The MeV Sky — A Wealth of Opportunity for High-energy Astrophysics and More

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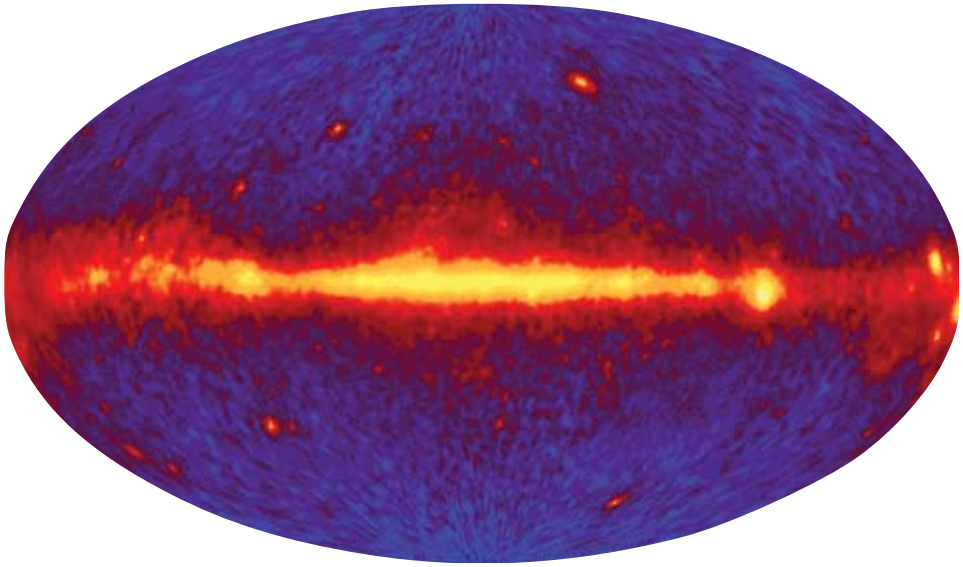
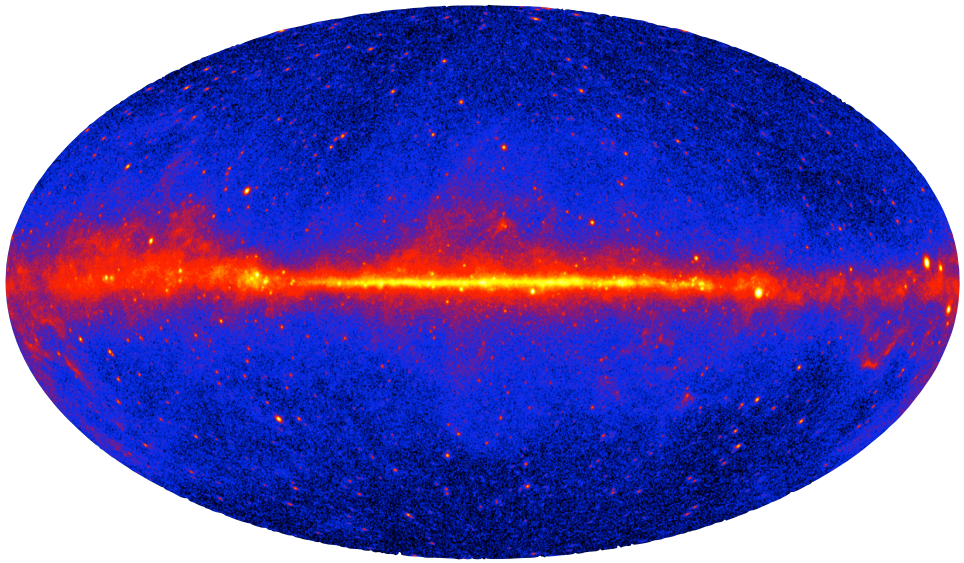
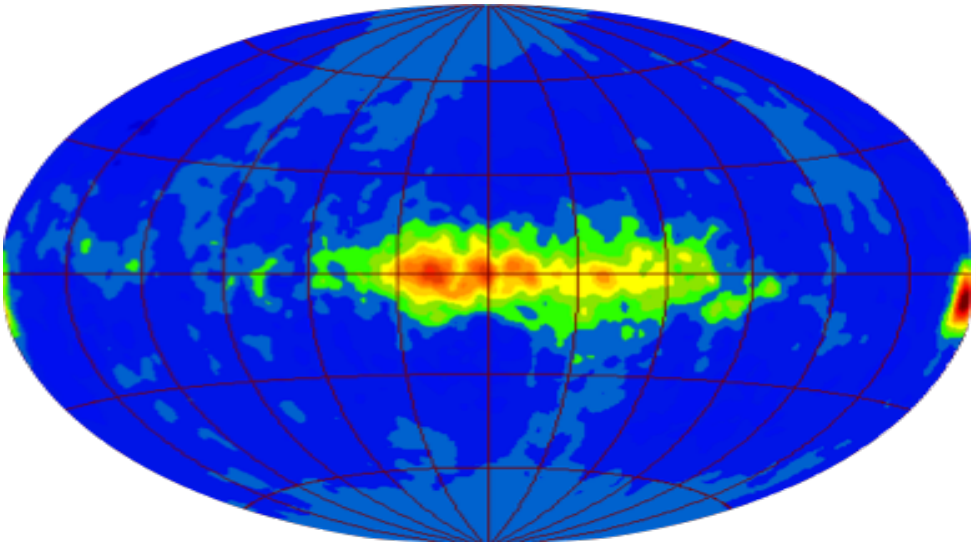
Why MeV?



EGRET All-sky Map



Fermi 5-yr Map



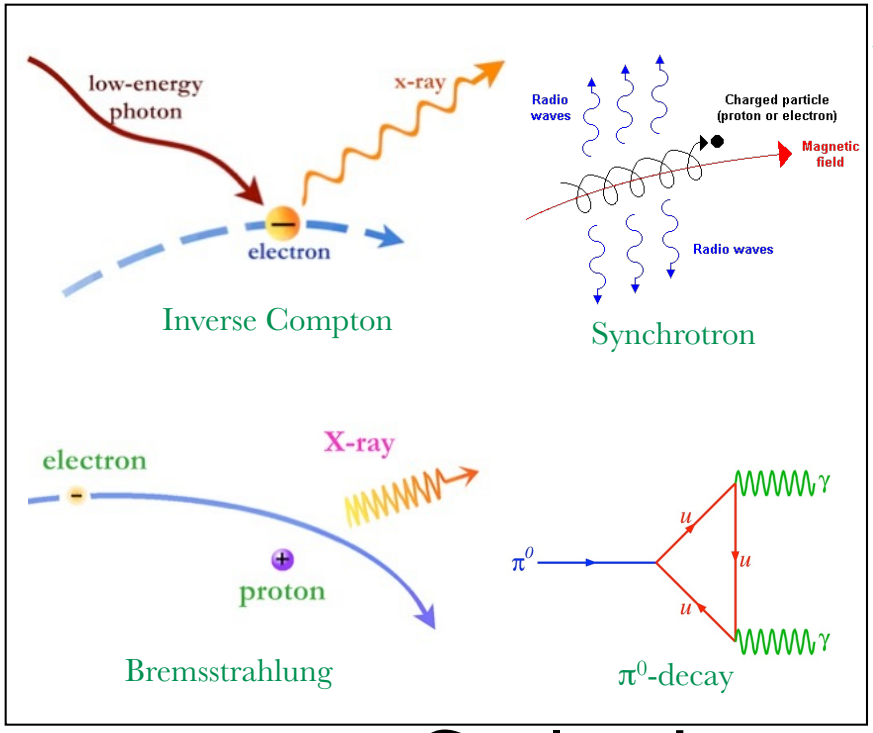
COMPTEL All-sky Map

???

Galactic Science

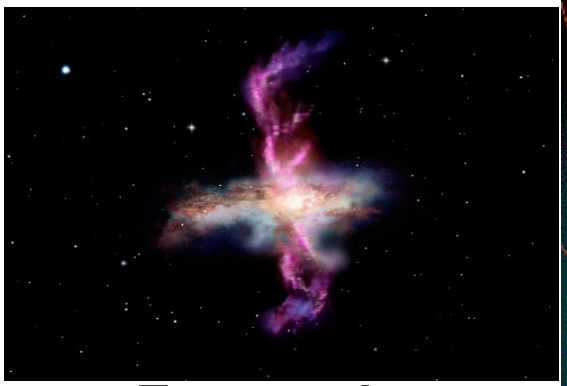
The Life of a Cosmic Ray

$$\frac{\partial N(E)}{\partial t} = D\nabla^2 N(E) + \frac{\partial}{\partial E}\left[b(E)N(E)\right] - \frac{N(E)}{\tau(E)} + Q(E)$$



