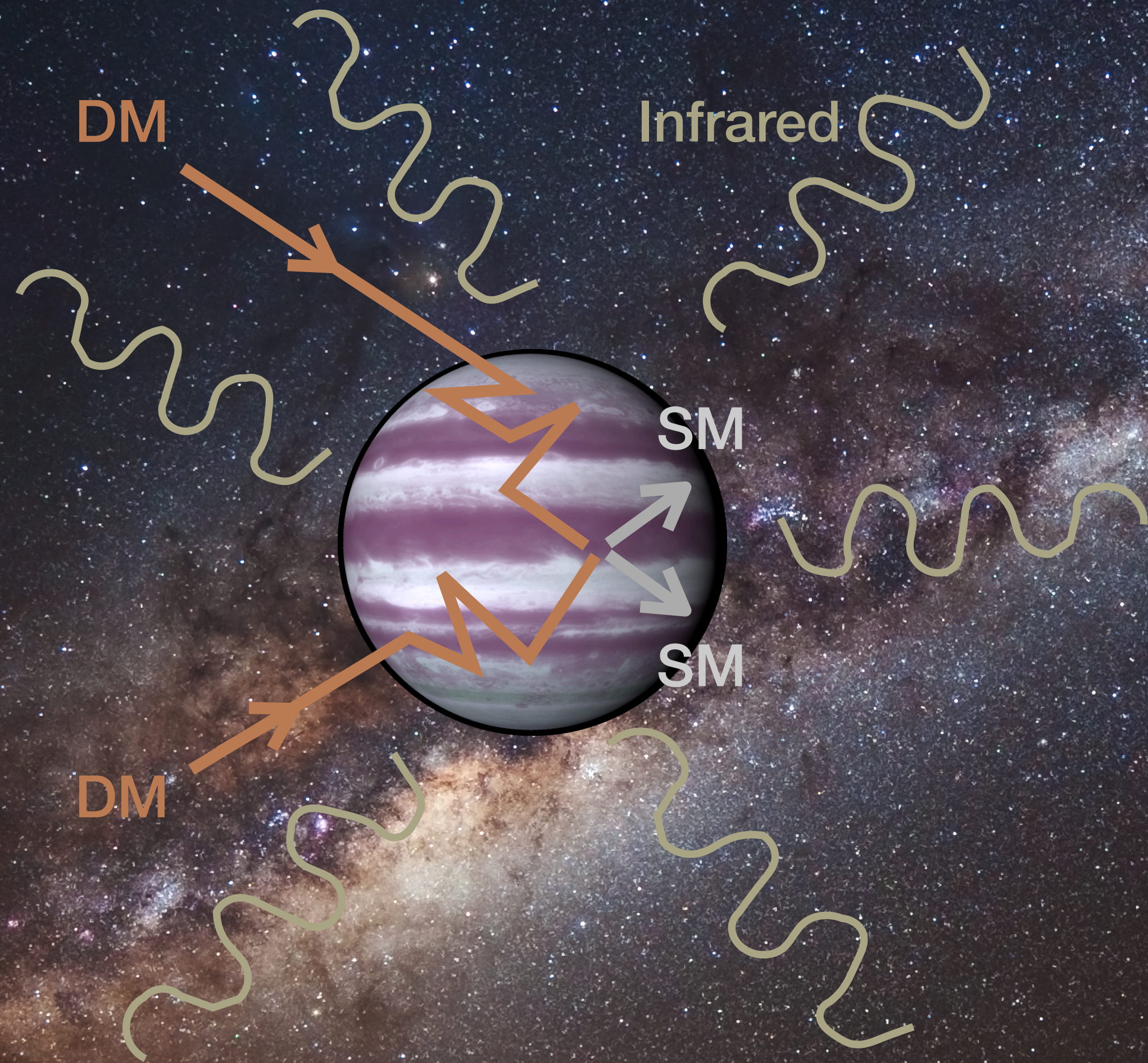
keV



Macroscopic  
quantum effects

$m_{\text{DM}} \gtrsim 10^{-22} \text{ eV}$

# Indirect **D**ark **M**atter search



# Bayesian Hierarchical Model

Details & results in poster, during coffee break, soon arXiv



Konstantin Karchev & I  
would be happy to discuss  
further

