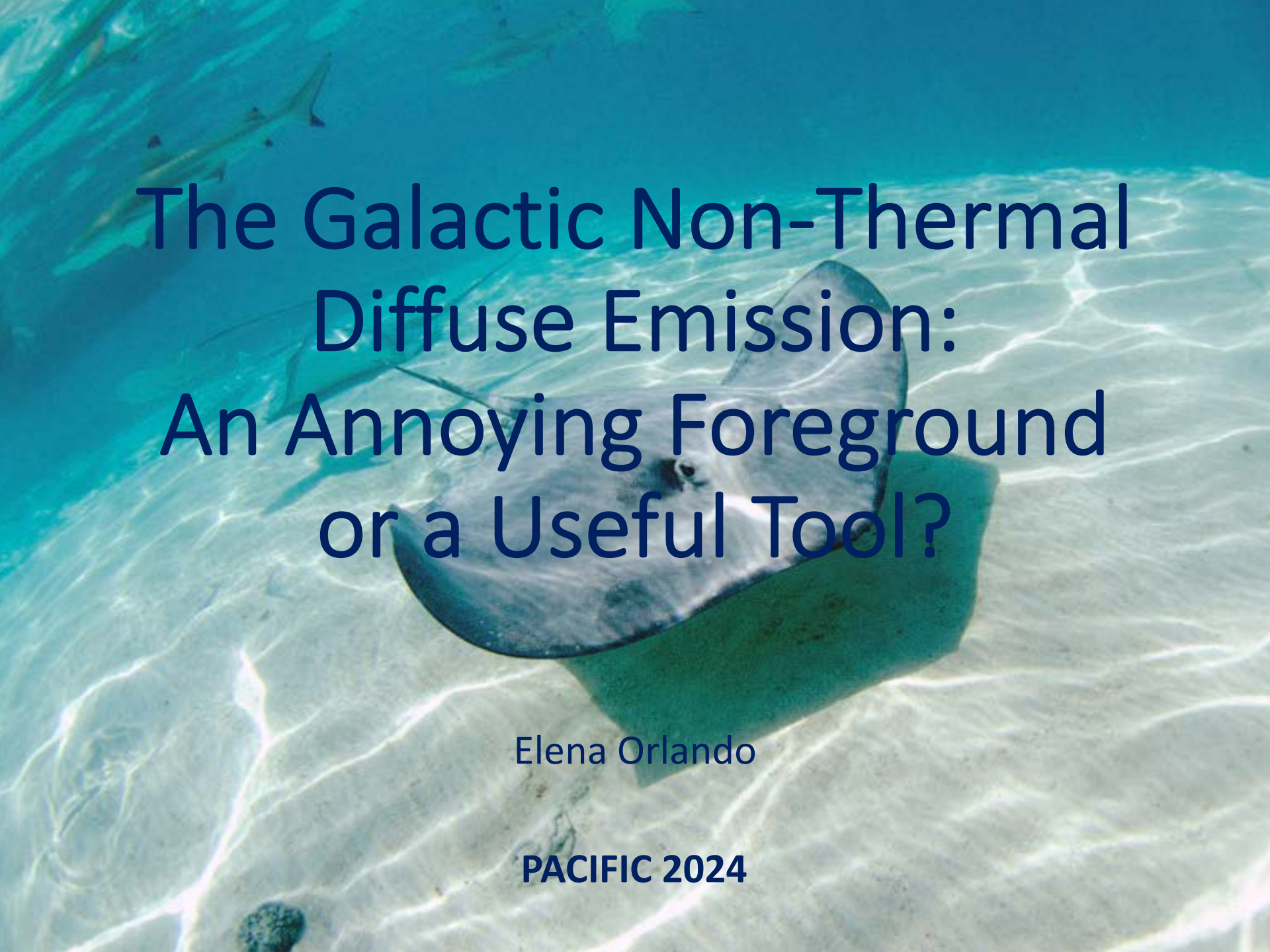
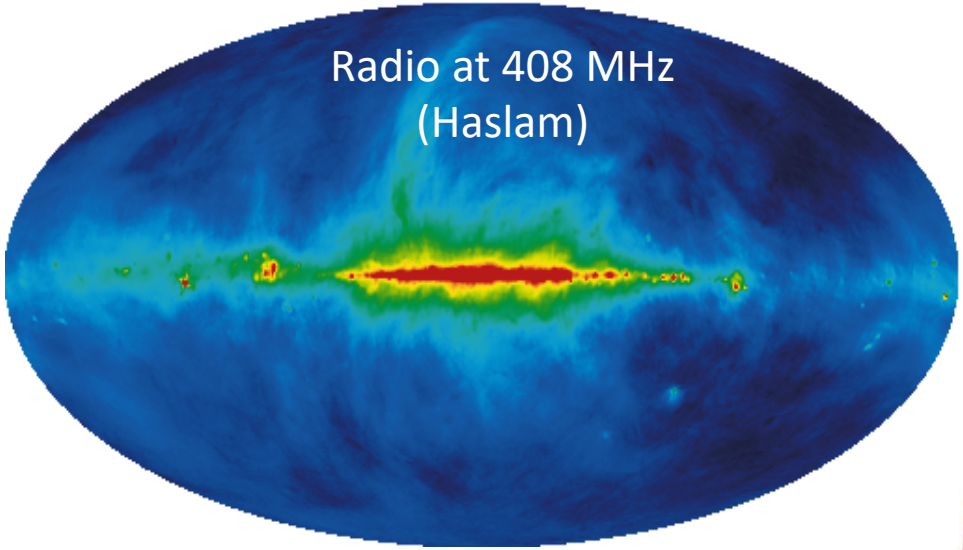


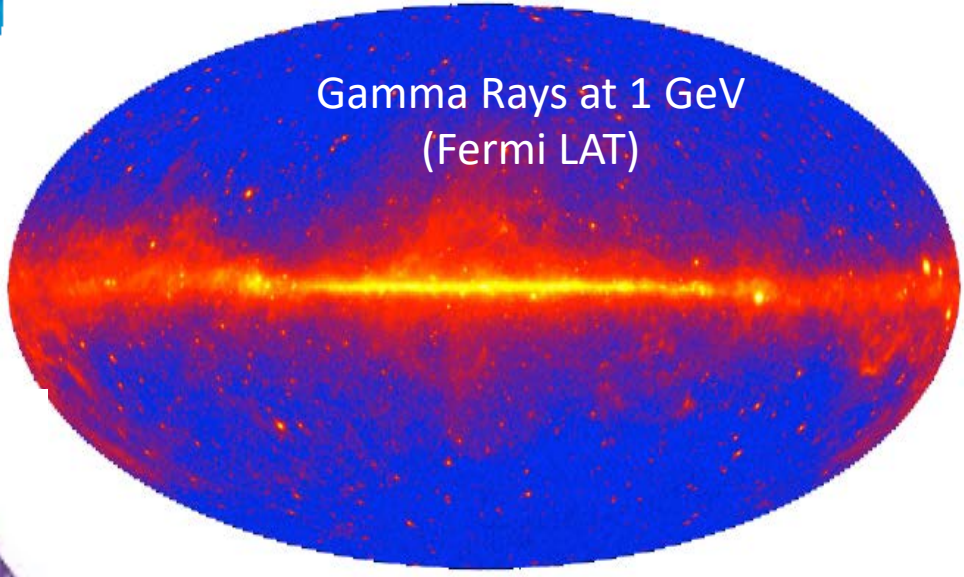
The Galactic Non-Thermal Diffuse Emission: An Annoying Foreground or a Useful Tool?