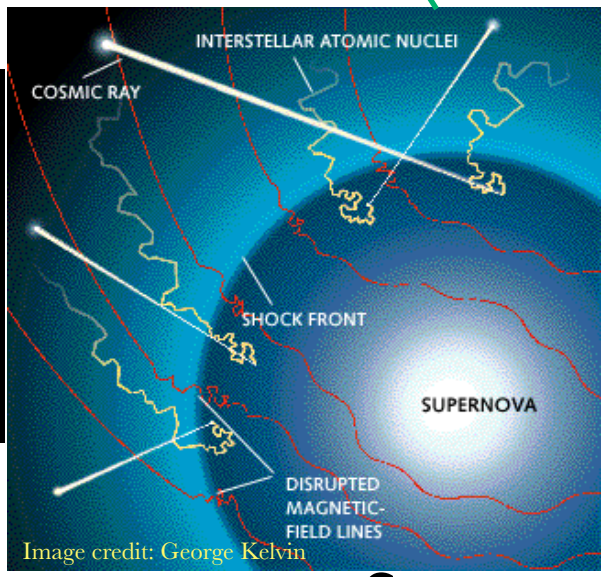
Cooling Losses

- Interstellar Medium
- Interstellar Radiation Field
- Magnetic Field



Escape Losses

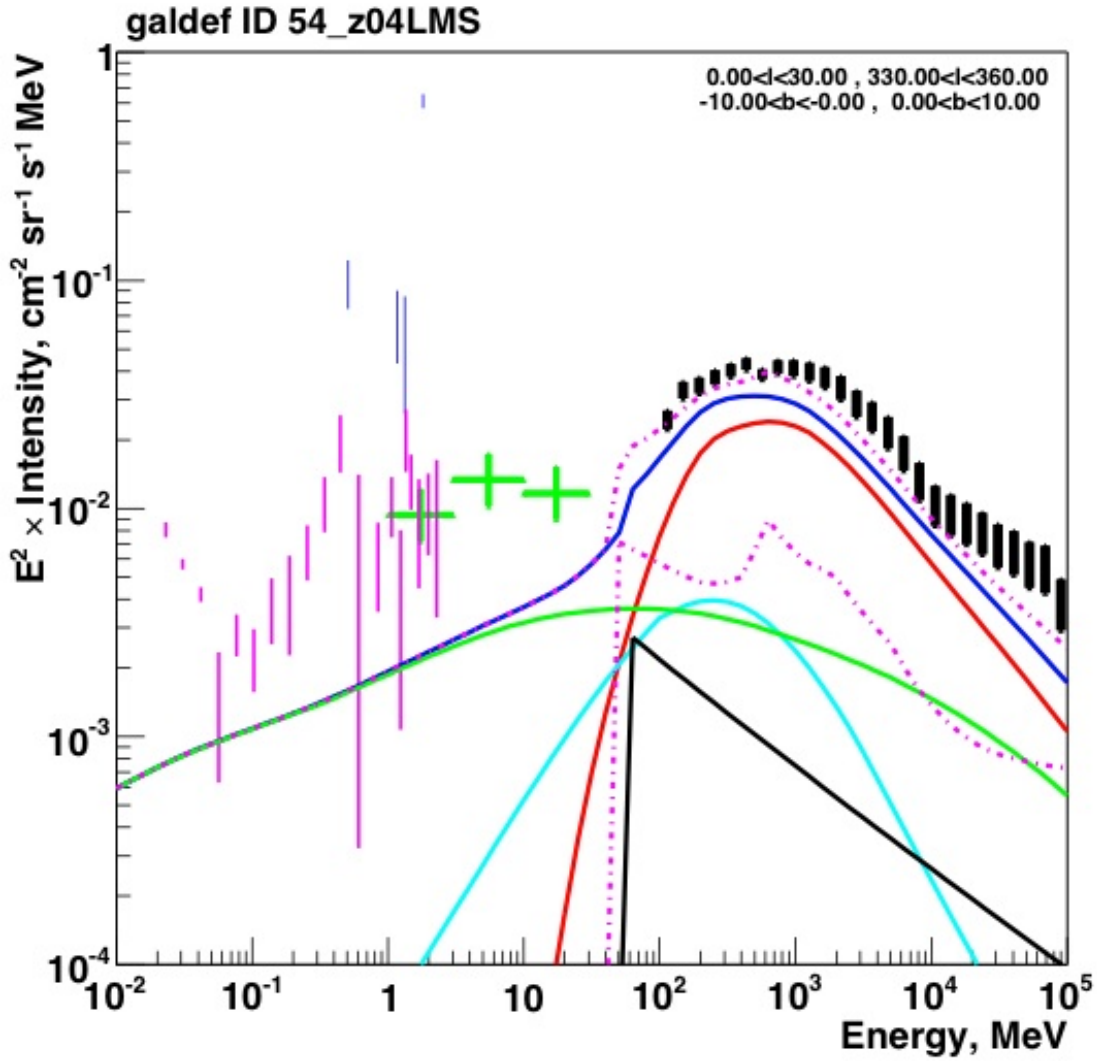
- Diffusion
- Starburst Wind (Advection)
- Annihilation (positrons)



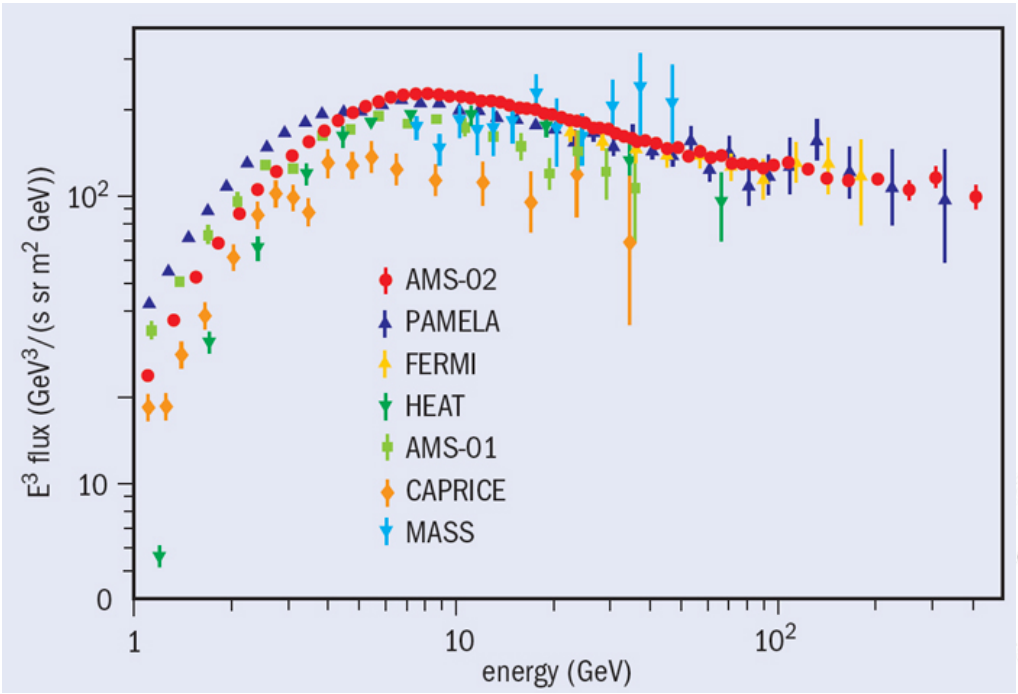
Sources

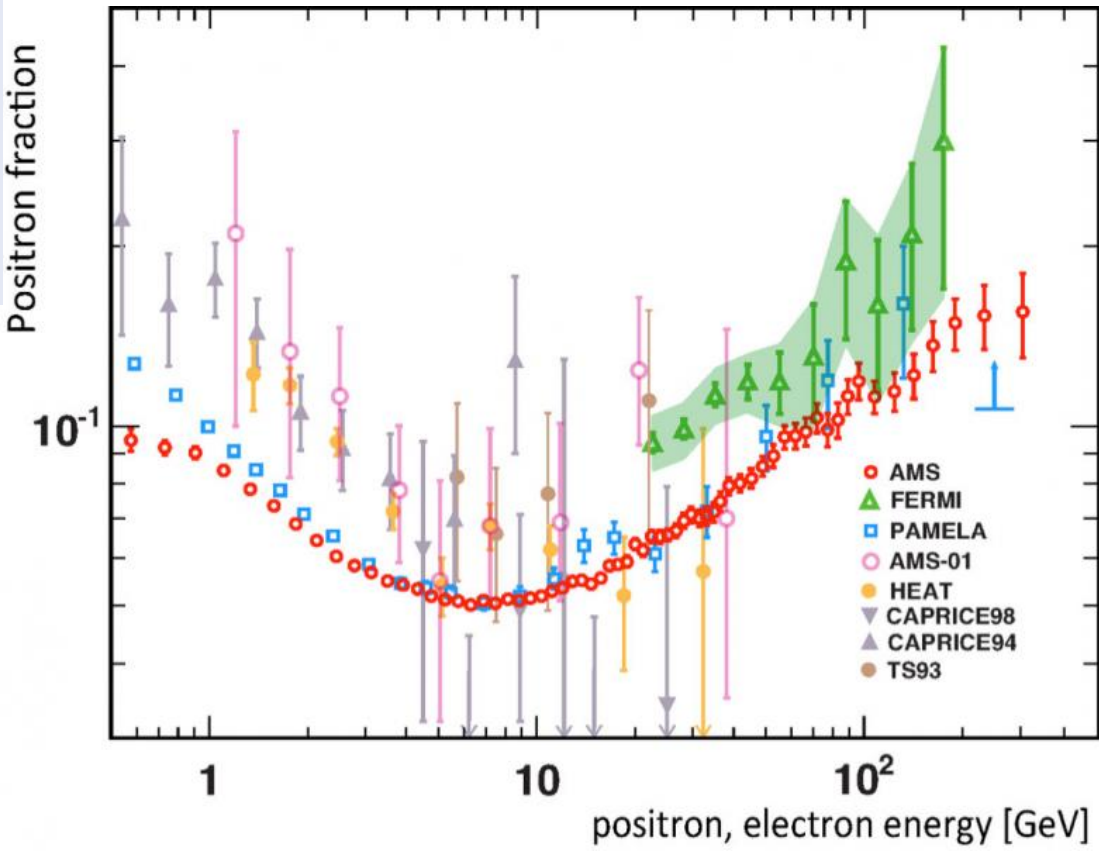
- Supernova Rate
- Acceleration Efficiency
- Primary Spectrum

