

CRISM 2011

The GeV-TeV Galactic γ -ray diffuse emission

I. Uncertainties in the predictions of the hadronic component

A&A 531, A37 (2011)

Timur DELAHAYE



with Armand Fiasson, Martin Pohl, Pierre Salati

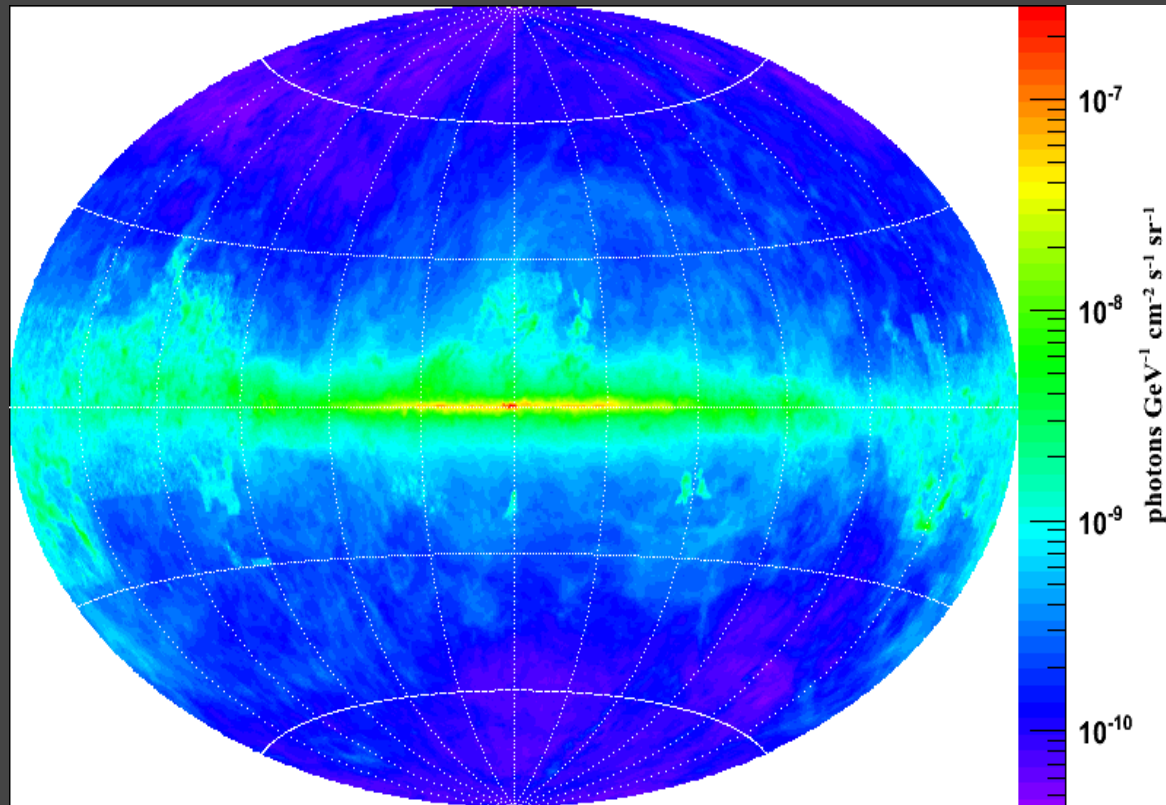


The γ -ray diffuse emission

Why should one care ?