Elena Orlando

PACIFIC 2024

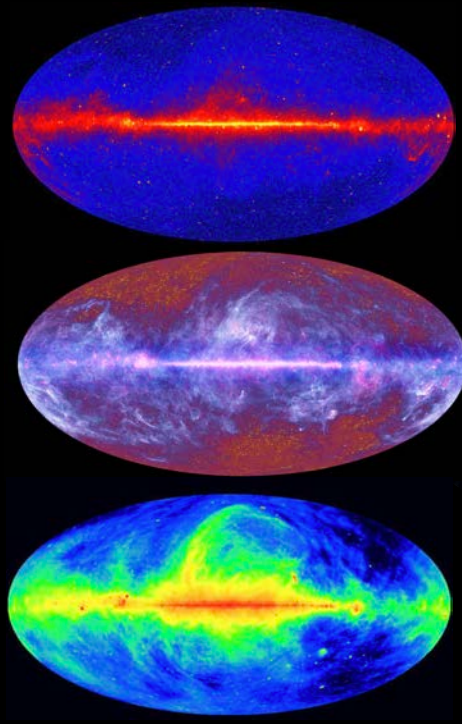
All-Sky Maps


Radio at 408 MHz
(Haslam)

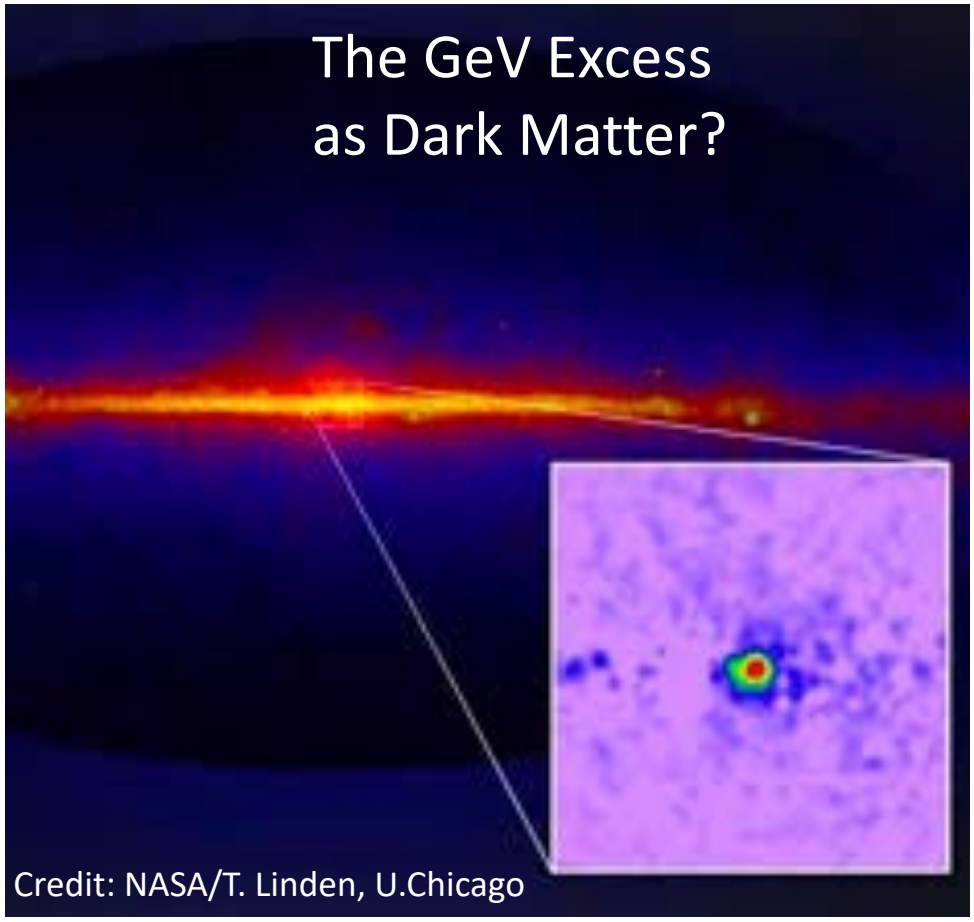

Gamma Rays at 1 GeV
(Fermi LAT)


Microwaves at 30 GHz
(Planck)

The Galactic Non-Thermal Diffuse Emission

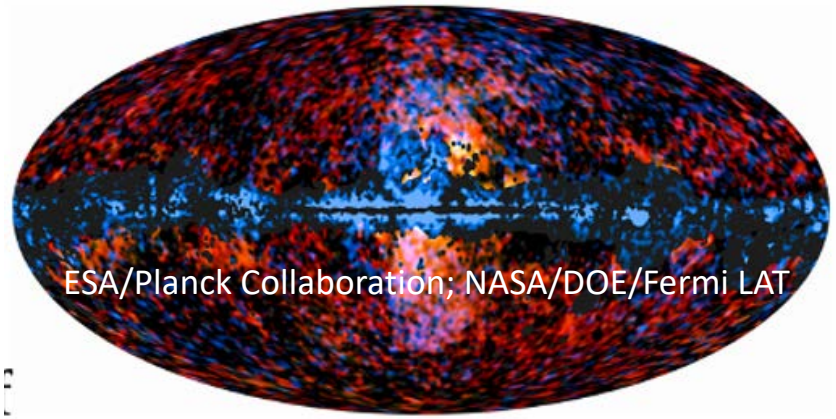


The GeV Excess as Dark Matter?

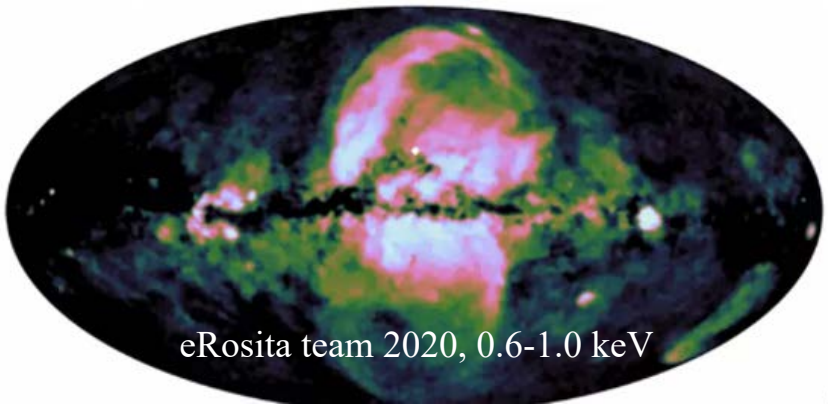


Credit: NASA/T. Linden, U.Chicago

Fermi Bubbles/Planck Haze /eRosita Bubbles as past AGN activity?