Galactic Diffuse

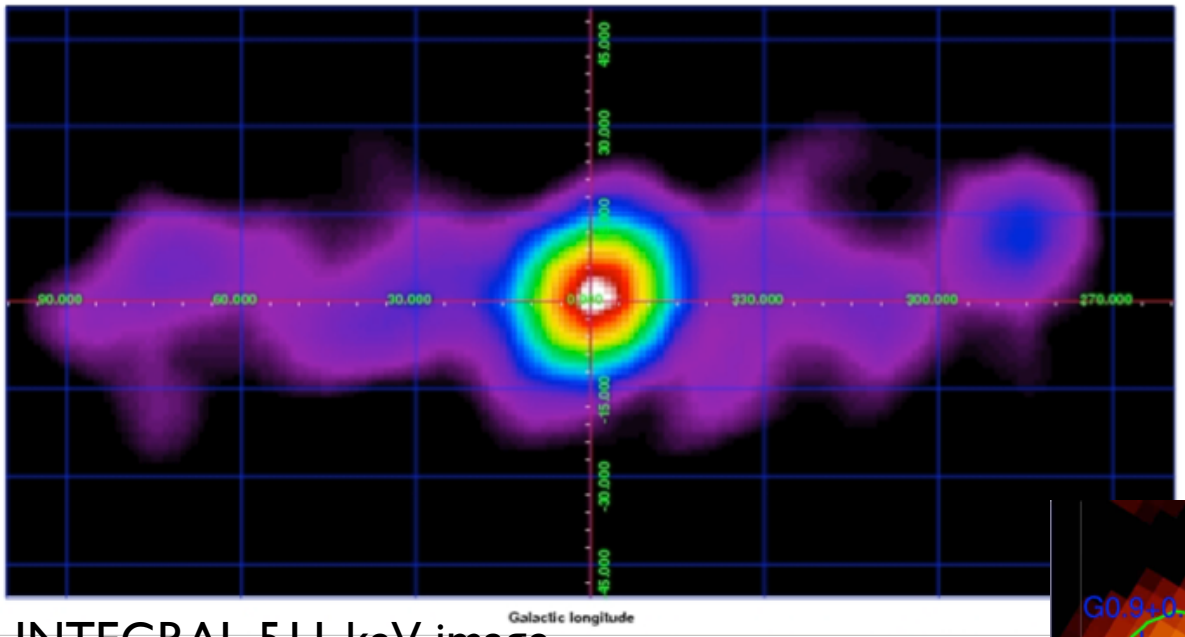


Galactic Electrons and Positrons

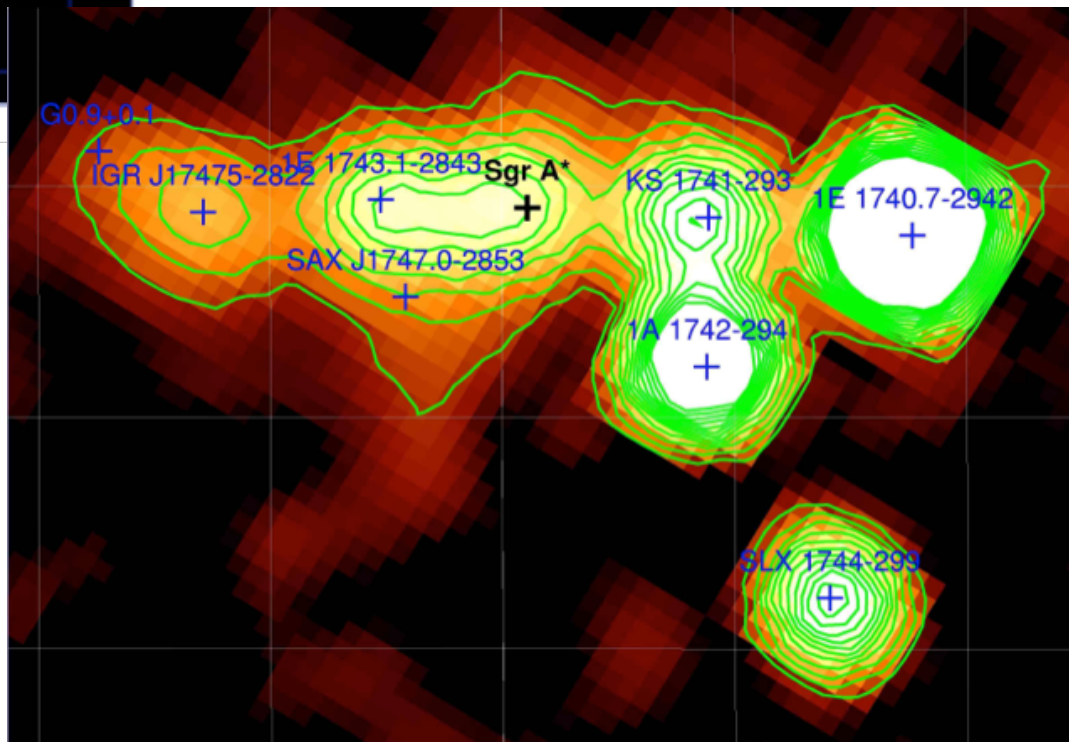




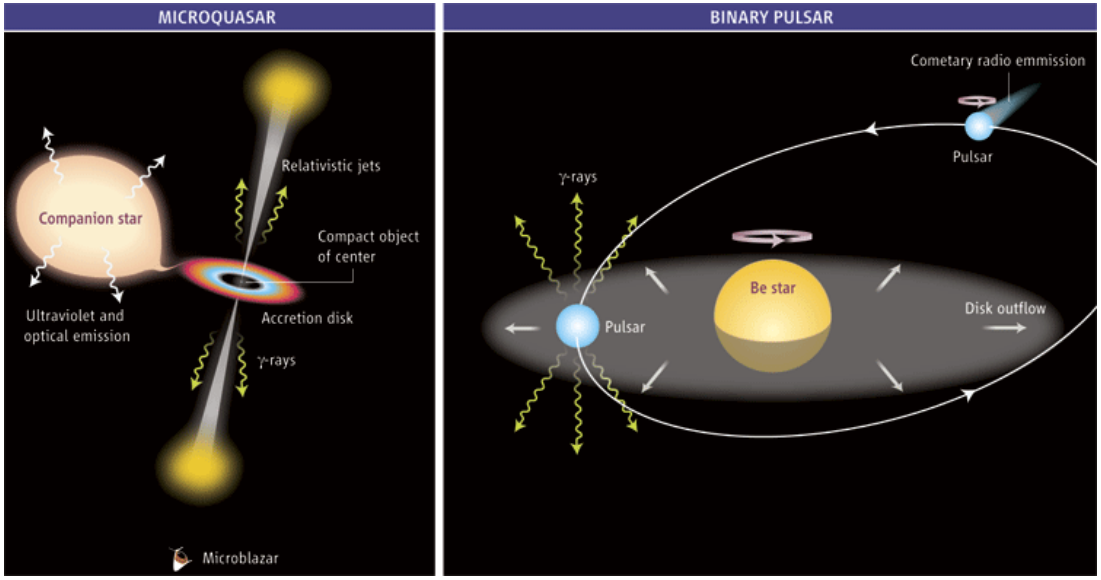
Galactic Center



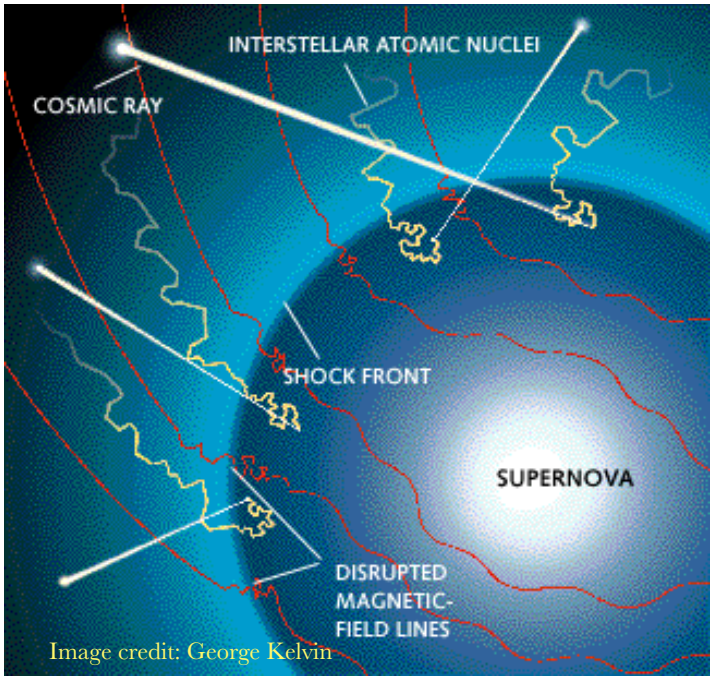
INTEGRAL 511 keV image



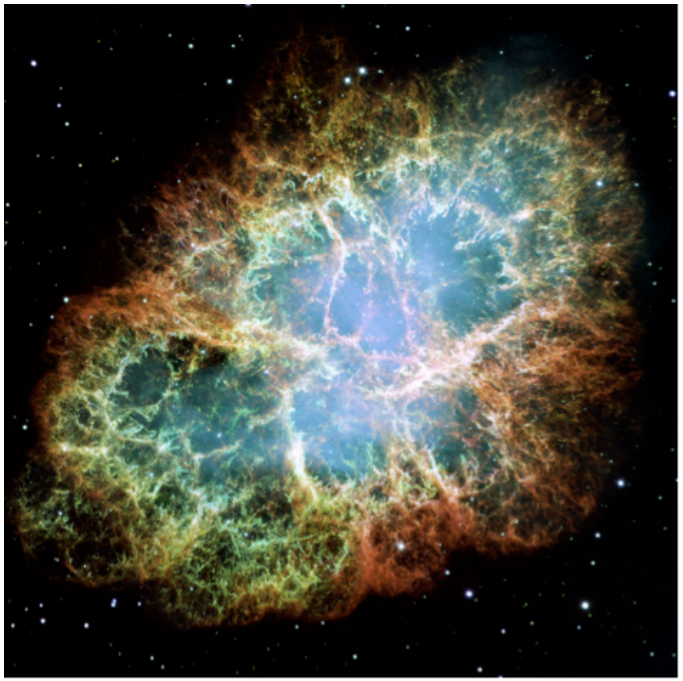
Galactic Sources



Gamma-ray Binaries



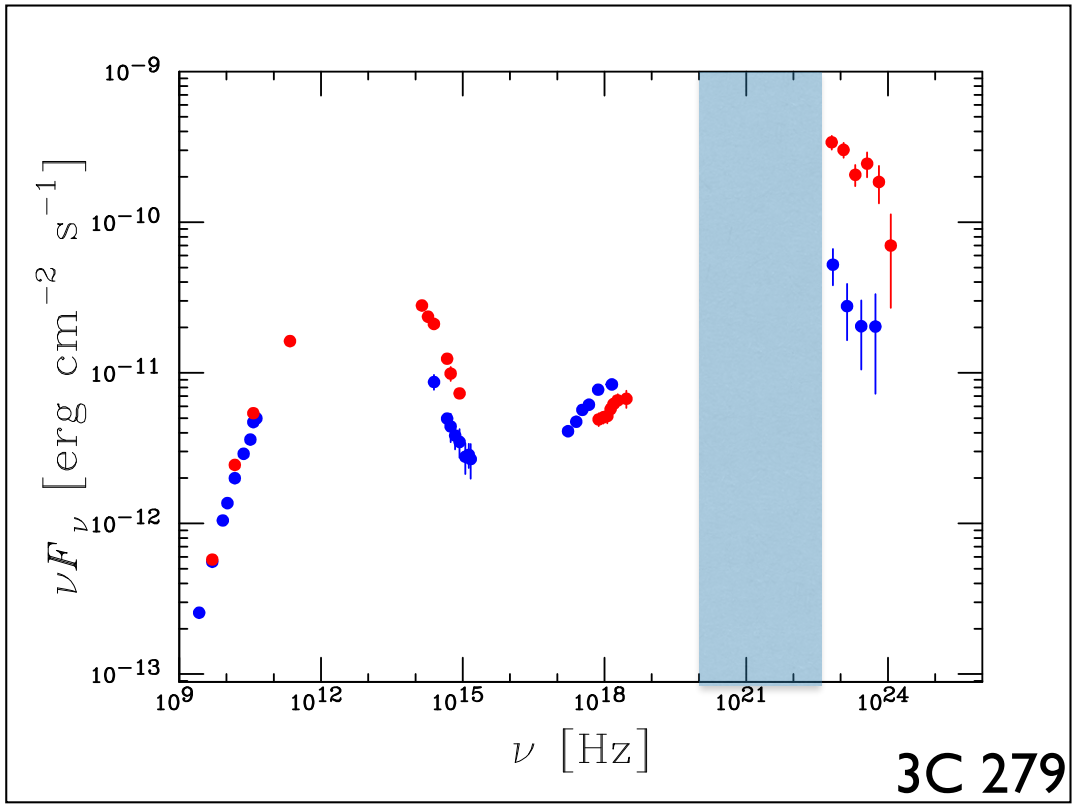
SNRs and Superbubbles