Interesting probe of the ISM

Indirect measurement of
cosmic rays everywhere
in the Galaxy



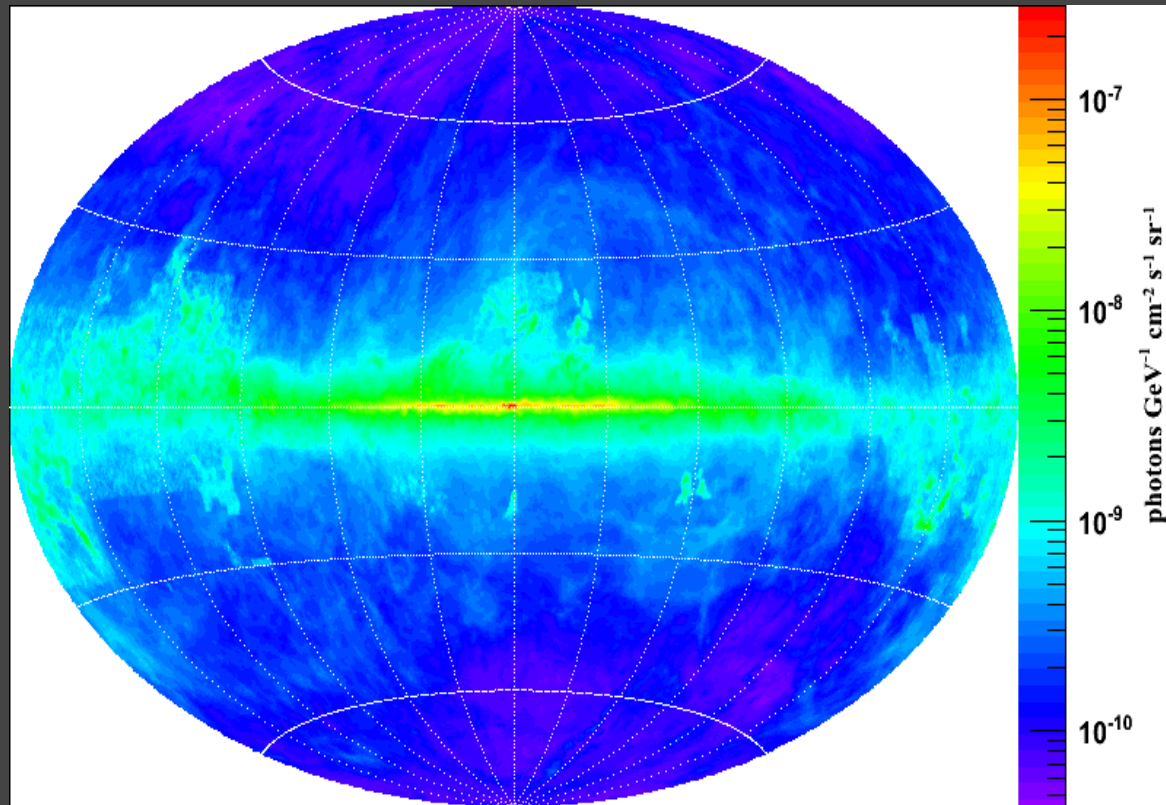
The γ -ray diffuse emission

Why should one care ?

Main background to source resolution

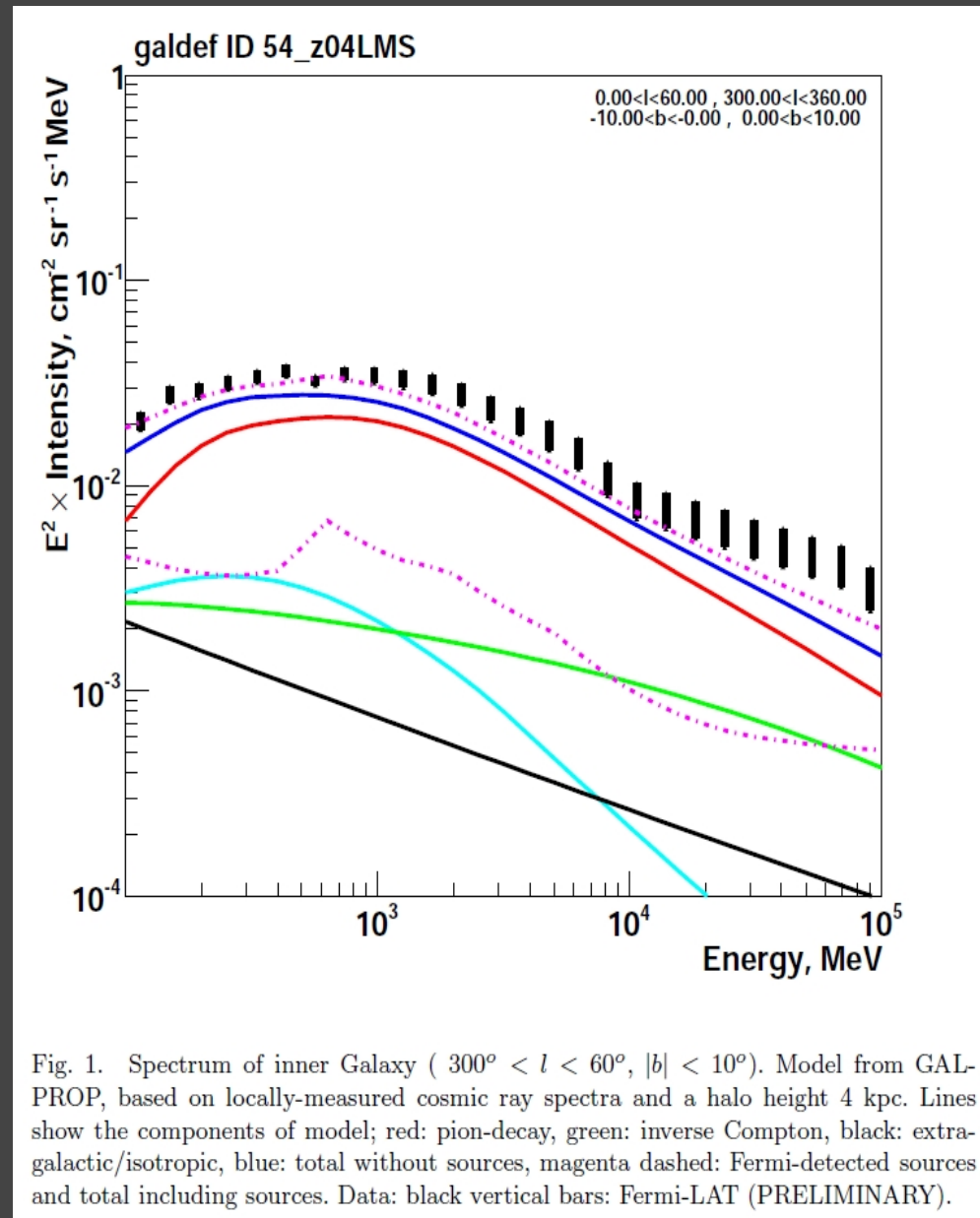
Main foreground to extragalactic component