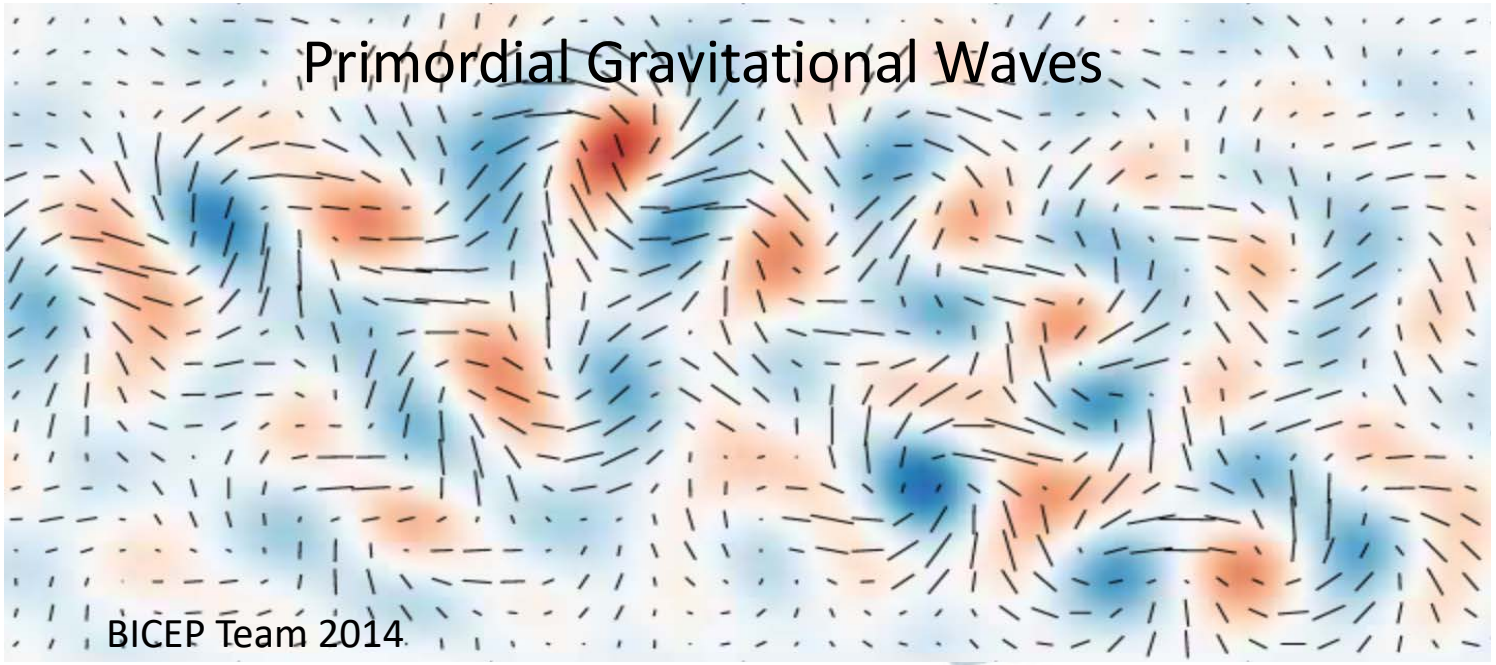


ESA/Planck Collaboration; NASA/DOE/Fermi LAT



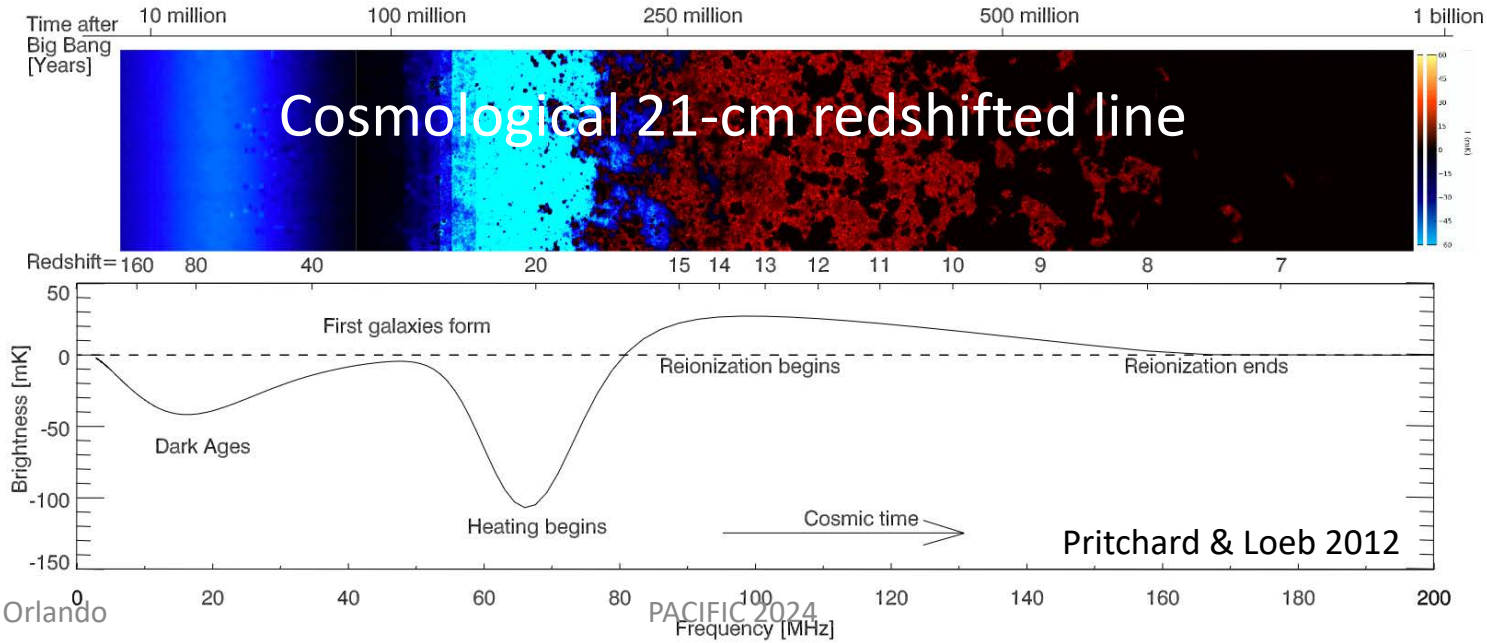
eRosita team 2020, 0.6-1.0 keV

Primordial Gravitational Waves



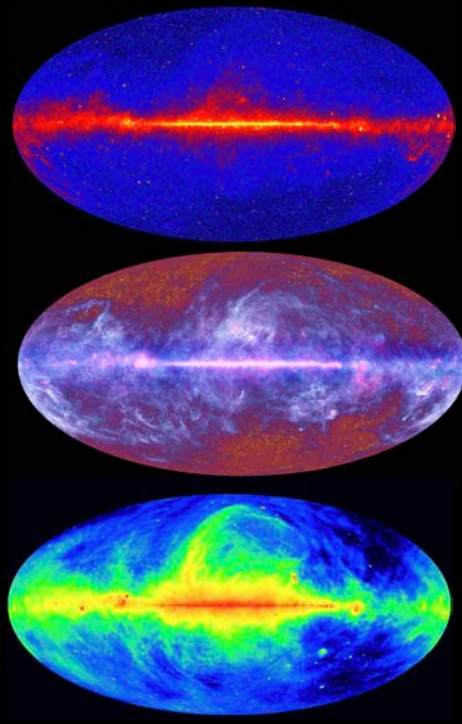
BICEP Team 2014

Cosmological 21-cm redshifted line



Pritchard & Loeb 2012

The Galactic Non-Thermal Diffuse Emission

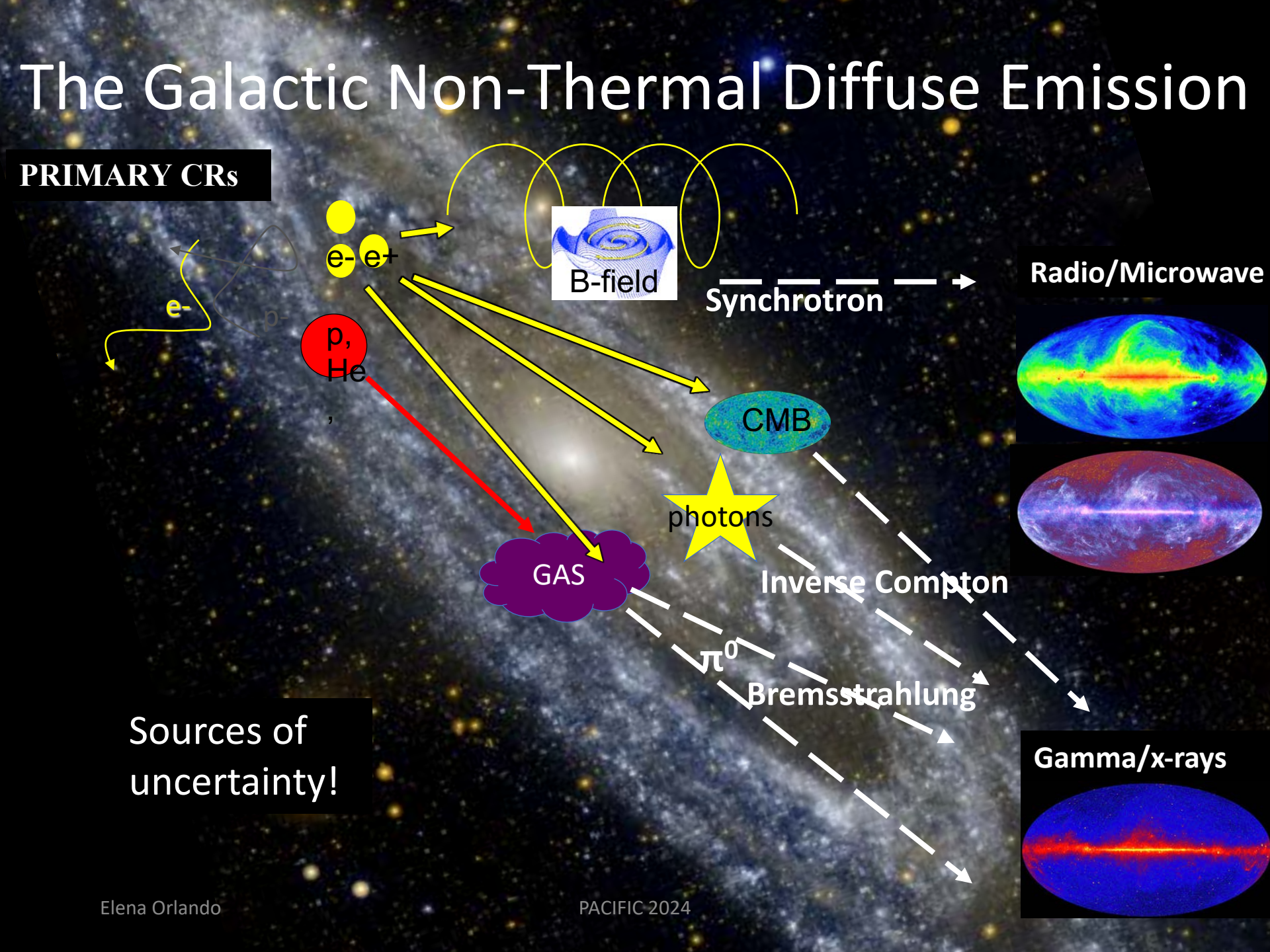


Cosmic-Ray (CR) Propagation

CR

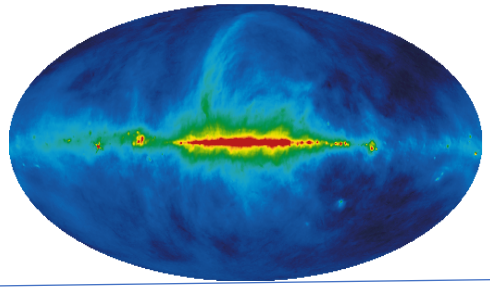
Earth

The Galactic Non-Thermal Diffuse Emission



Sources of uncertainty!

Our Multimessenger Approach for Diffuse Emission, CR, and B-Field



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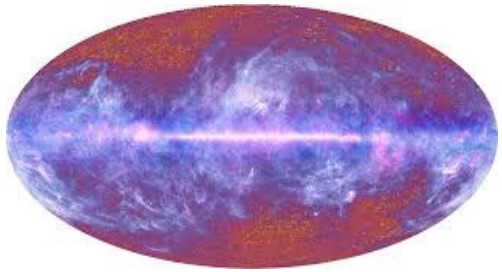

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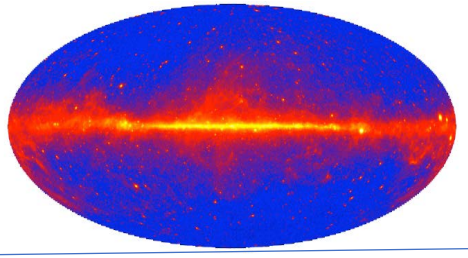