Pulsars and PWNe

Extragalactic Science

Blazar Emission Mechanisms

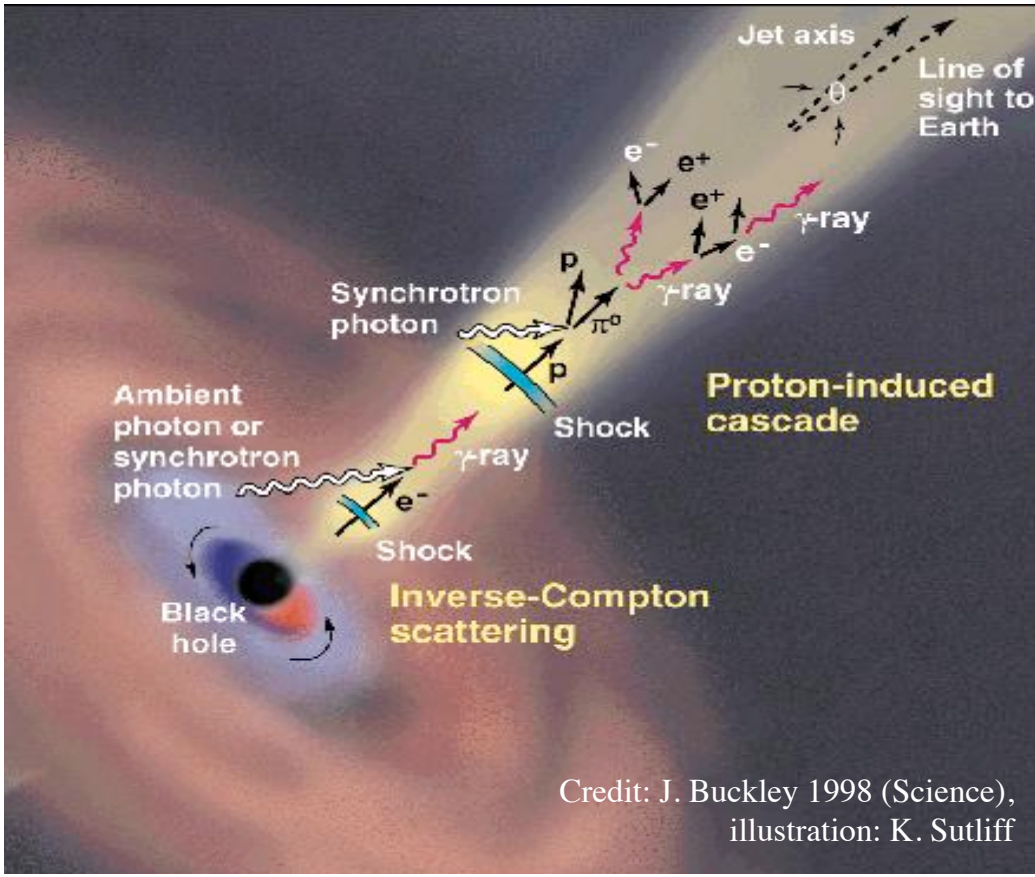


Leptonic - HE hump due to Inverse Compton scattering

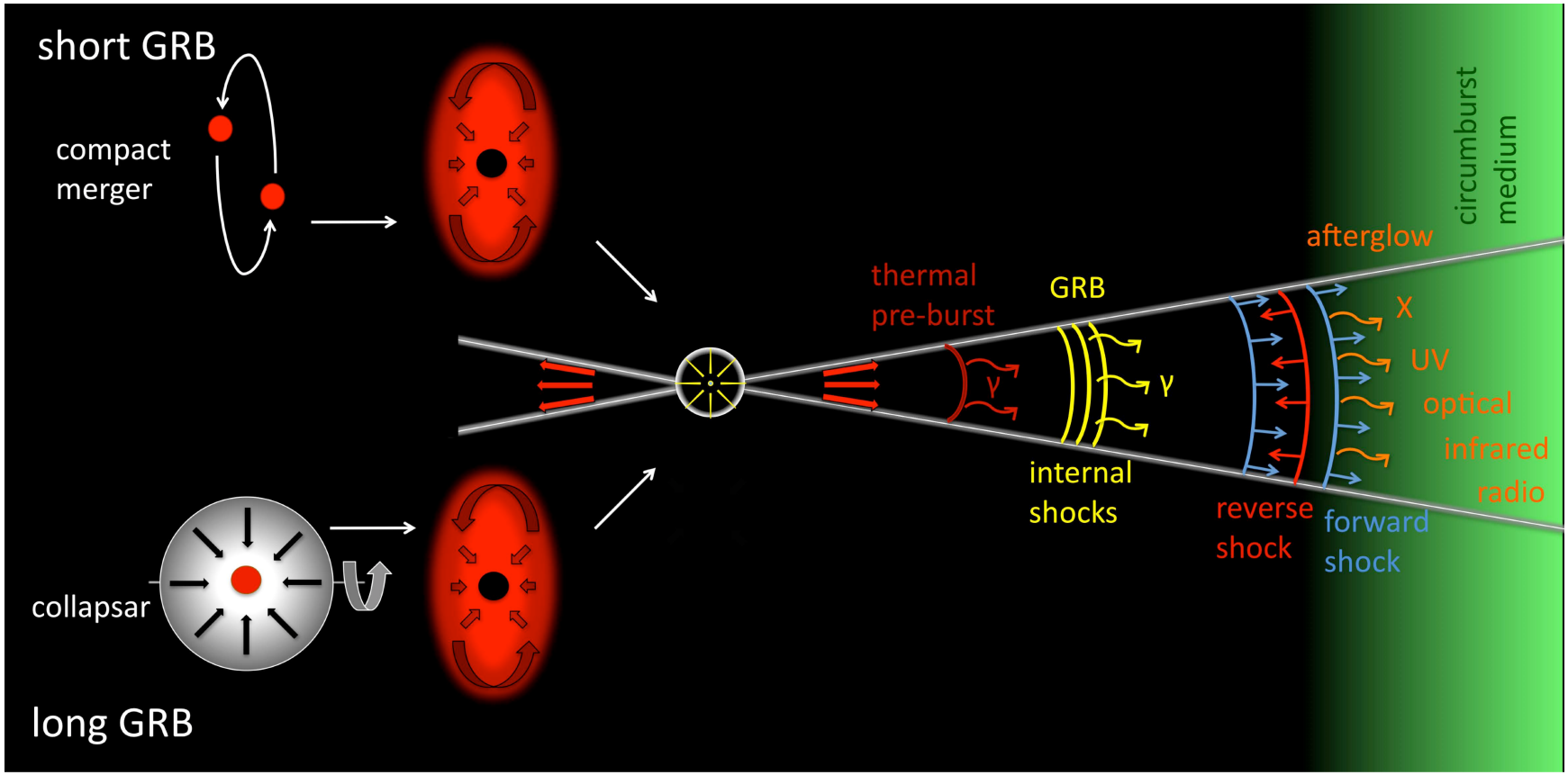
- Synchrotron Self-Compton
- External Compton

Hadronic - HE hump due to emission from hadronic interactions

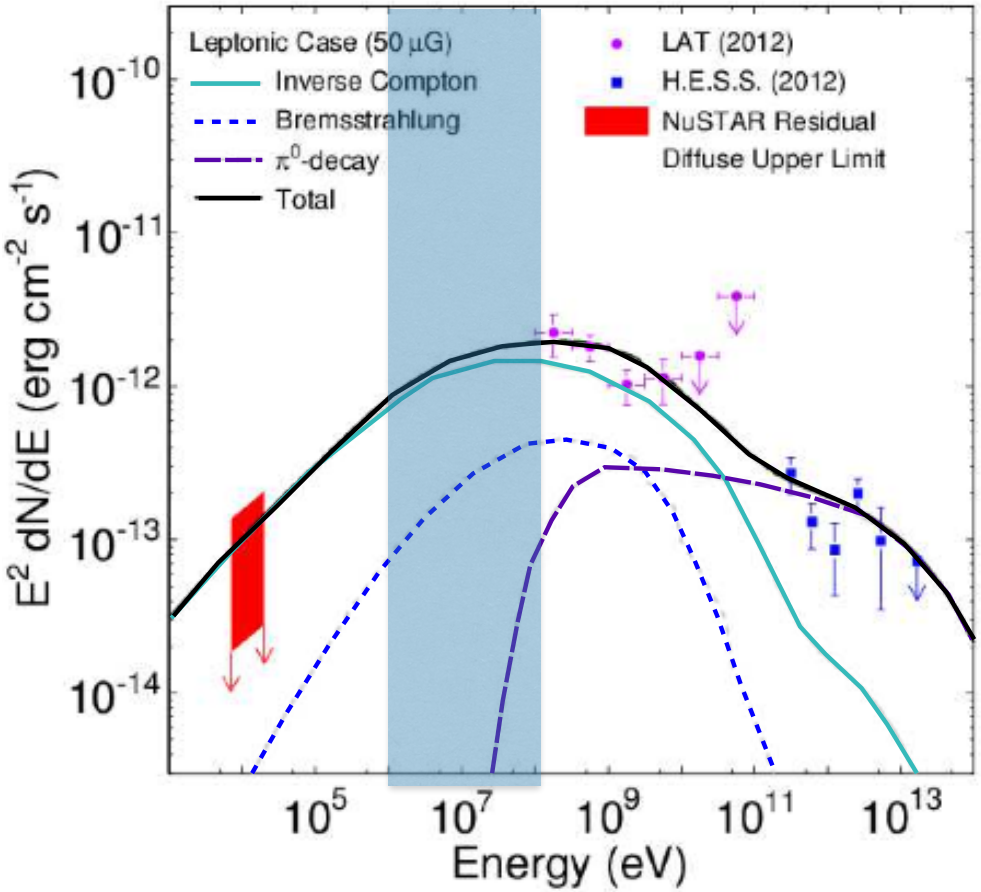
- Proton Synchrotron
- Photomeson production
- Muon Synchrotron



