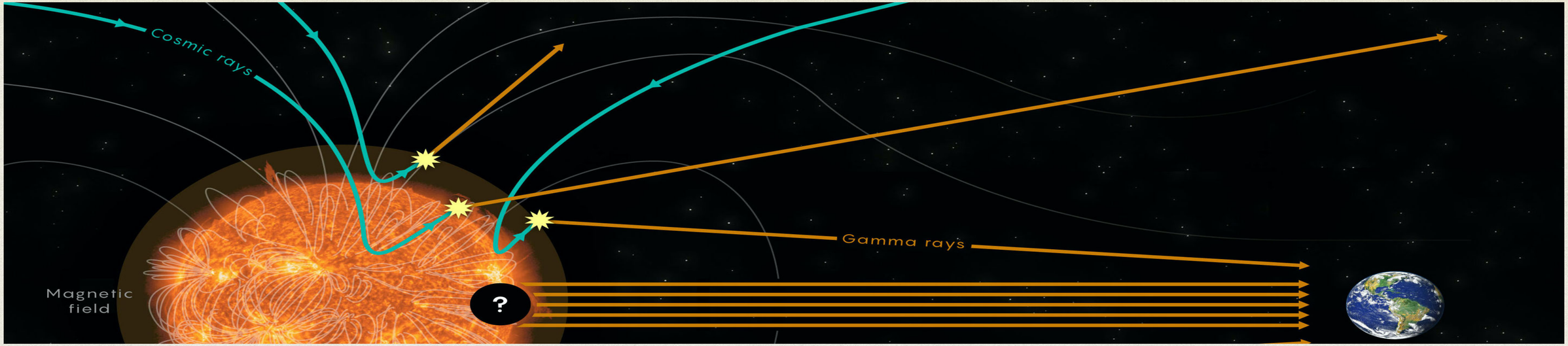



# Gamma-Ray Emission from the Solar Disk

[T. Linden et al., arXiv:2012.04654]

[G. Zhu et al., in prep]

Guanying Zhu

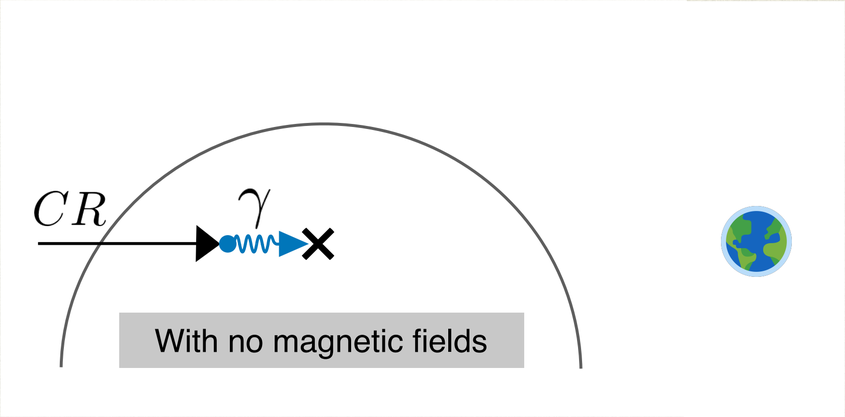
Collaborators: John Beacom, Tim Linden, Annika Peter

The Ohio State University

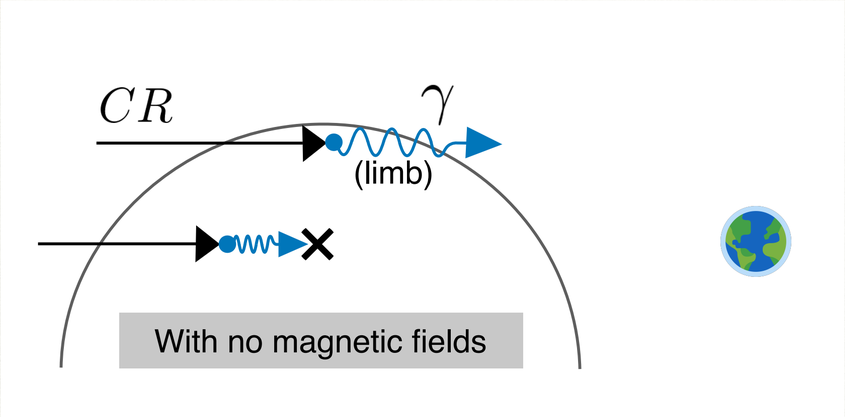
CCAPP

THE OHIO STATE UNIVERSITY

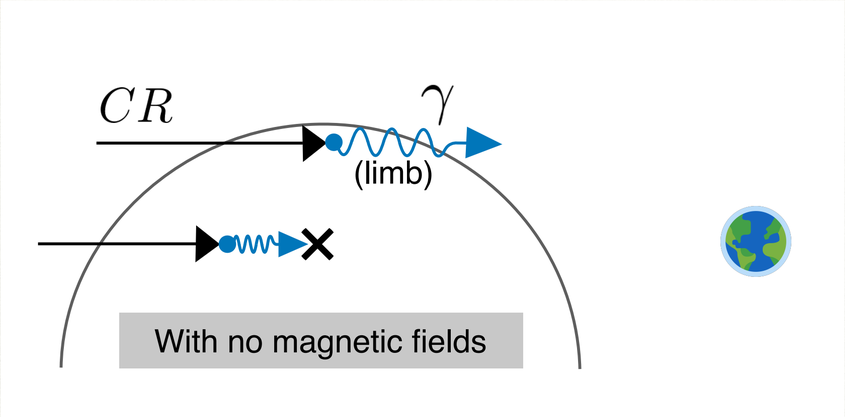
# Gamma-Ray Kinematics: With No Magnetic Fields