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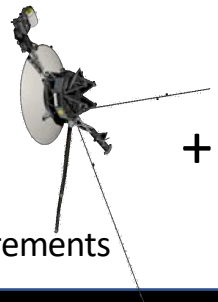

Cosmic Rays Measurements

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Modeling

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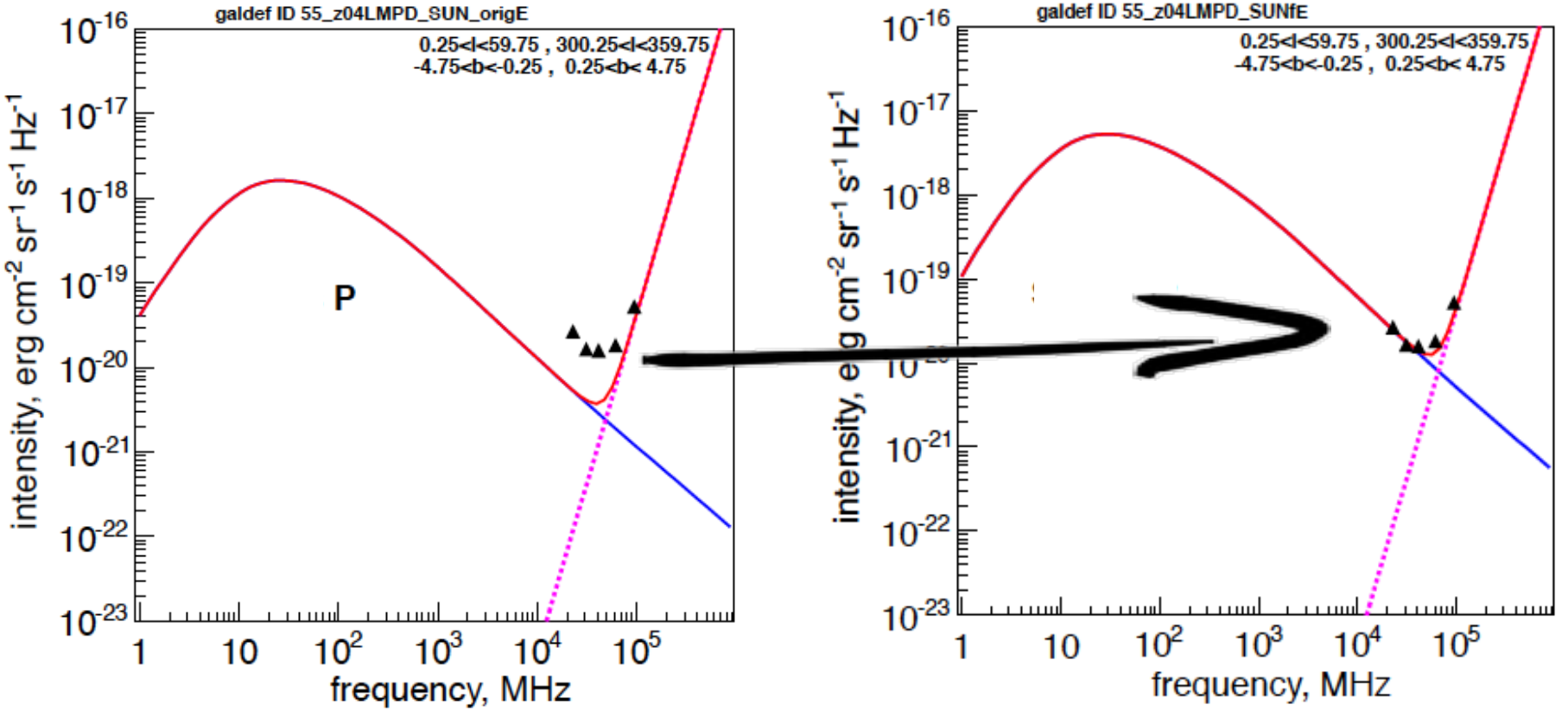
Indipendent observations of B-field and ISM

A selection of the most significant results with this approach

R1: Evidence of Anisotropic Component of the Galactic B-field

Orlando & Strong (2013)

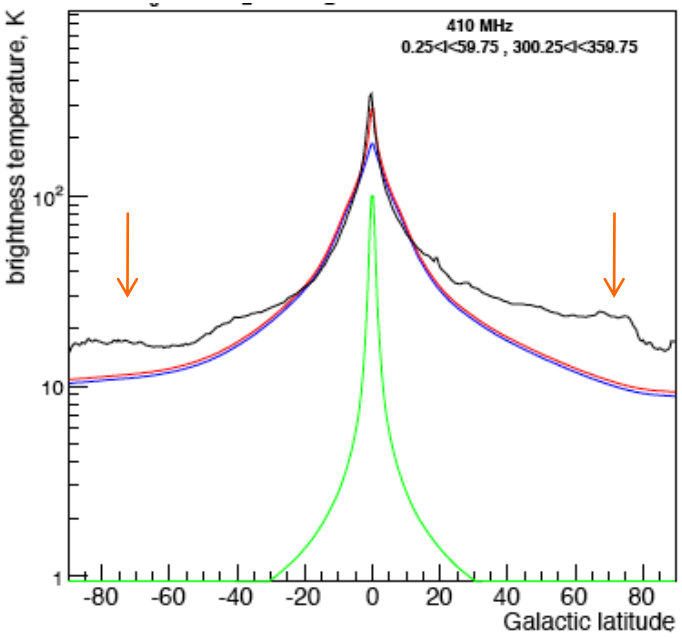


*The best synchrotron spectral model was used for generating the Planck component maps officially released by the Planck Consortium

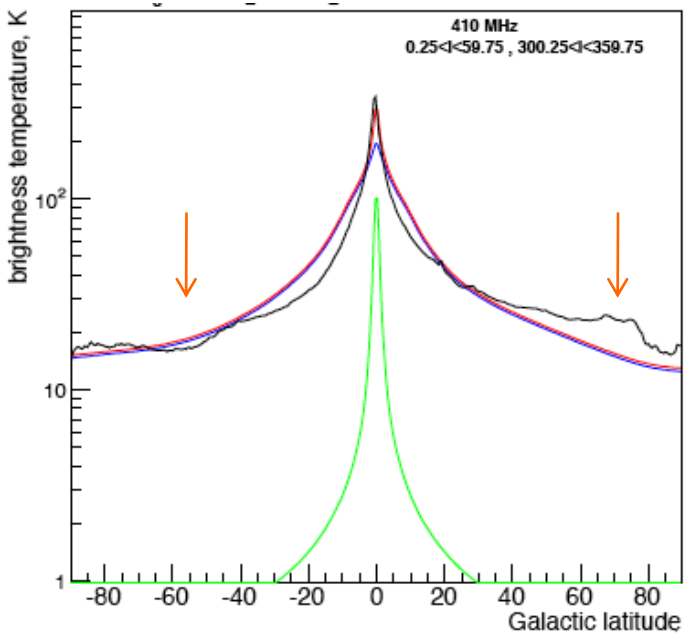
R2: Large Halo or Something Else?