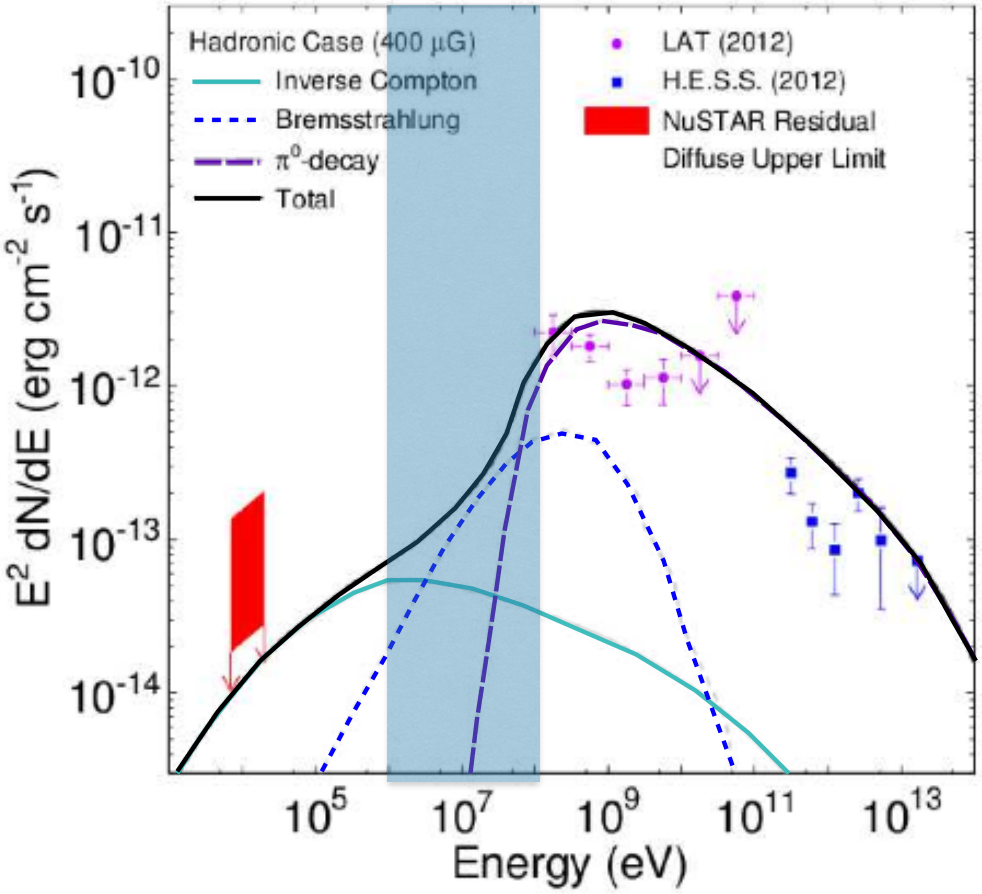
GRB Emission Mechanisms



Broadband Diffuse in Starburst Galaxies



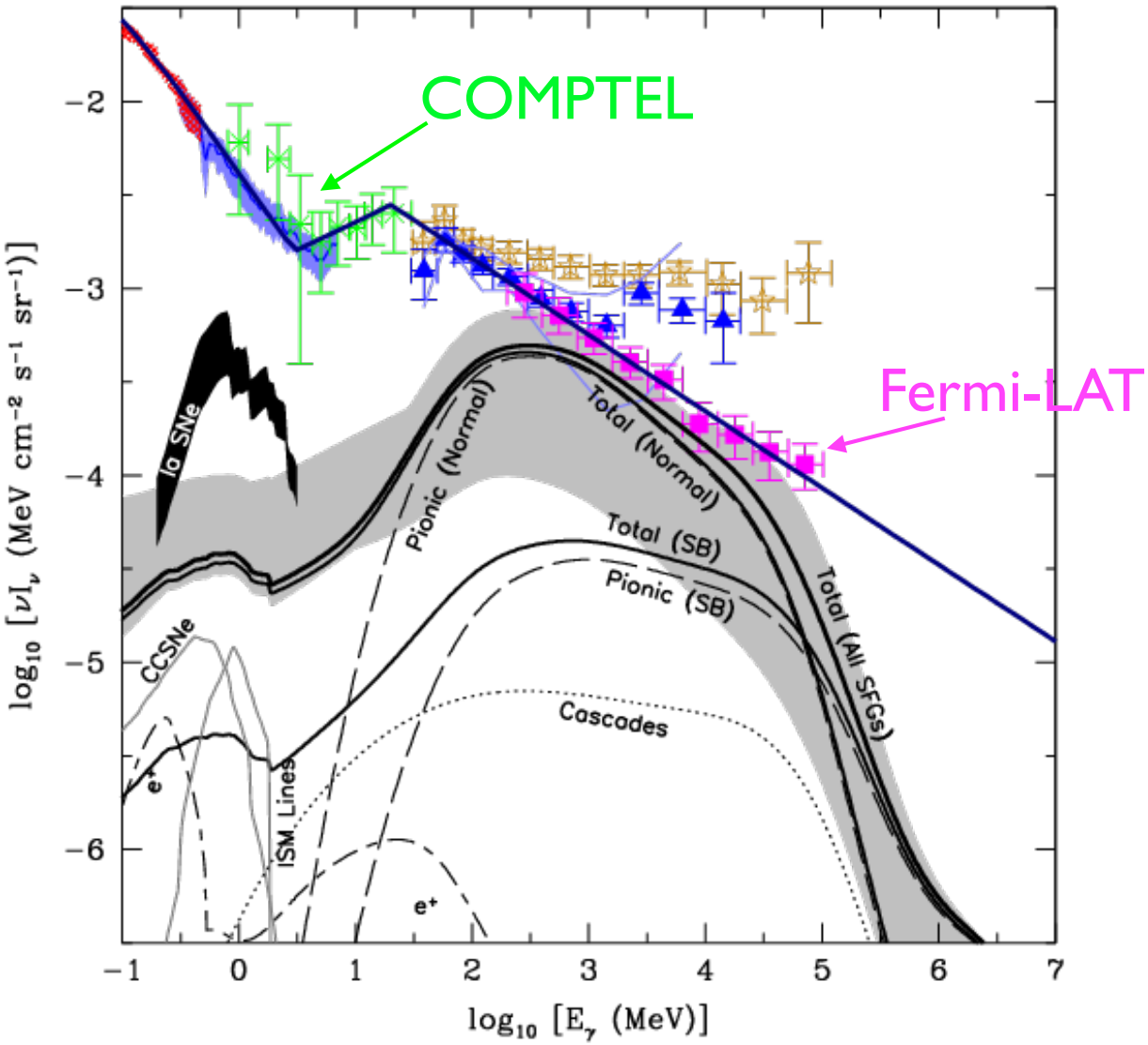
Leptonic Model



Hadronic Model

Wik et al. 2014

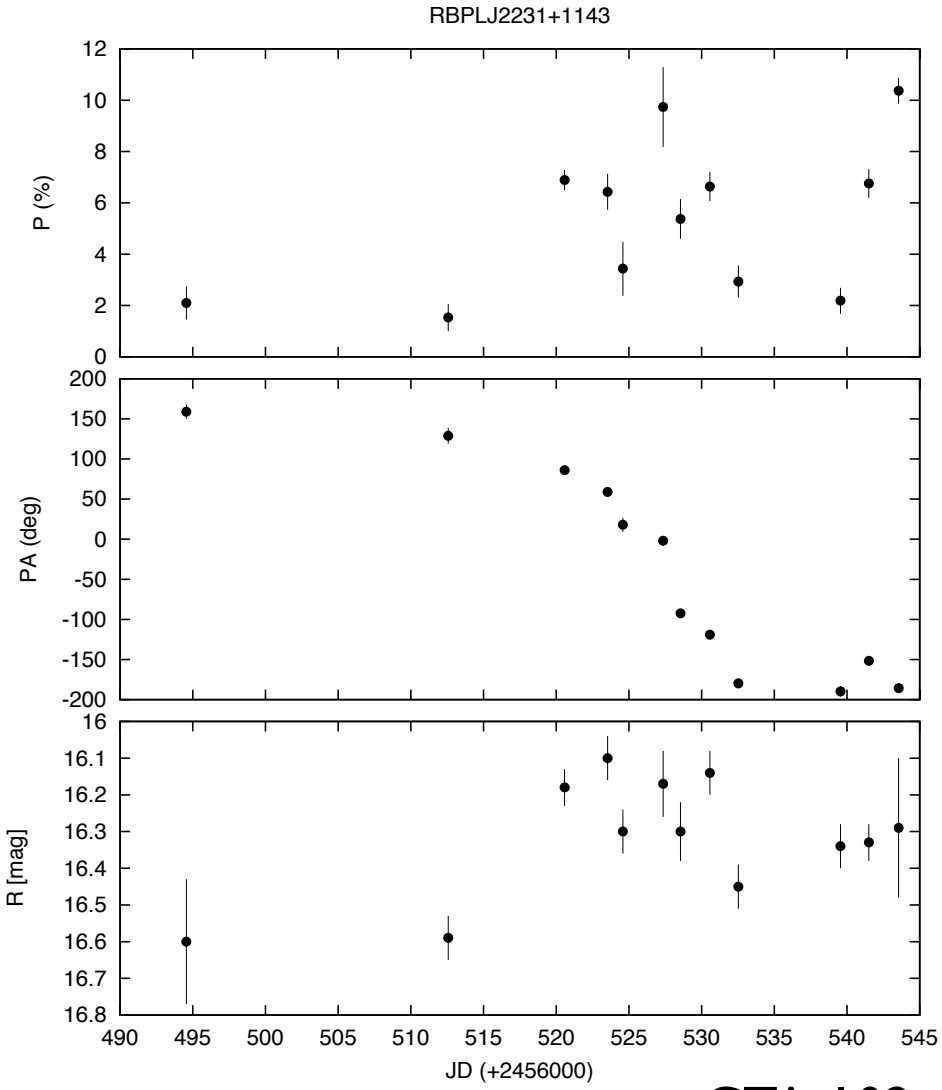
Extragalactic Diffuse



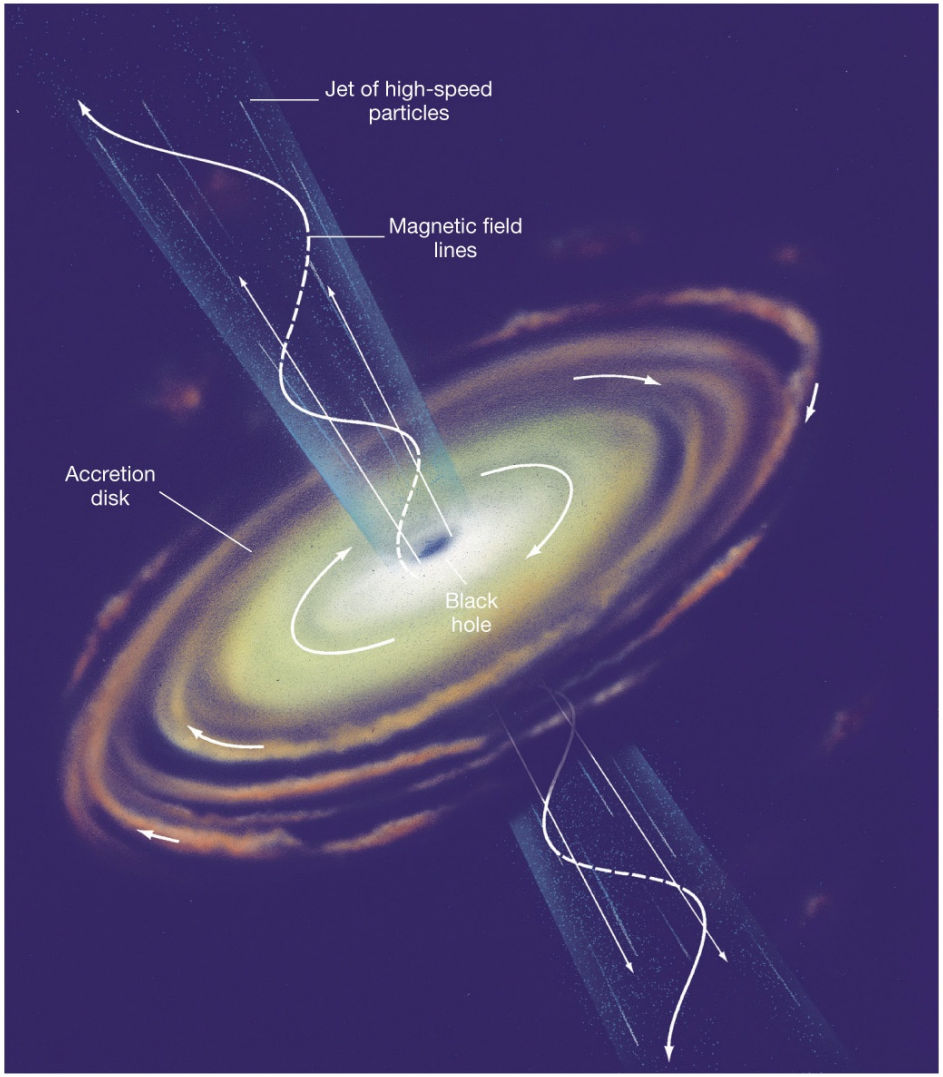