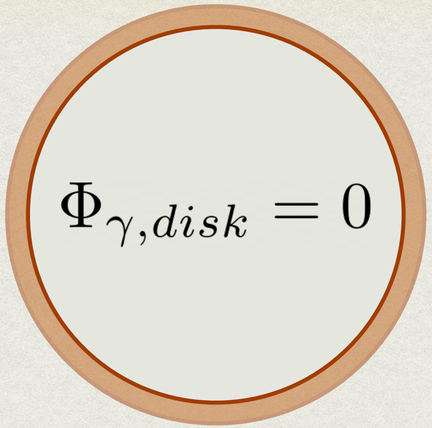


# Gamma-Ray Kinematics: With No Magnetic Fields

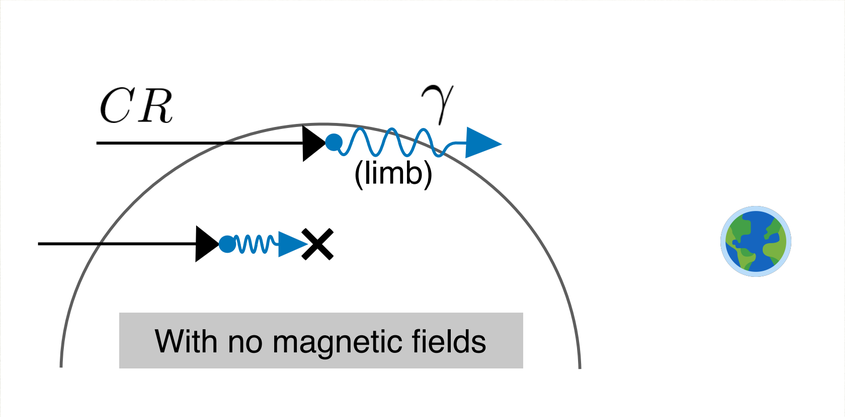


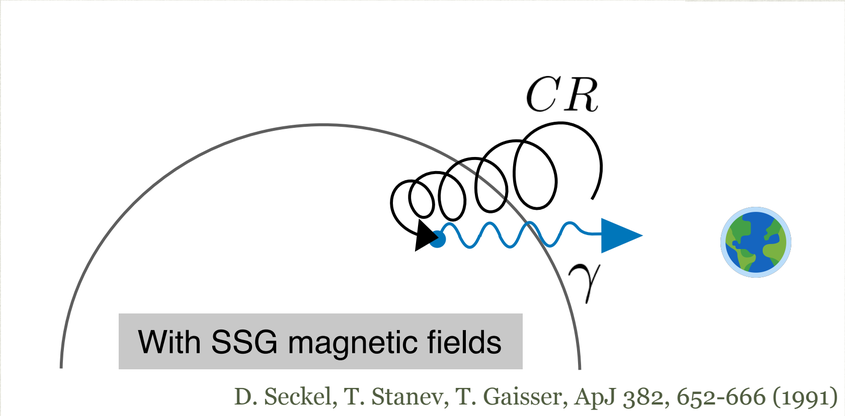
# Gamma-Ray Kinematics: With No Magnetic Fields