Orlando & Strong (2013)

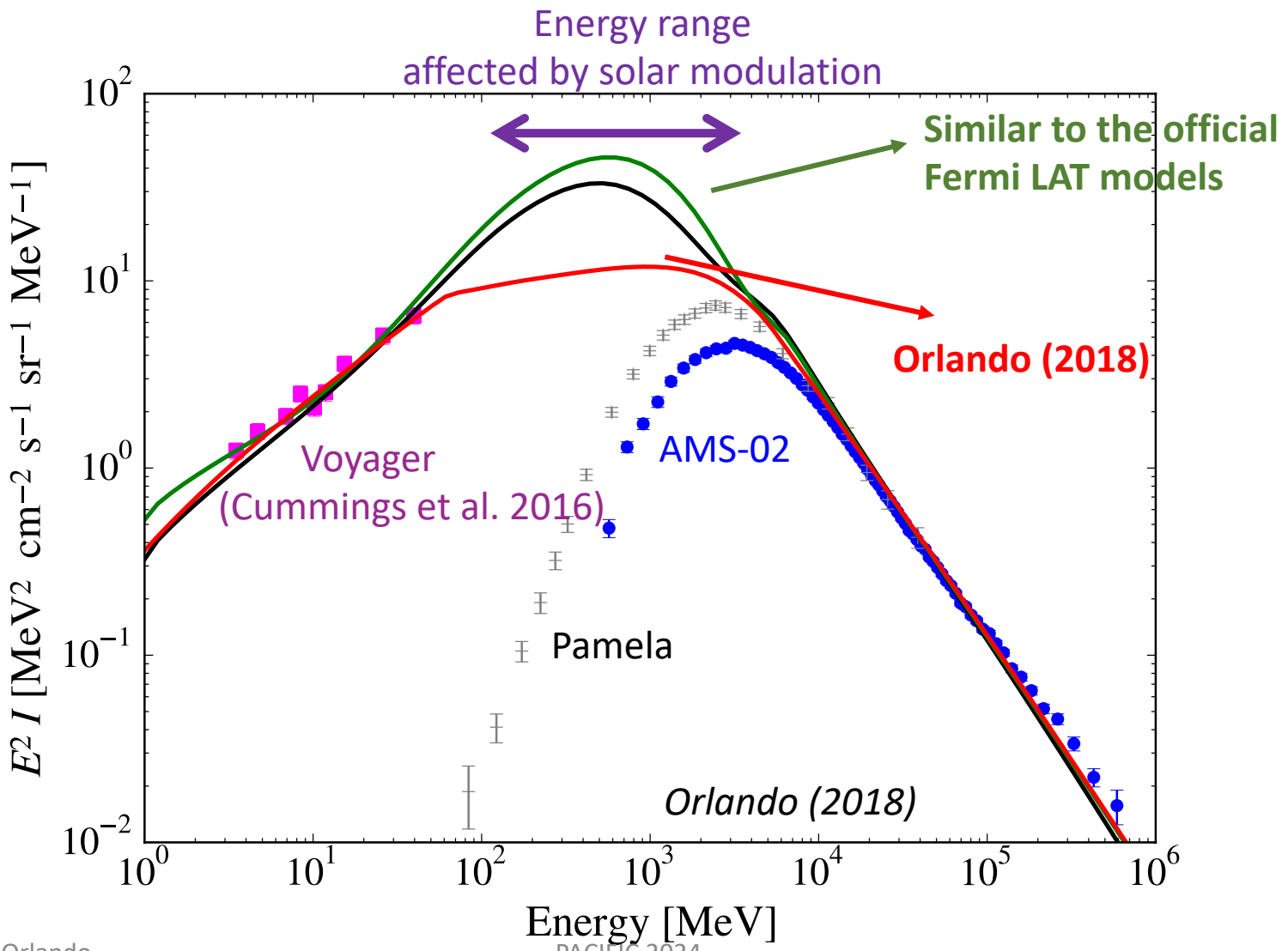
z = 4 kpc



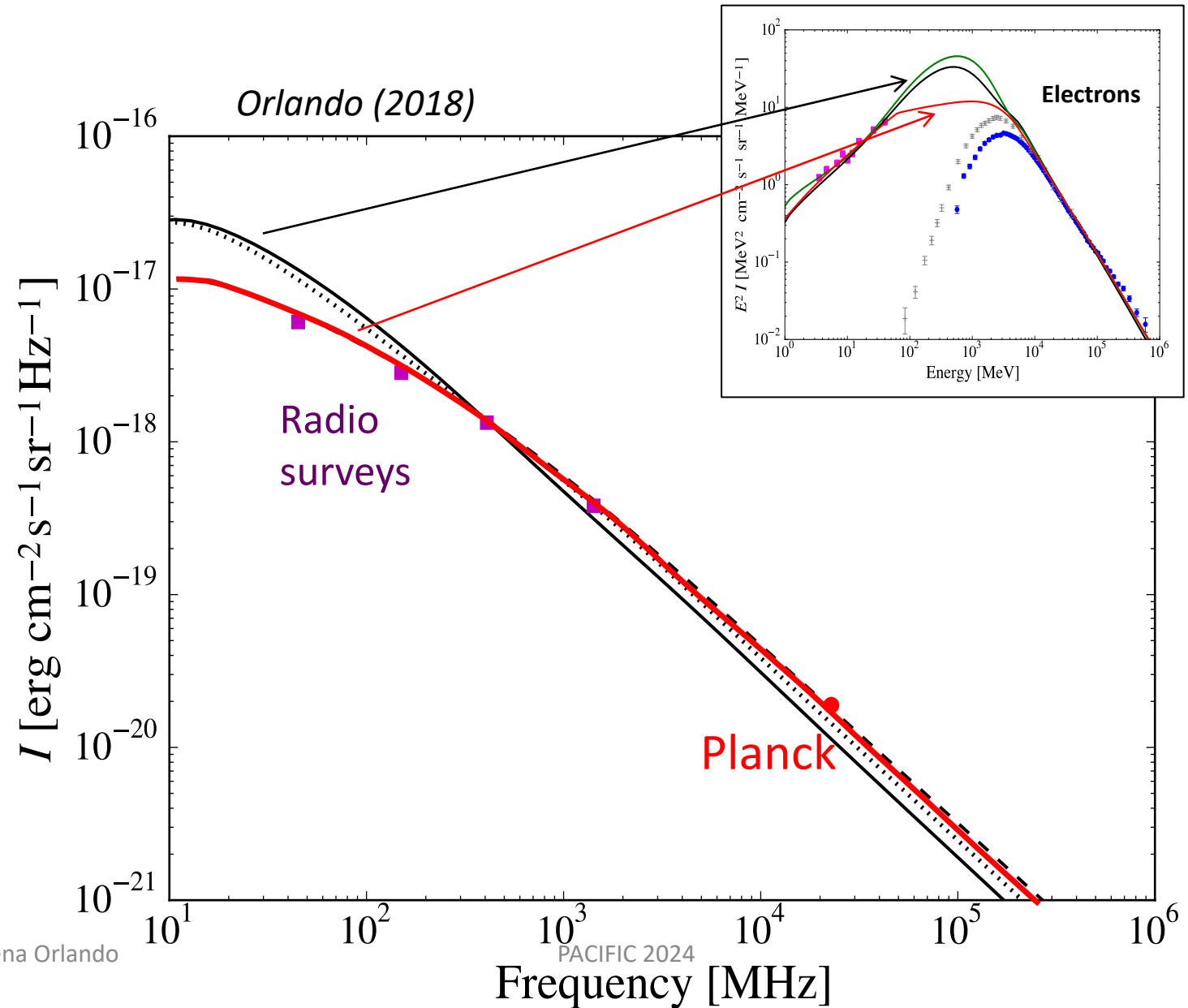
z = 10 kpc



R3: Interstellar **Electrons**

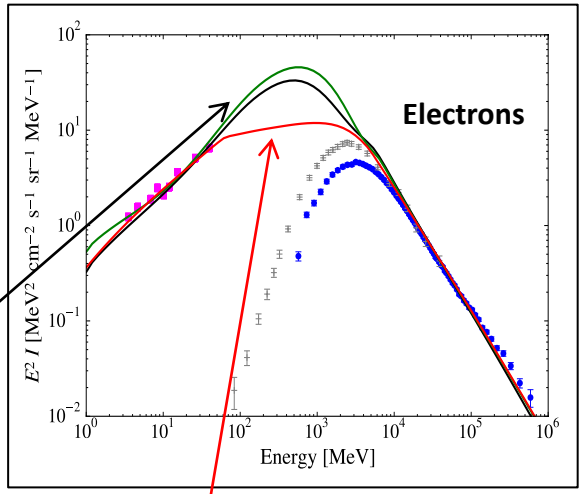


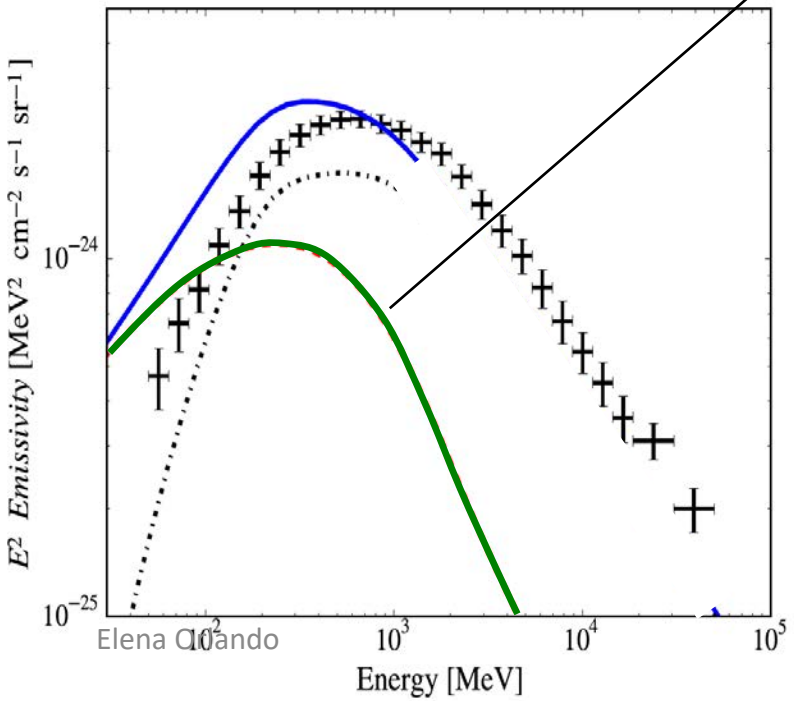