Lacki et al. 2012

Magnetic Fields

Probing Jets and their B Fields

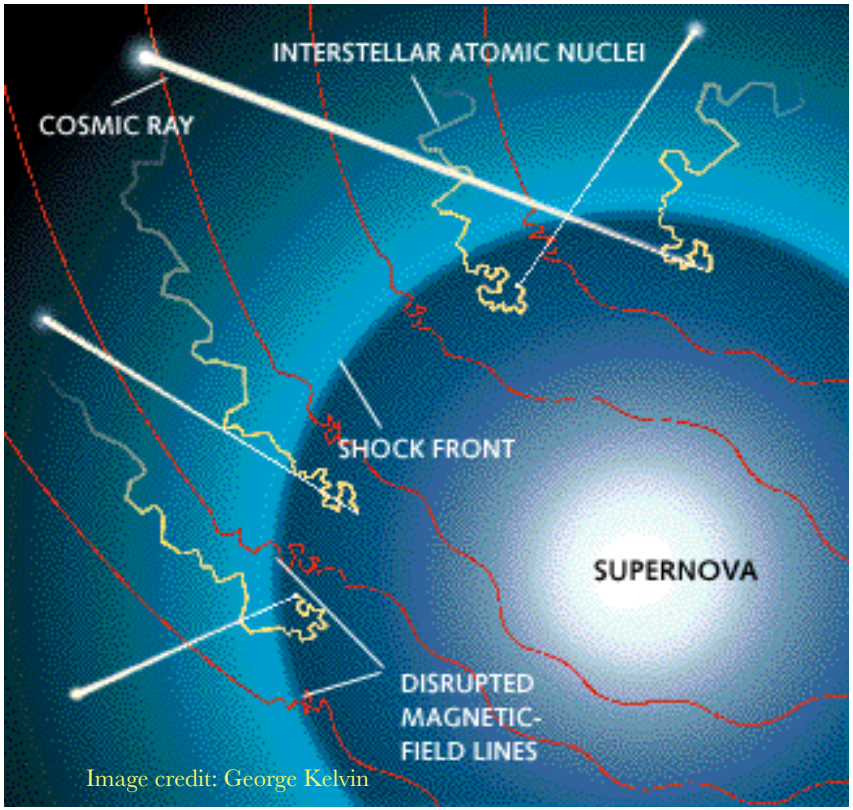


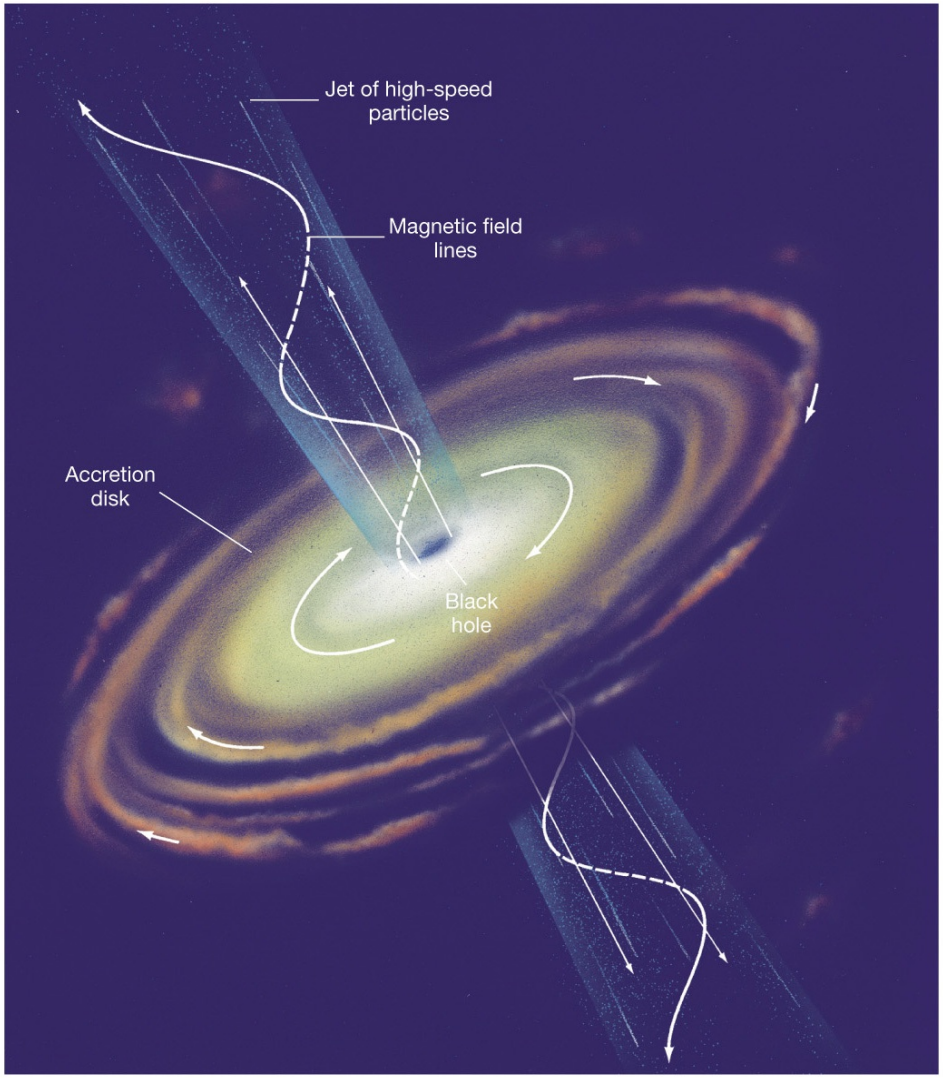
CTA 102



Why Polarization?

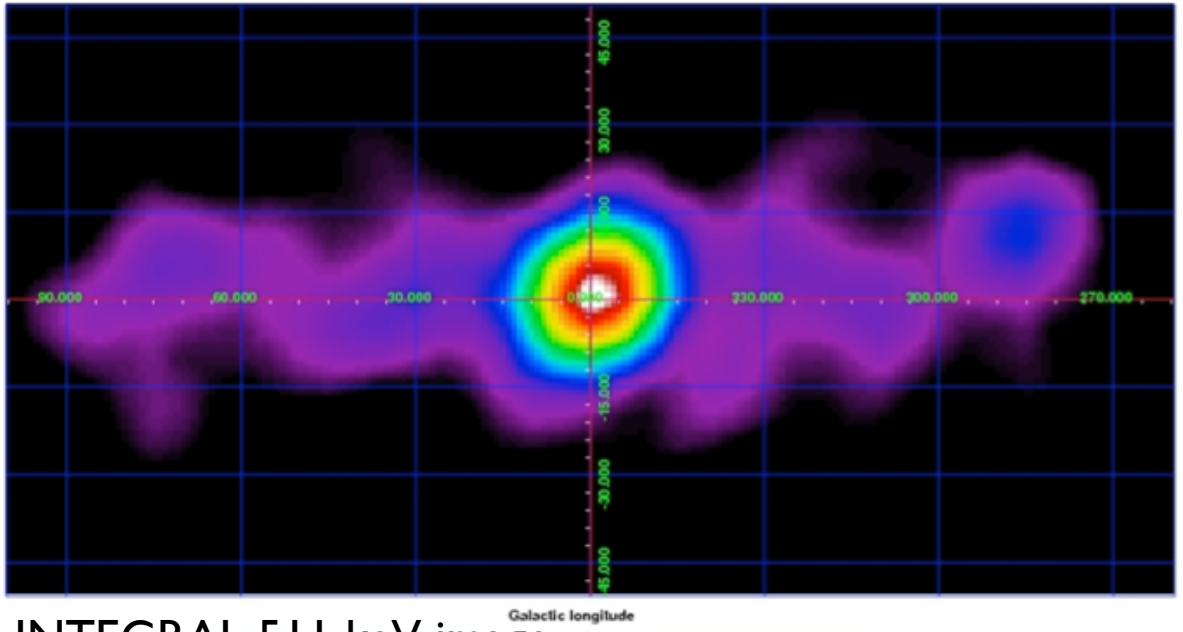
Probing Magnetic Fields in HE Astrophysical Systems