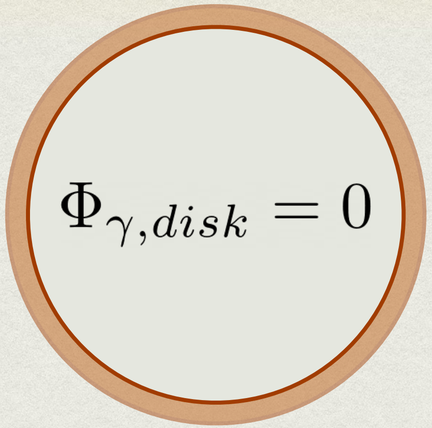



# Gamma-Ray Kinematics: With SSG Magnetic Fields

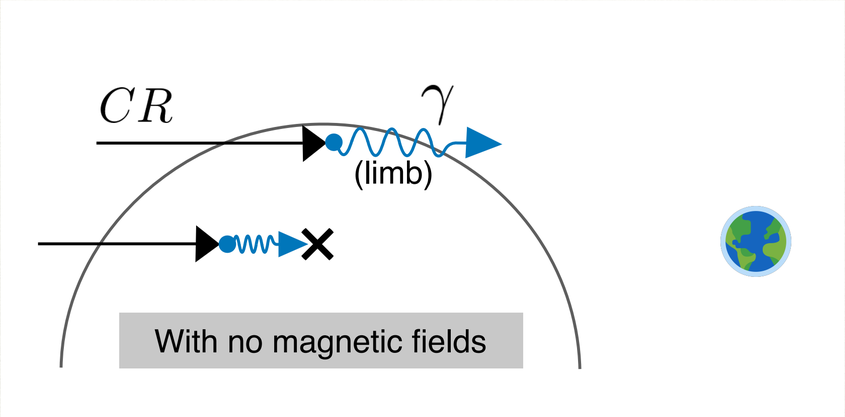


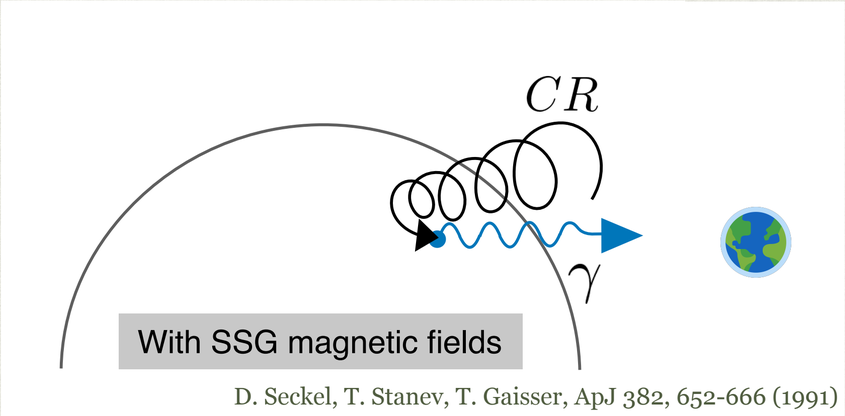




D. Seckel, T. Stanev, T. Gaisser, ApJ 382, 652-666 (1991)



# Gamma-Ray Kinematics: With SSG Magnetic Fields



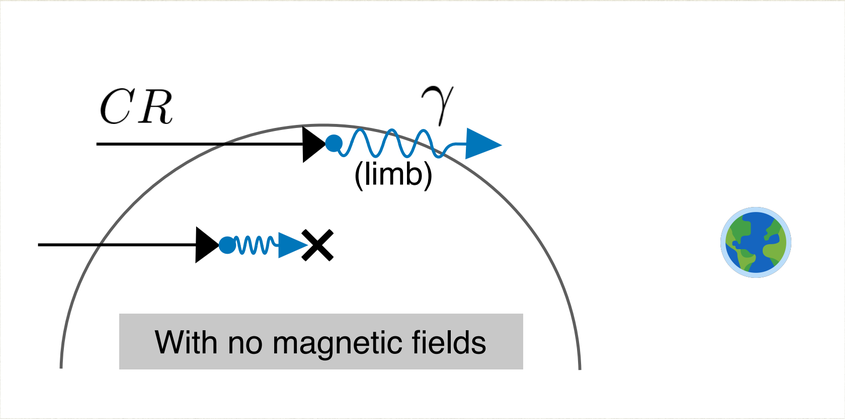



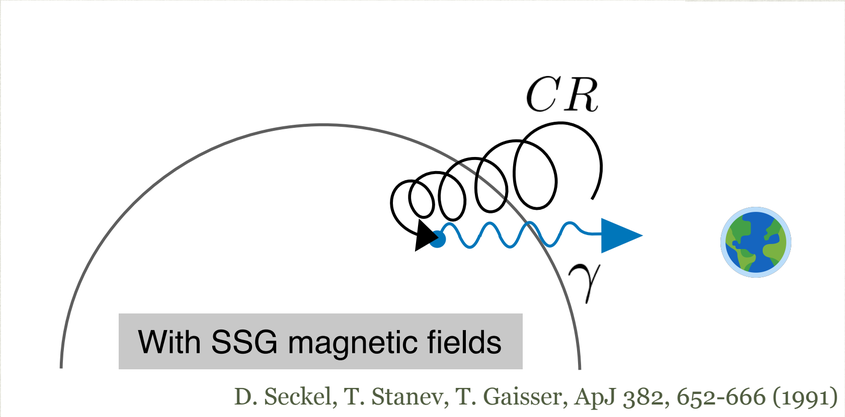

D. Seckel, T. Stanev, T. Gaisser, ApJ 382, 652-666 (1991)

$$\Phi_{\gamma,disk} = 0$$

Enhanced $\Phi_{\gamma,disk}$