R3: Interstellar **Electrons** from Synchrotron Data

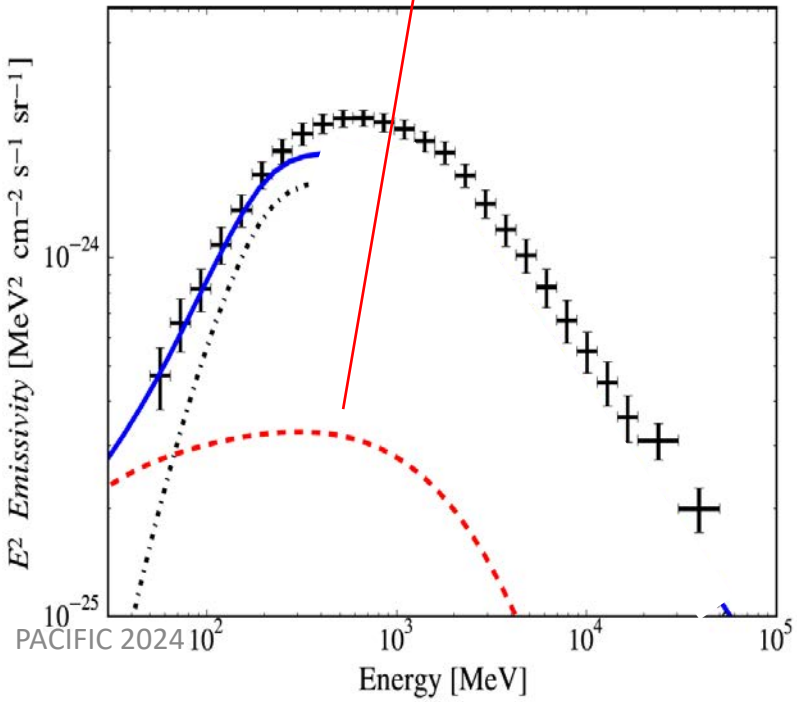


R3: Interstellar **Electrons** from Gamma-Ray Data

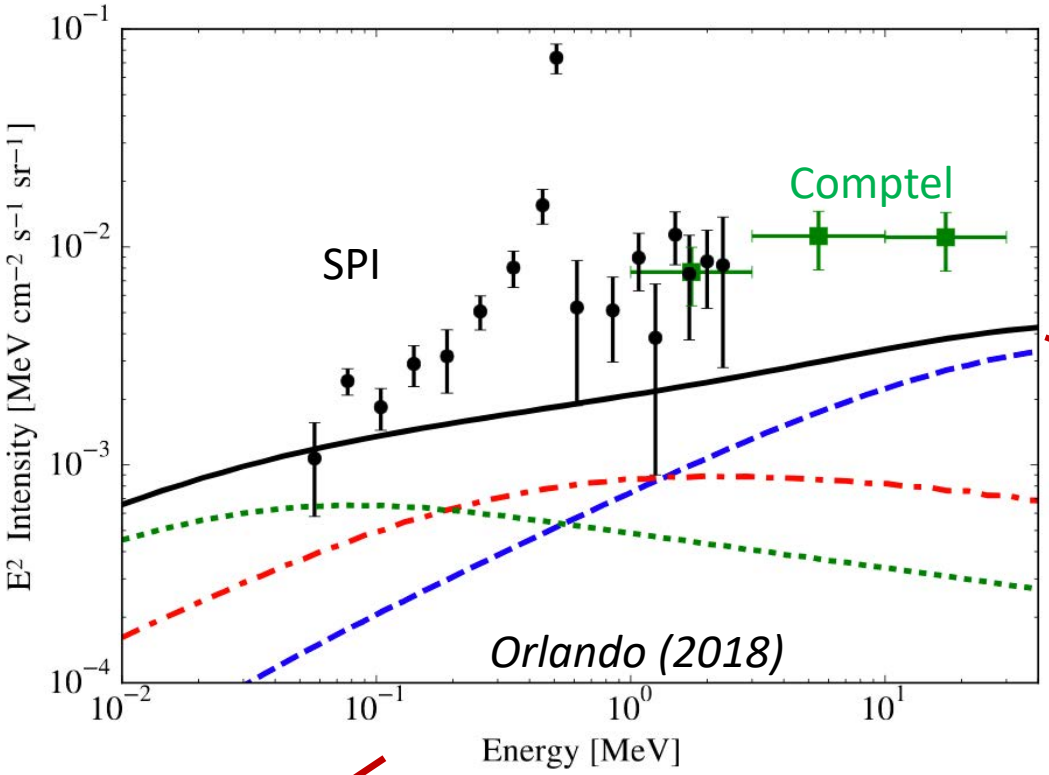
Orlando (2018)