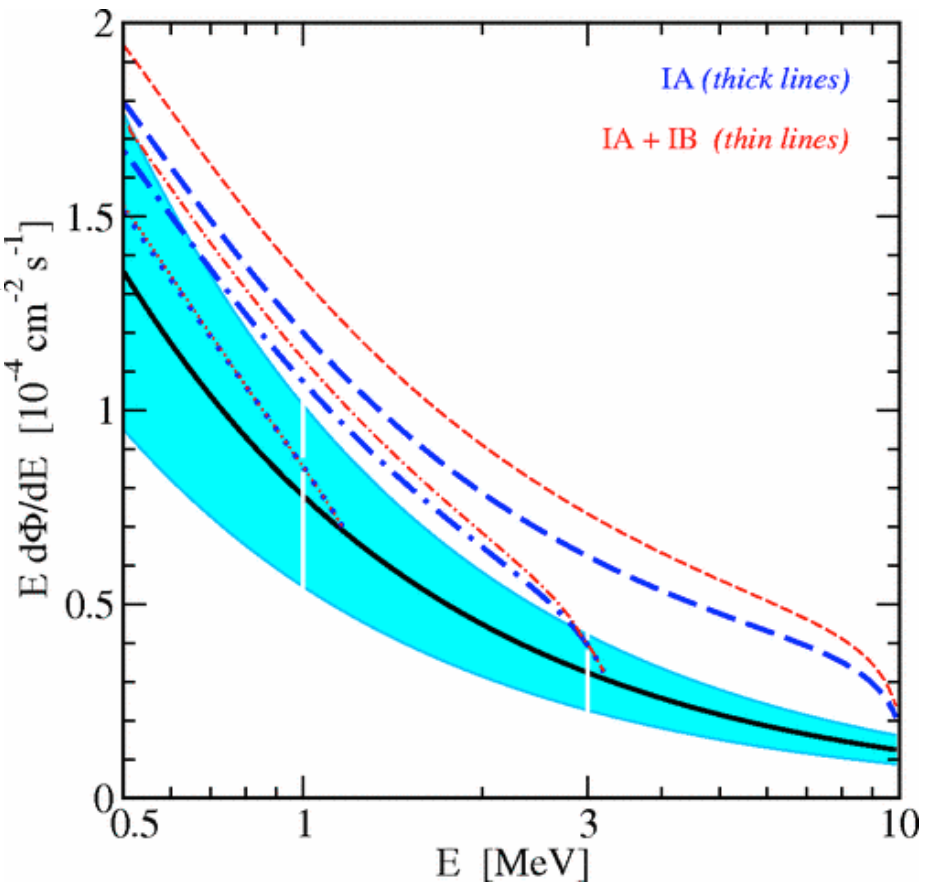


Fundamental Physics

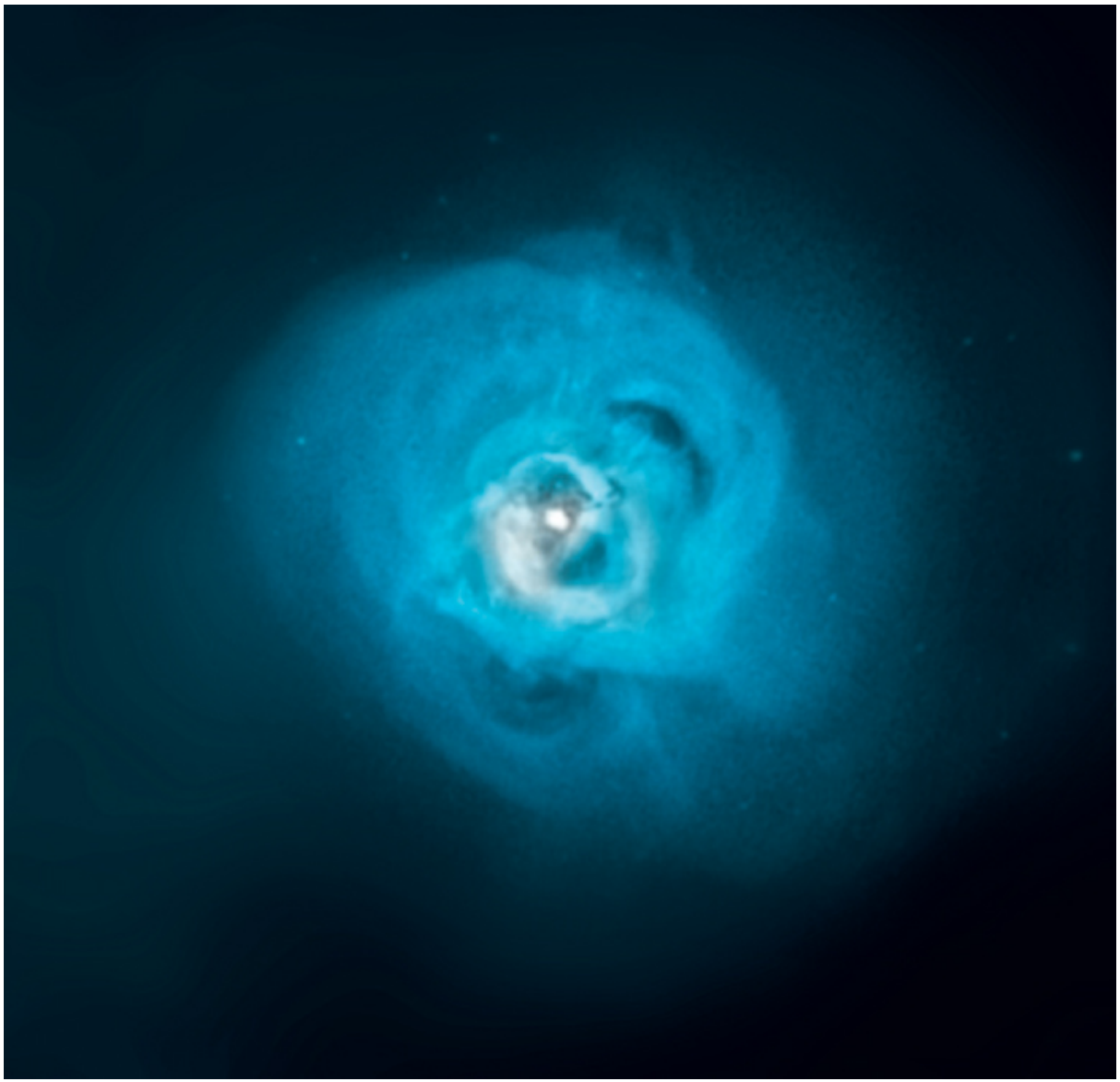
DM ➢ 511 keV line?



INTEGRAL 511 keV image

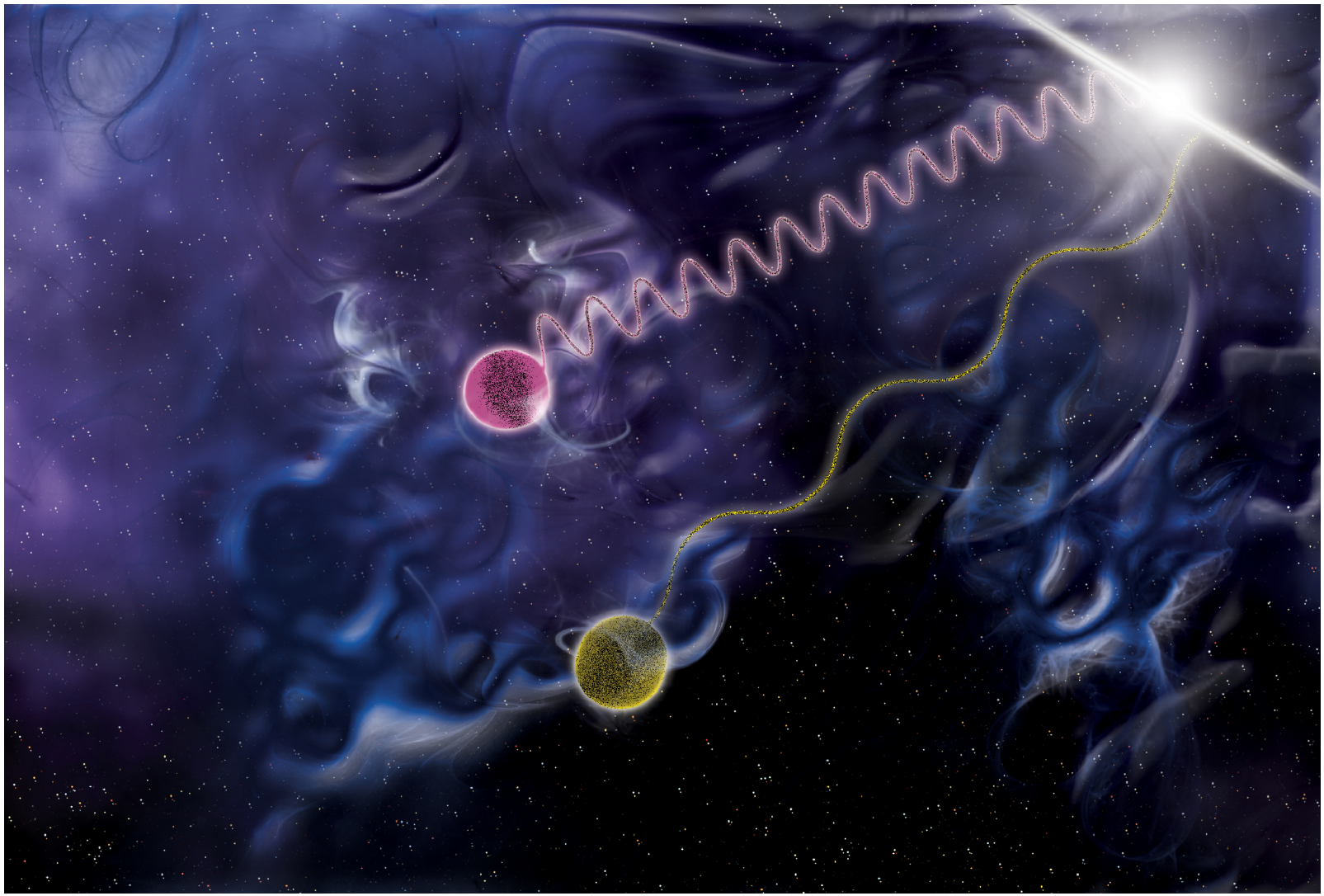


Sterile Neutrinos? Axions?