# Gamma-Ray Kinematics: With SSG Magnetic Fields



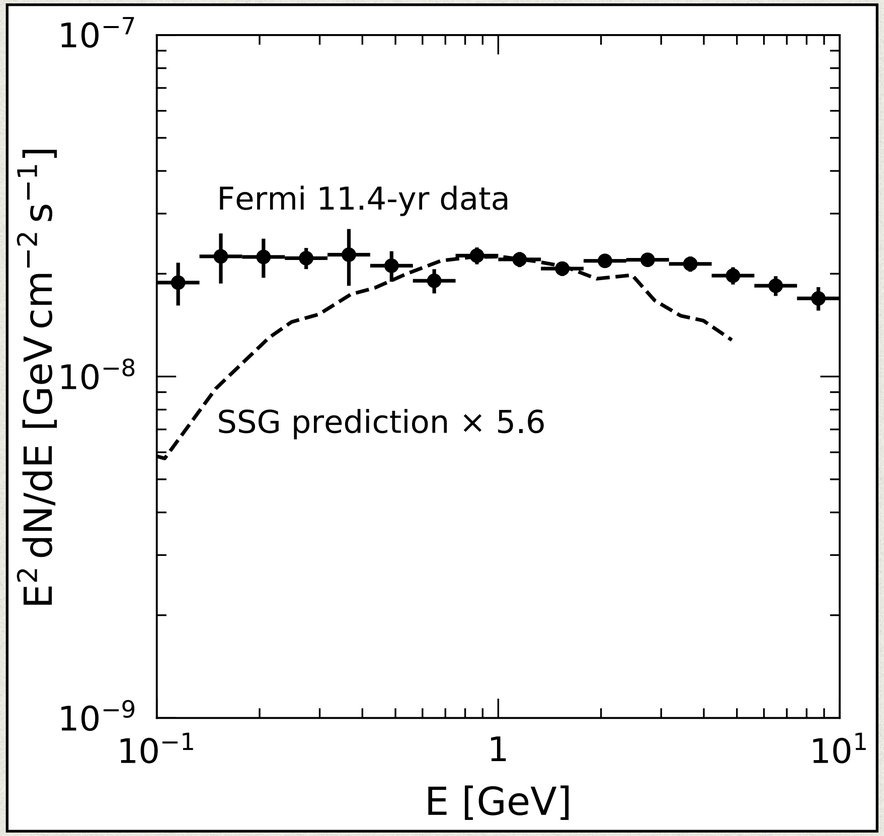

D. Seckel, T. Stanev, T. Gaisser, ApJ 382, 652-666 (1991)

$$\Phi_{\gamma,disk} = 0$$

Enhanced $\Phi_{\gamma,disk}$

Probe: (1) solar modulation on CRs, (2) solar magnetic fields

# Solar-Disk Gamma-Ray Flux: Data vs. Theory



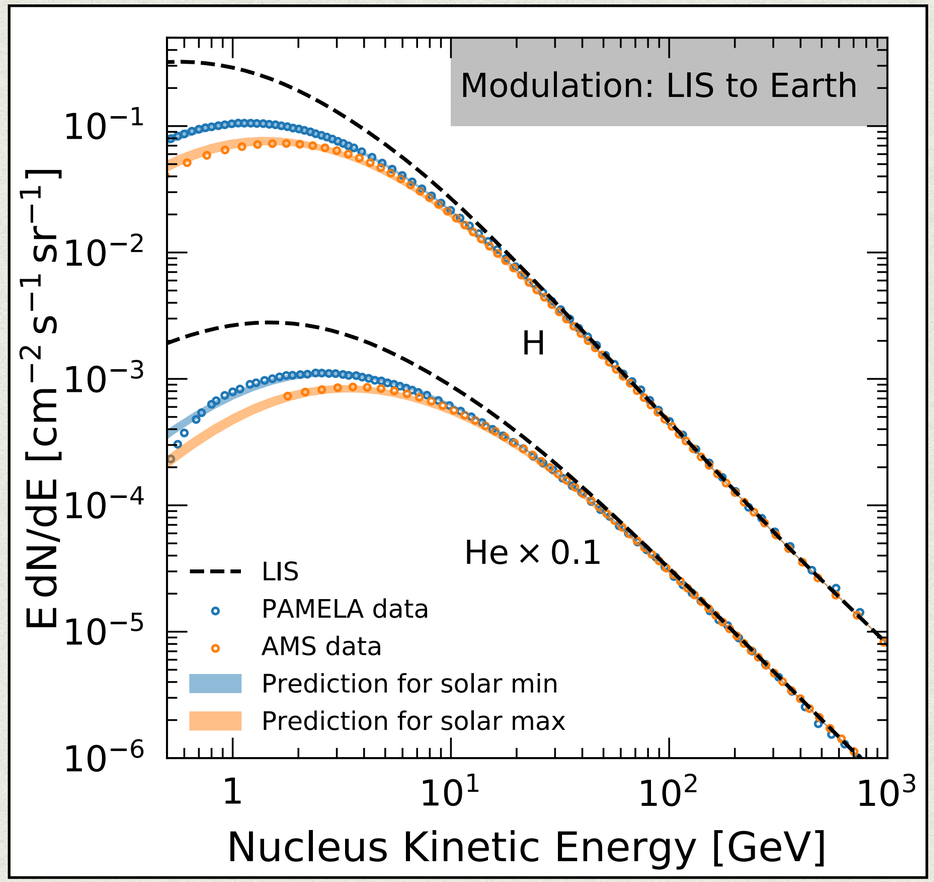

Data: T. Linden, J. Beacom, A. Peter and et al., arXiv:2012.04654

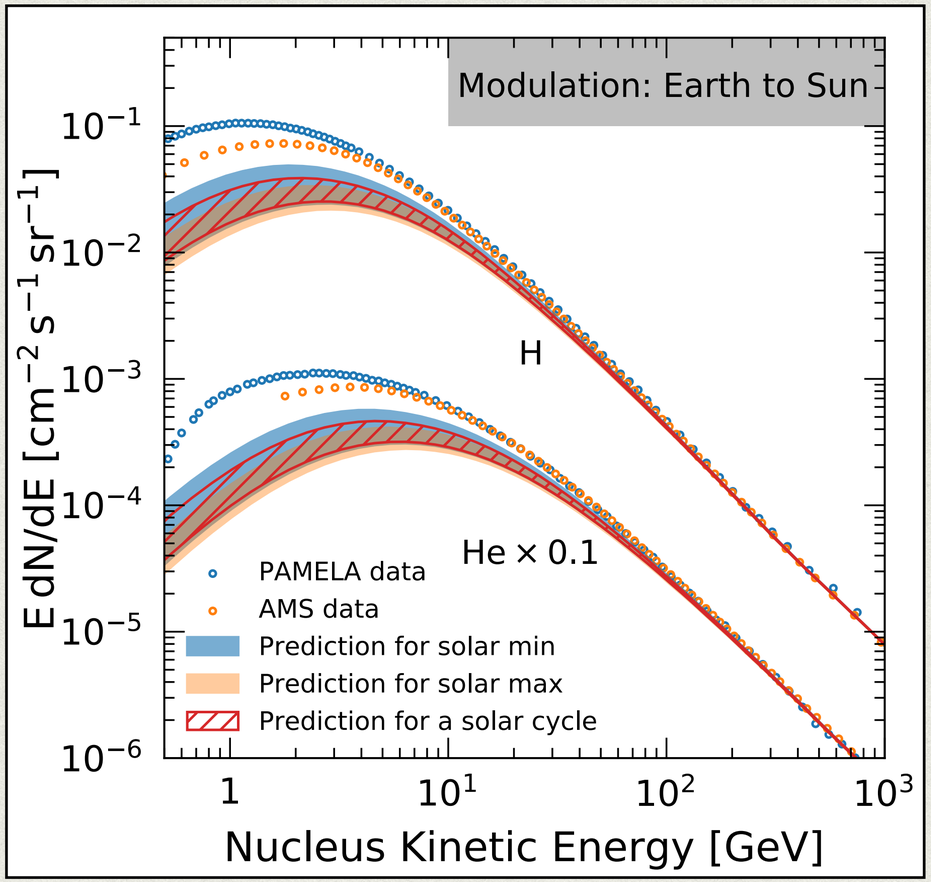
Theory: D. Seckel, T. Stanev, T. Gaisser, ApJ 382, 652-666 (1991)