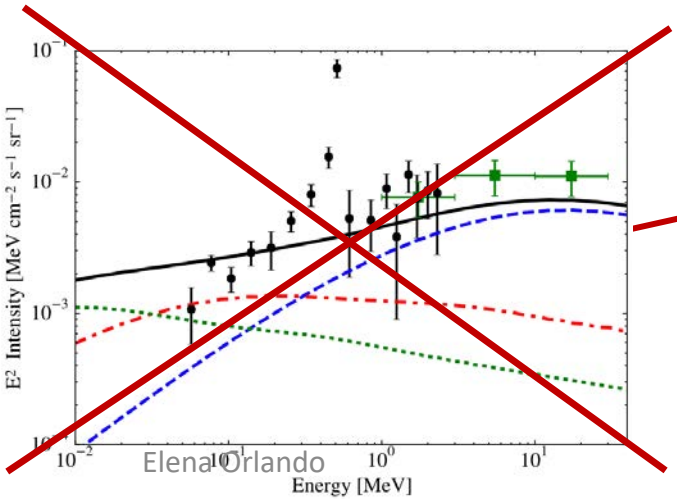


R4: The MeV Excess



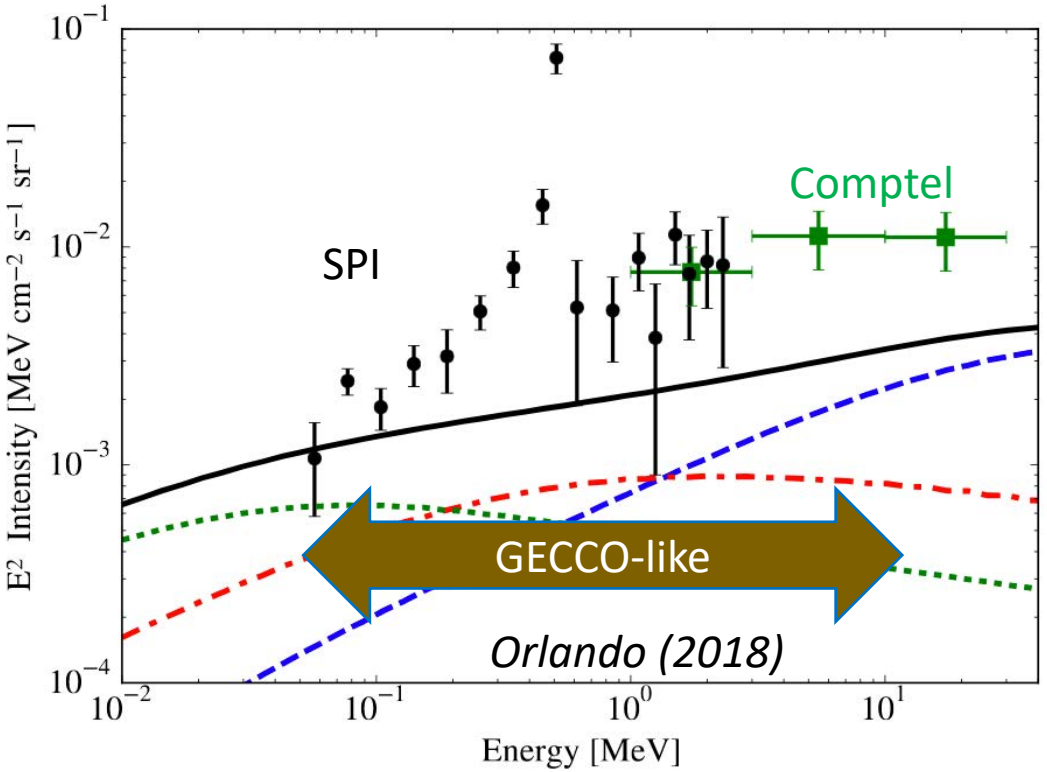
SPI data of the diffuse from *Bouchet et al., ApJ. 2011, 739,29*

OK with Fermi and radio data!



It would overproduce Fermi and radio data!

R4: The MeV Excess



Coded Aperture Mask

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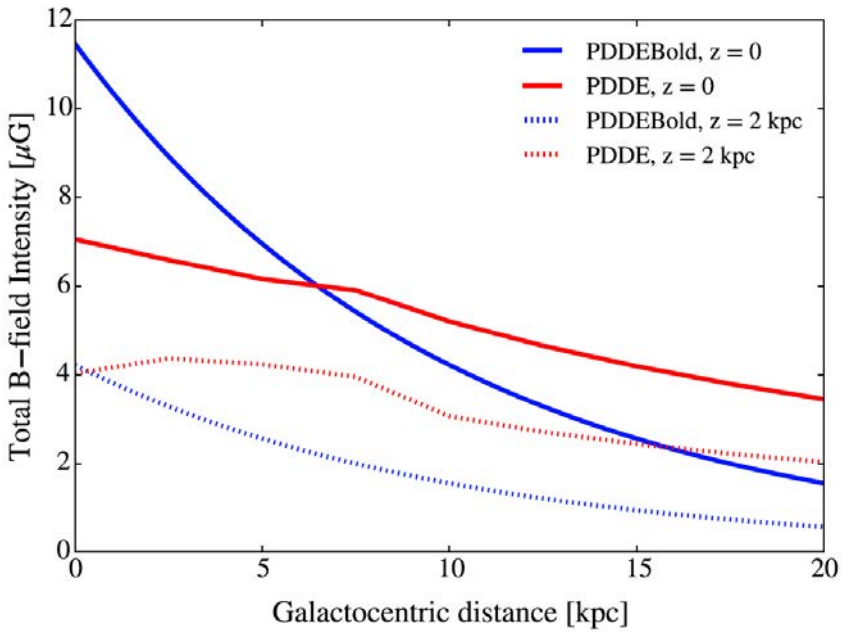
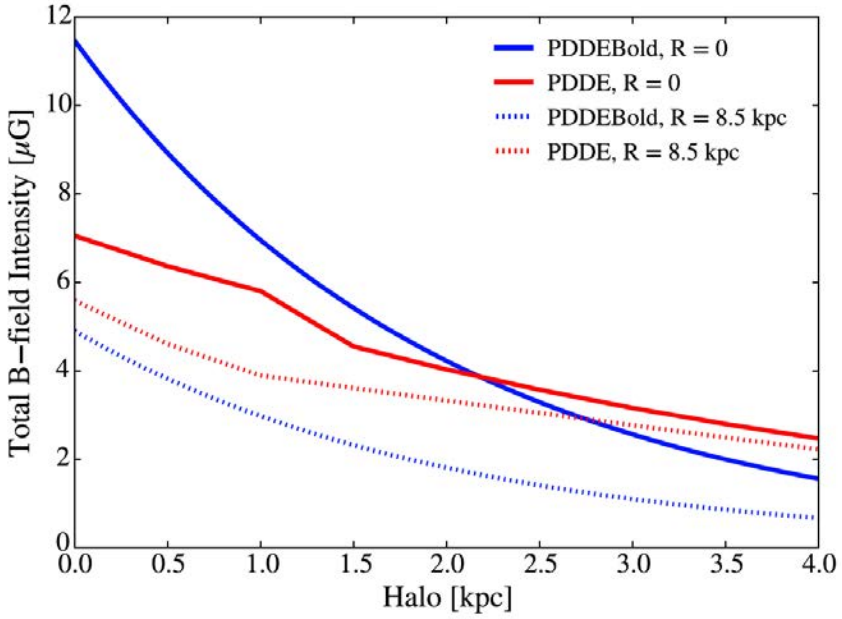
Compton Telescope

Orlando, Bottacini, Moiseev et al. (2022) JCAP 7, 36
Intrument PI: Alex Moiseev
Deputy PI: Eugenio Bottacini

See Eugenio's talk this conference

R5: Total B-Field Intensity

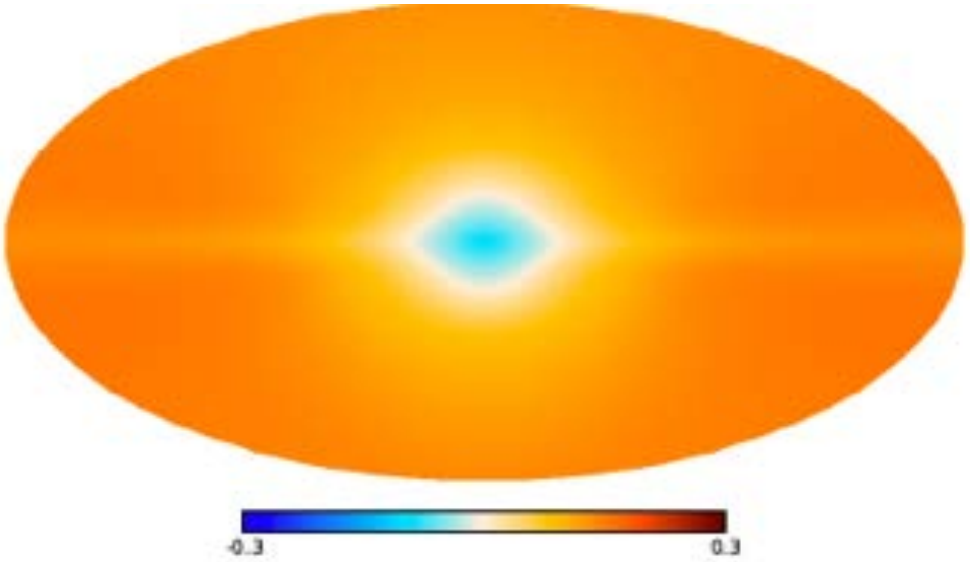




Orlando (2019)