Perseus Galaxy Cluster

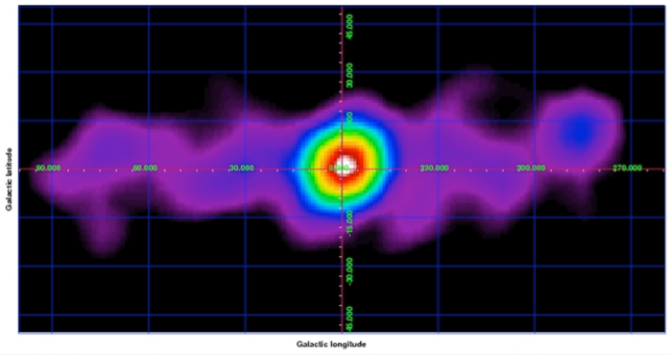
Lorentz Invariance Violation

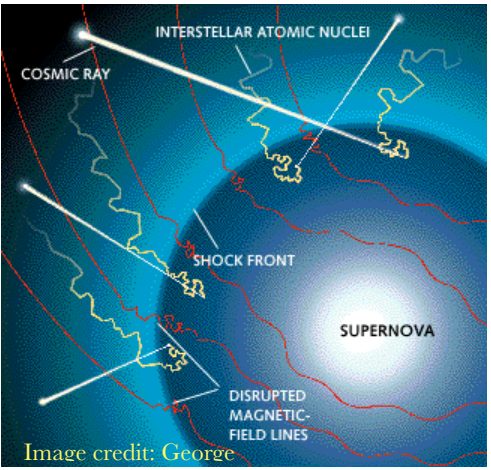


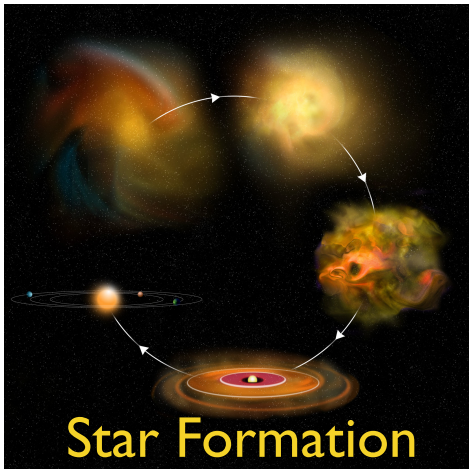
Observational

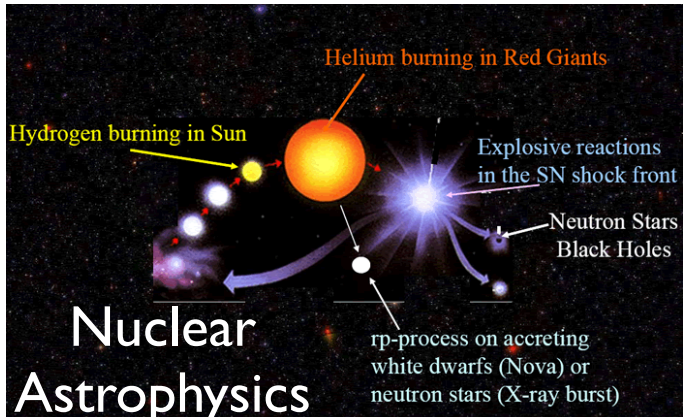
Unique Capabilities at MeVs

Lines

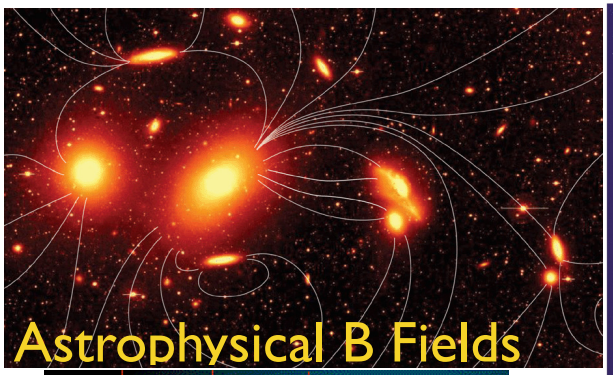


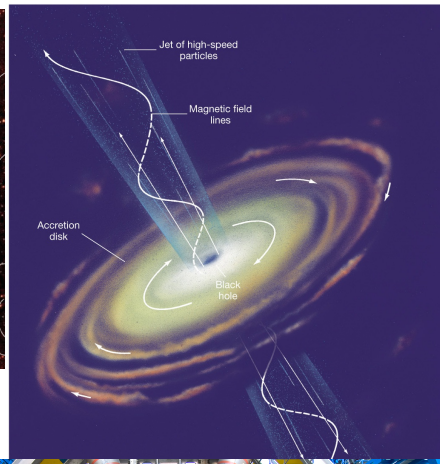


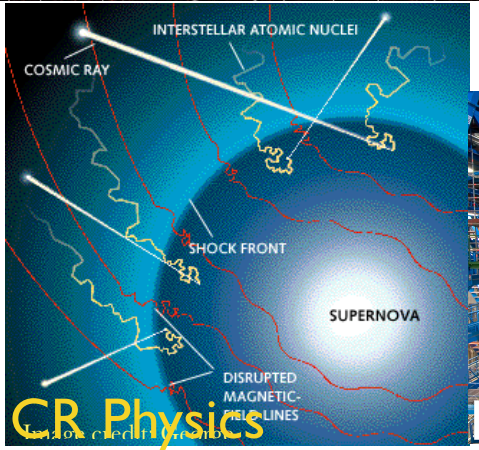


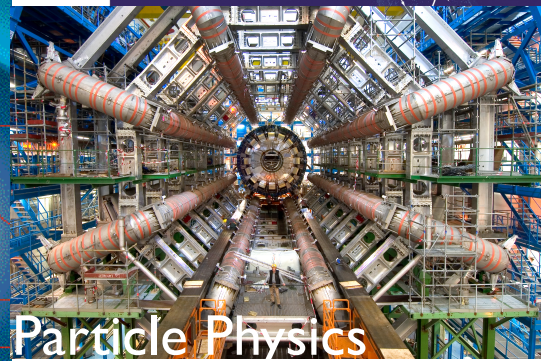


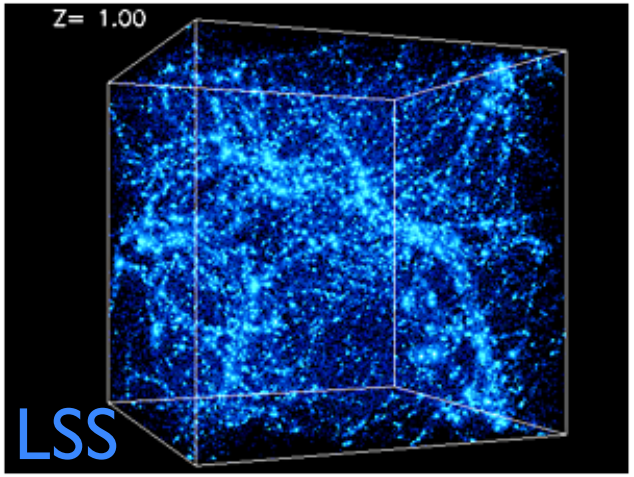
Polarization











Unique Capabilities at MeVs

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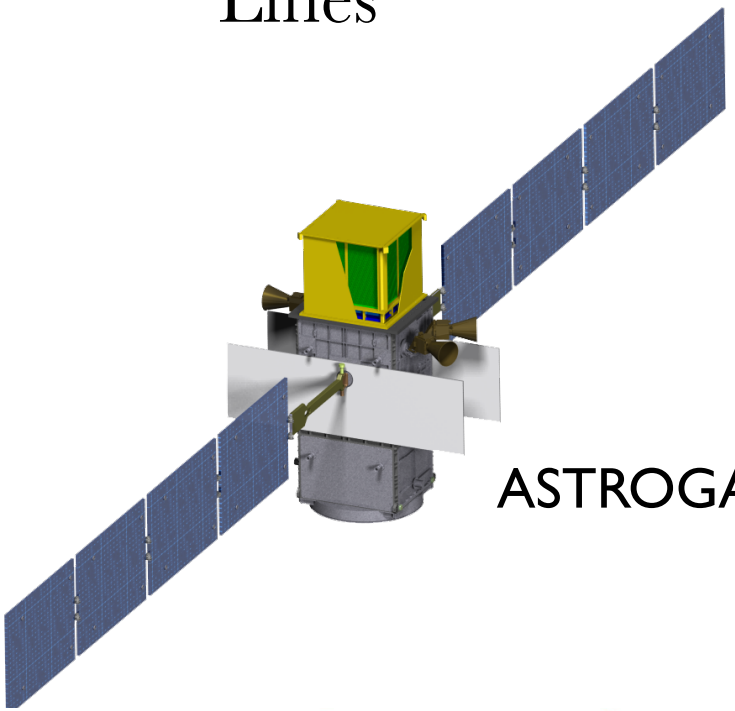
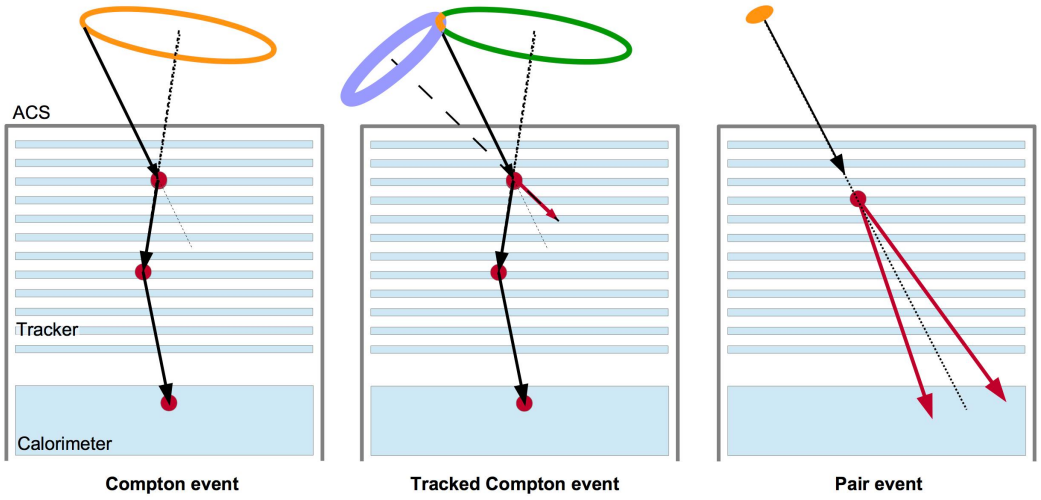
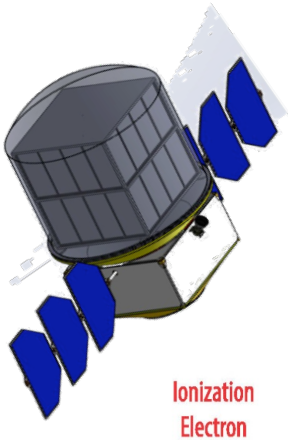


ASTROGAM



Polarization



AdEPT