Discrepancies exist in

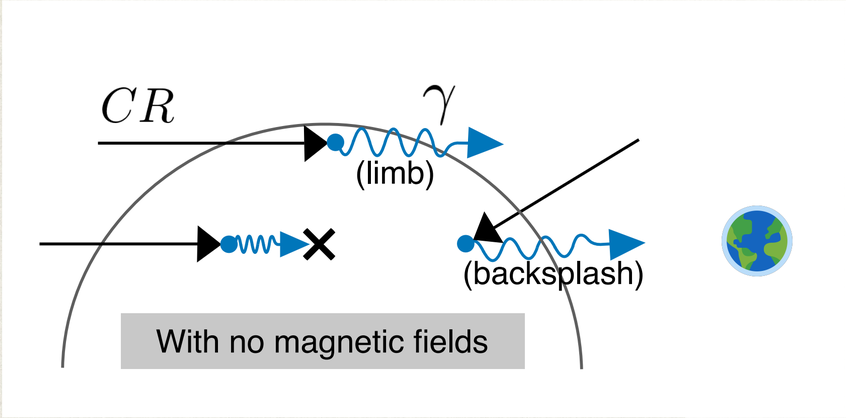
- Normalization
- Spectral shape

# Modulated CR Spectra (Force-Field Approximation)

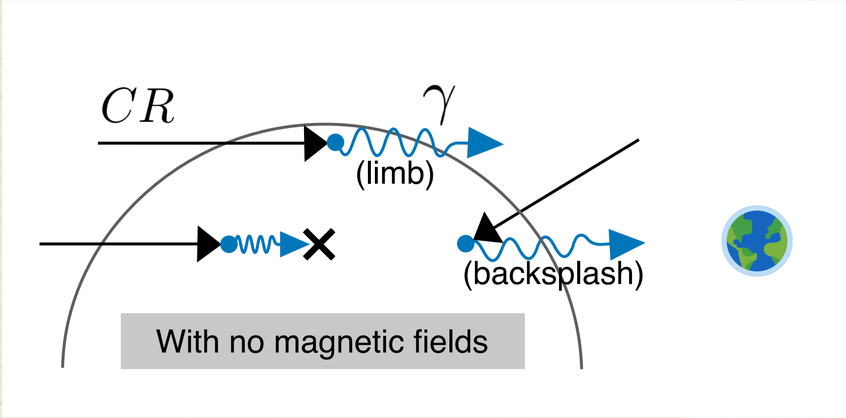


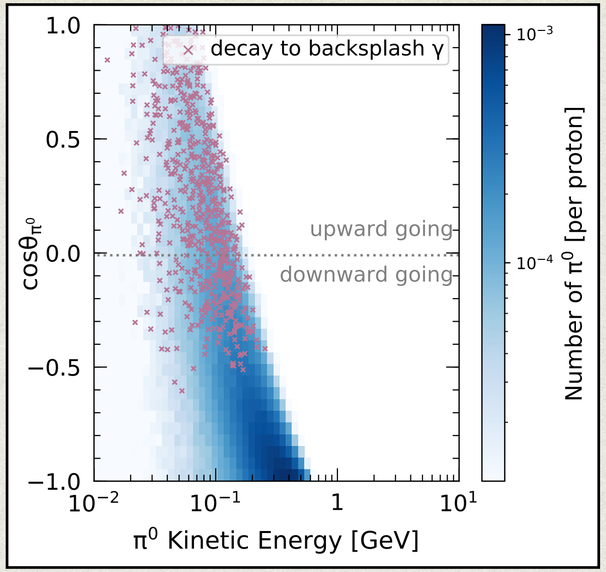



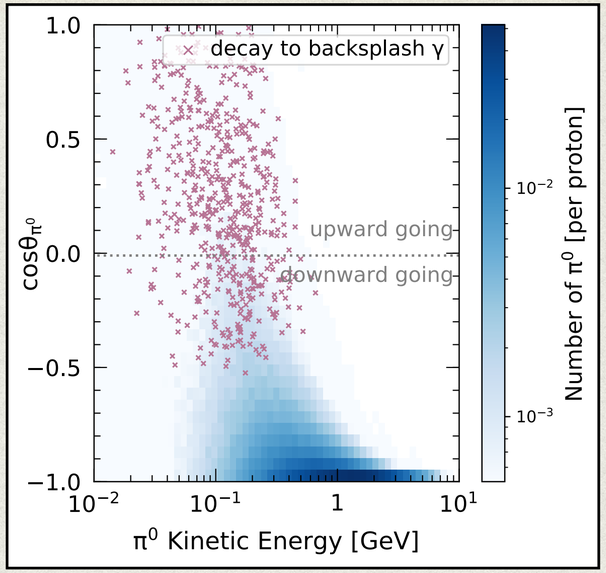
# Gamma-Ray Kinematics: With No Magnetic Fields