R6: More Gammas Prediction in the Inner Galaxy

Model
@10 GeV



~ 60%
difference

Orlando (2019)

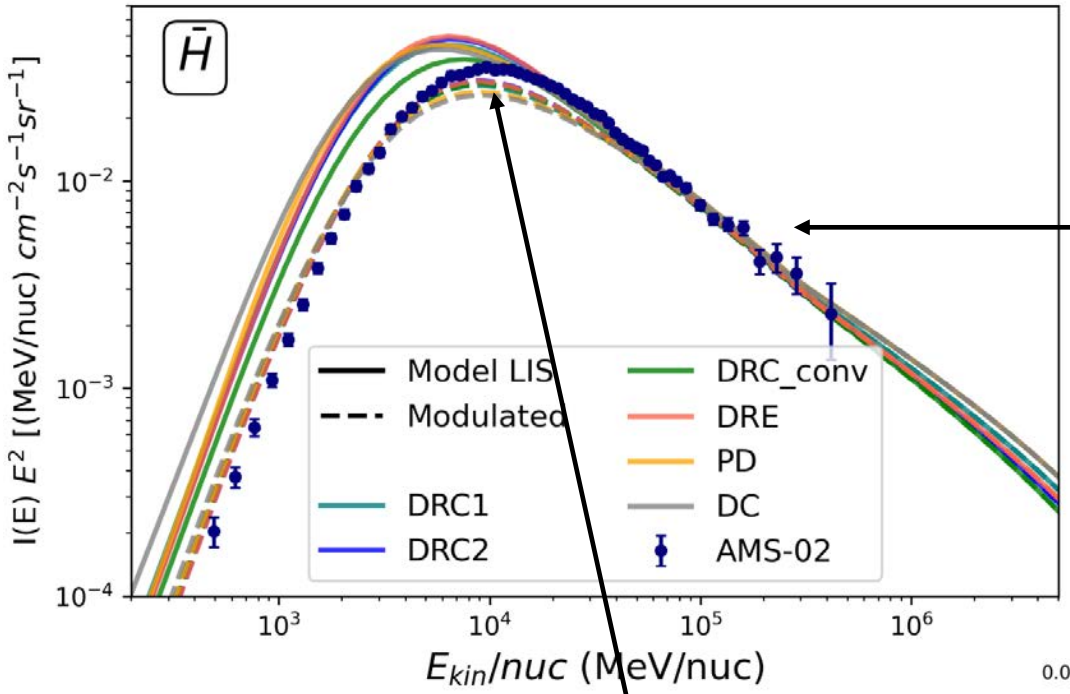
Updated B-fields produce a more peaked IC in the inner Galaxy than predicted by standard models and the difference increases with energy

R7: Revision of CR - Propagation

A simple propagation model works as well more complex ones

Silver & Orlando (2024)

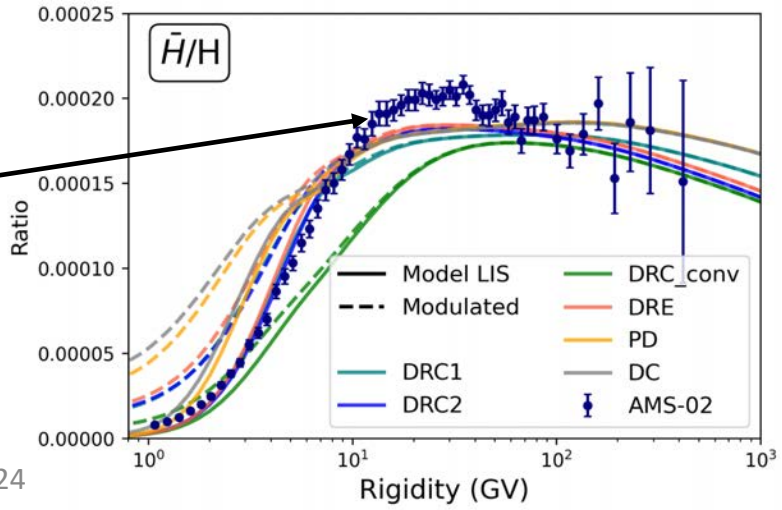
R7: Revision of CR - Antiprotons



no need of a new source > 40 GeV

Silver & Orlando 2024

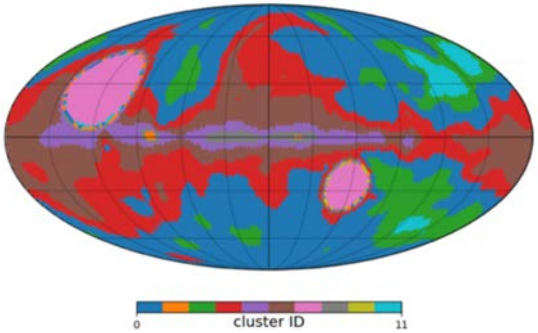
confirm the ~10 GV excess for all scenarios



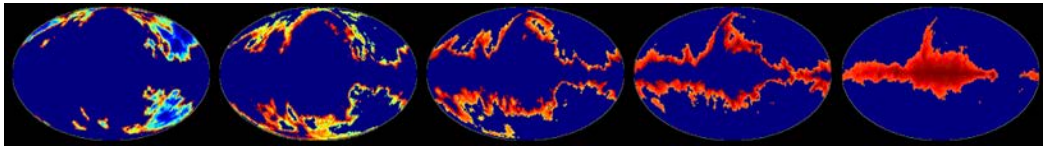
Ongoing projects

1) Identification of spatial structures in intensity, residual, and spectral maps and their correlation (with student Omar Tait)

Hierarchical Clustering (HCA) algorithm

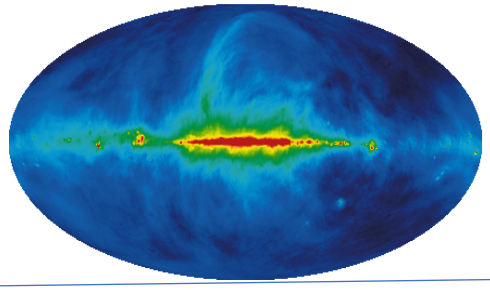


Bayesian Blocks



2) Machine Learning with CNN for Fermi source detection (with student Diana Horangic)

My Multimessenger Approach for Diffuse Emission, CR, and B-Field



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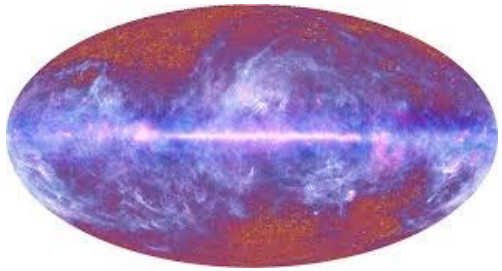

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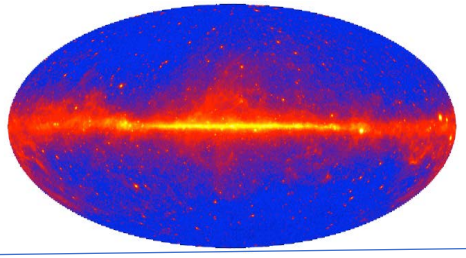

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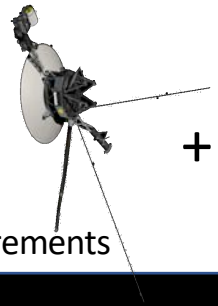

Cosmic Rays Measurements

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Modeling

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Indipendent observations of B-field and ISM

Thank you for your attention !