# Gamma-Ray Kinematics: With No Magnetic Fields

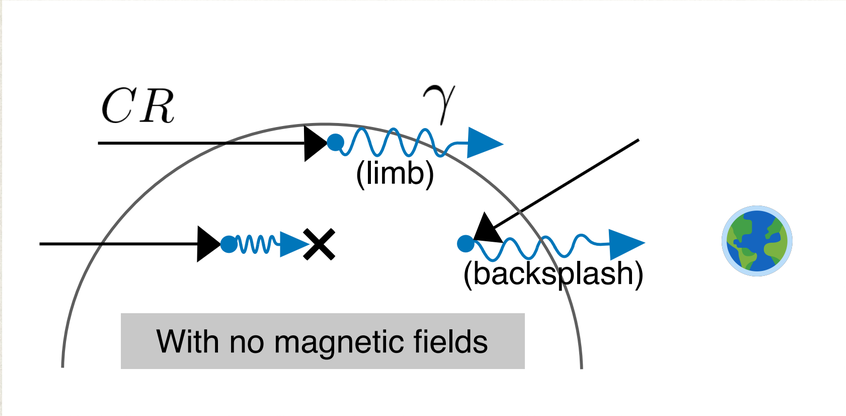


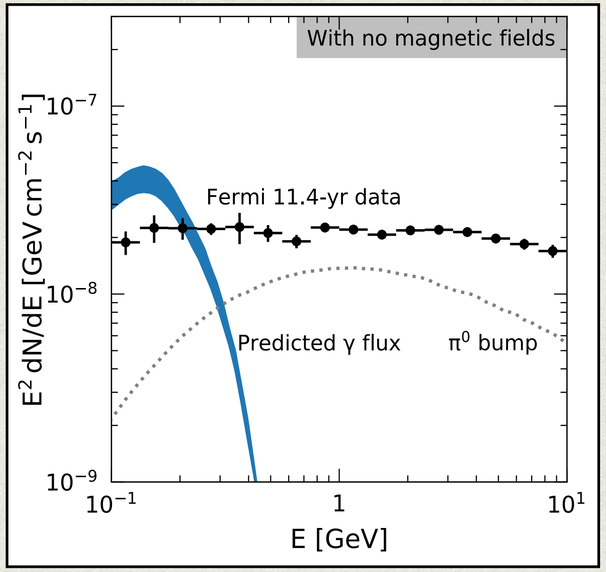



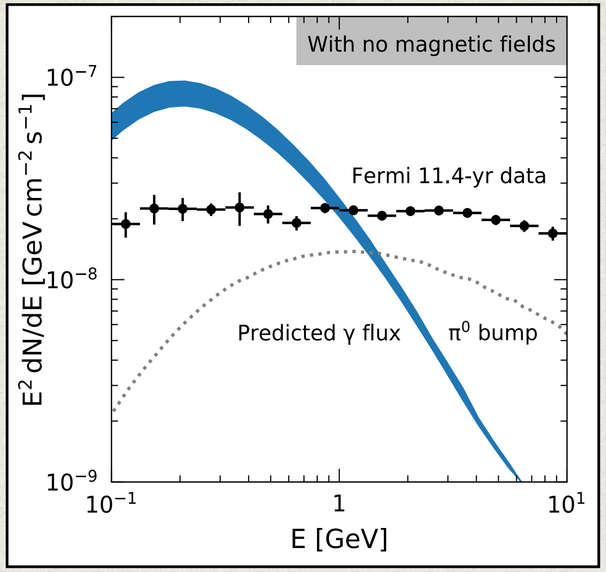



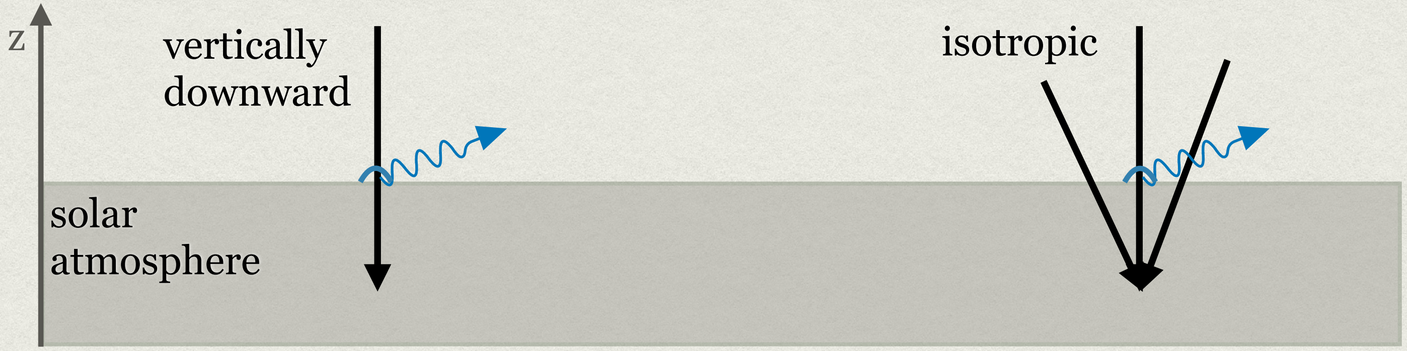

Backsplash Gamma-Rays

# Simulated Gamma-Ray Flux: With No Magnetic Fields



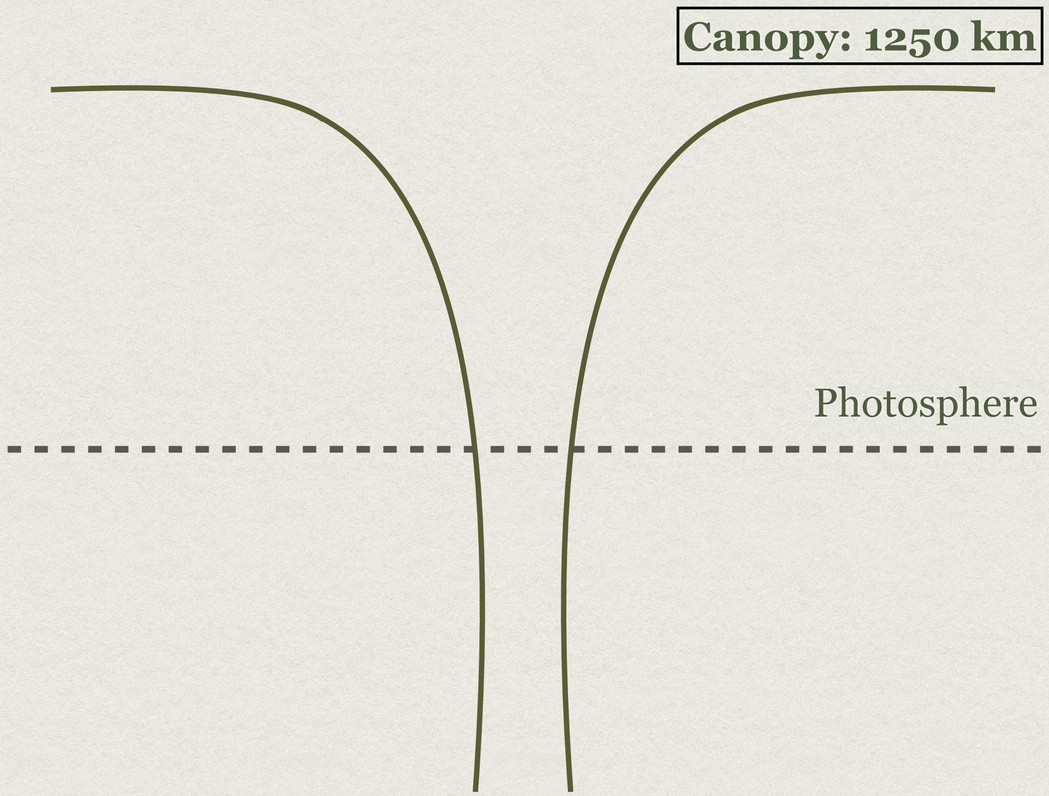



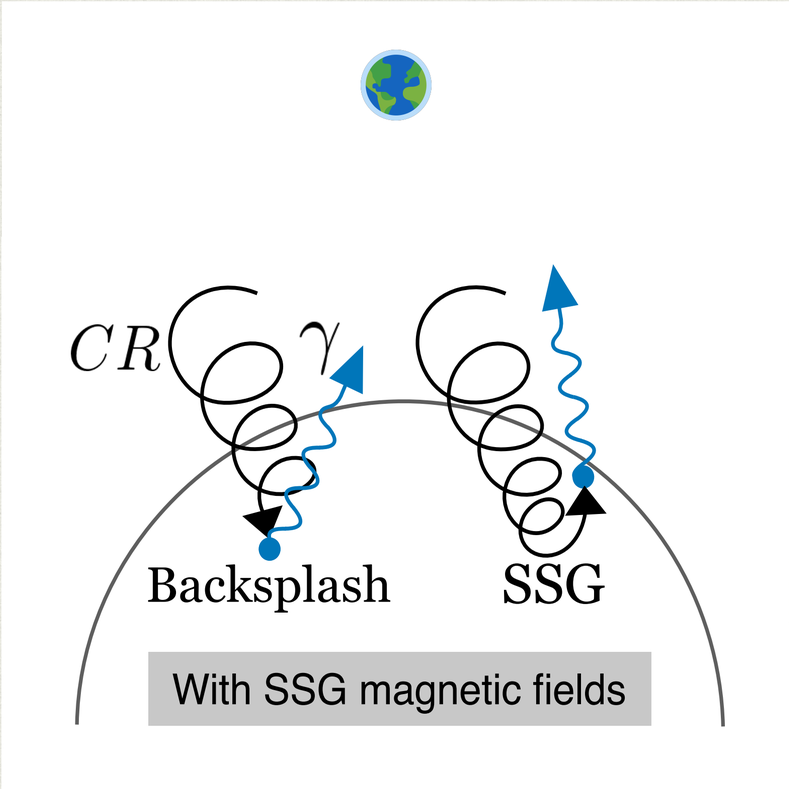



# Gamma-Ray Kinematics: With SSG Magnetic Fields

Magnetic Flux Tube

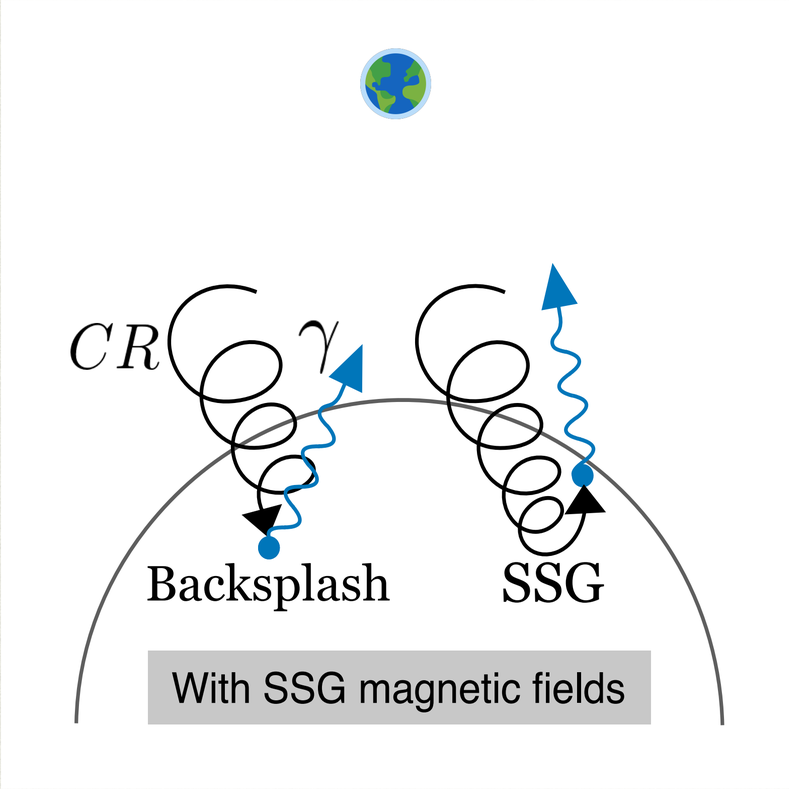



Magnetic Mirror

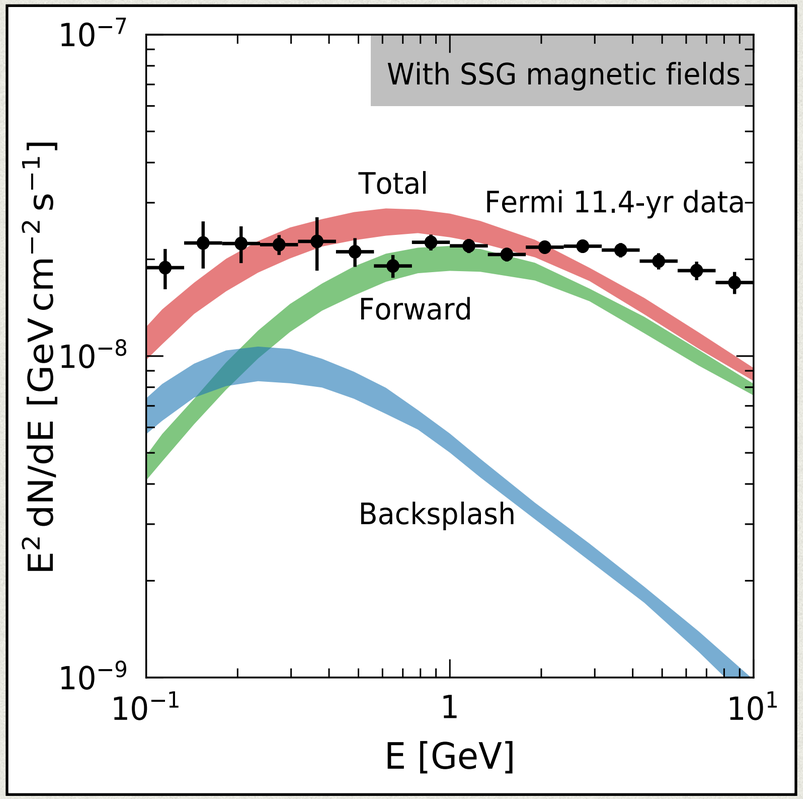


# Simulated Gamma-Ray Flux: Full Prediction

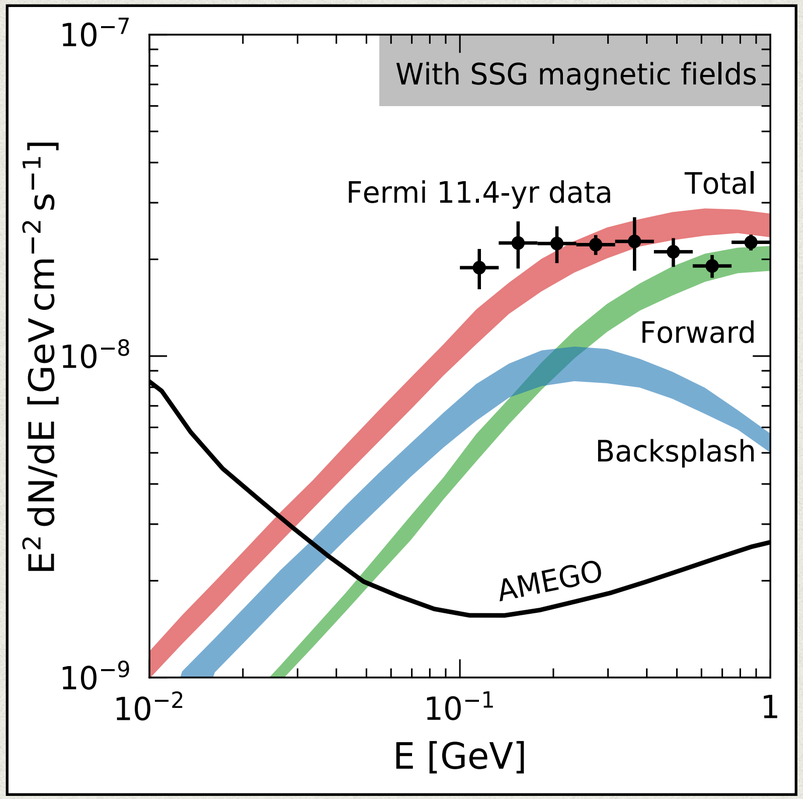
## Magnetic Mirror




## Canopy: 650 km



# Future Opportunity for AMEGO




AMEGO sensitivity: arXiv:1907.07558

- 0.1 — 1 GeV: Independent test on Fermi
- 0.01 —- 0.1 GeV: First observation

# Conclusions

- Solar gamma-ray: great probe of solar modulation & solar magnetic fields
- Fermi-LAT sub-GeV data can be well explained for the first time
- AMEGO can make unprecedented tests