Main background to dark matter research



Why only the hadronic contribution?

- π^0 decay
- Inverse Compton
- Bremsstrahlung
- Isotropic component
- Dark matter ?



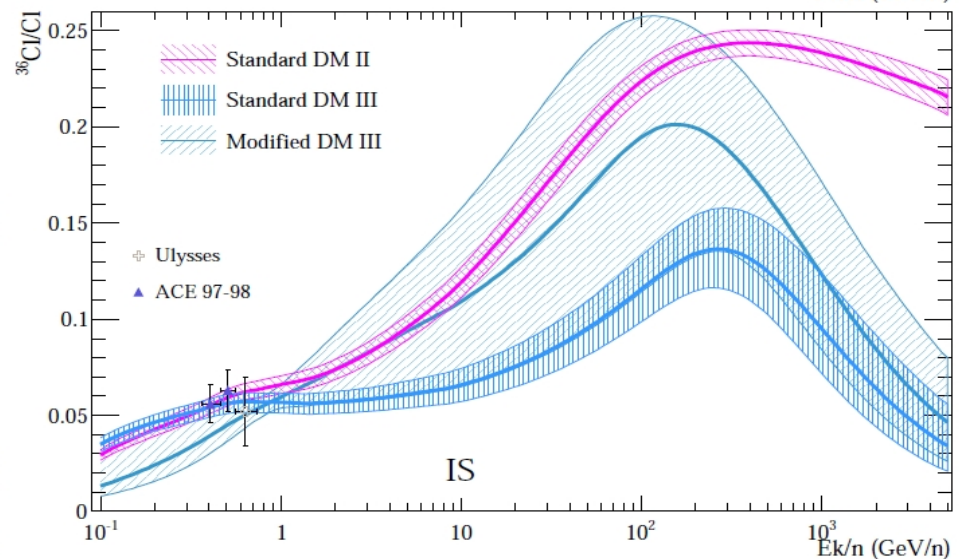
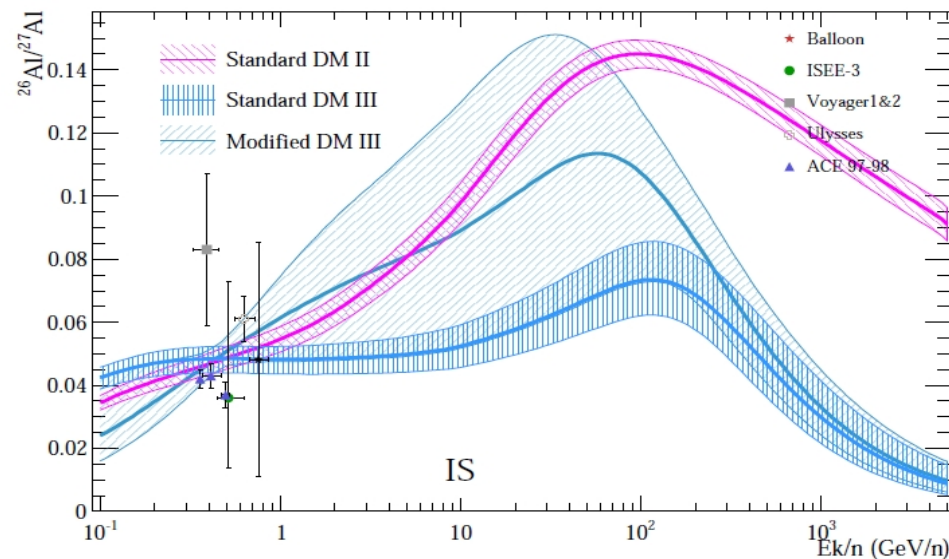
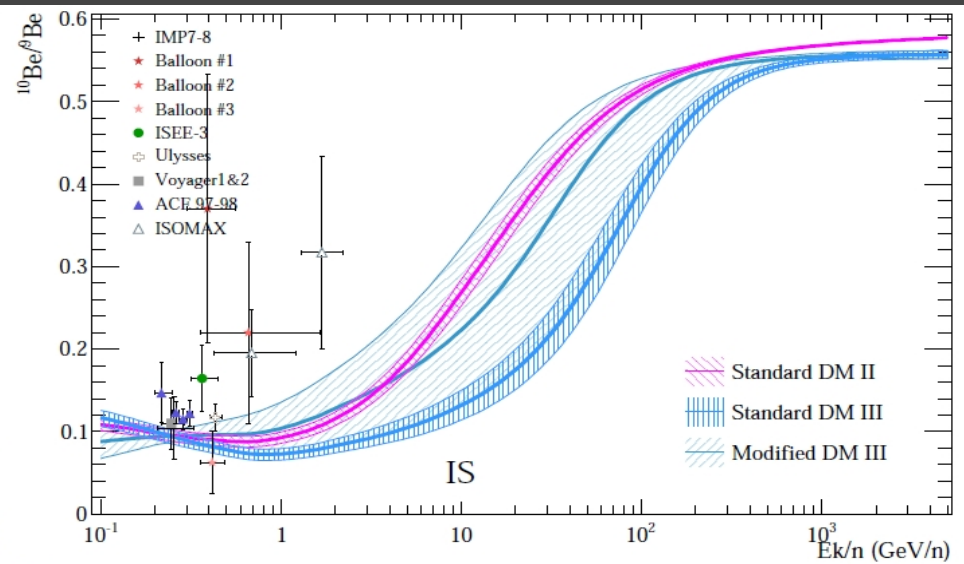
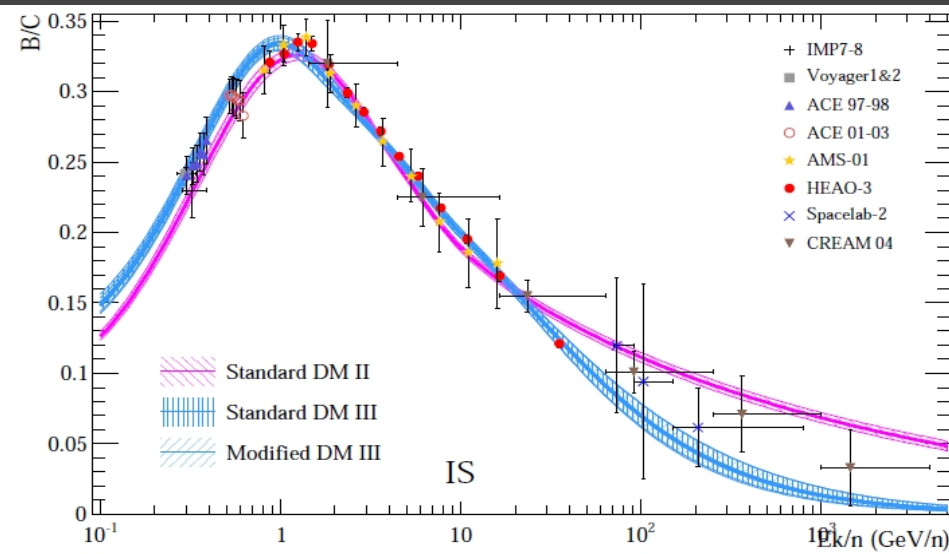
Strong 2011

What are the ingredients ?

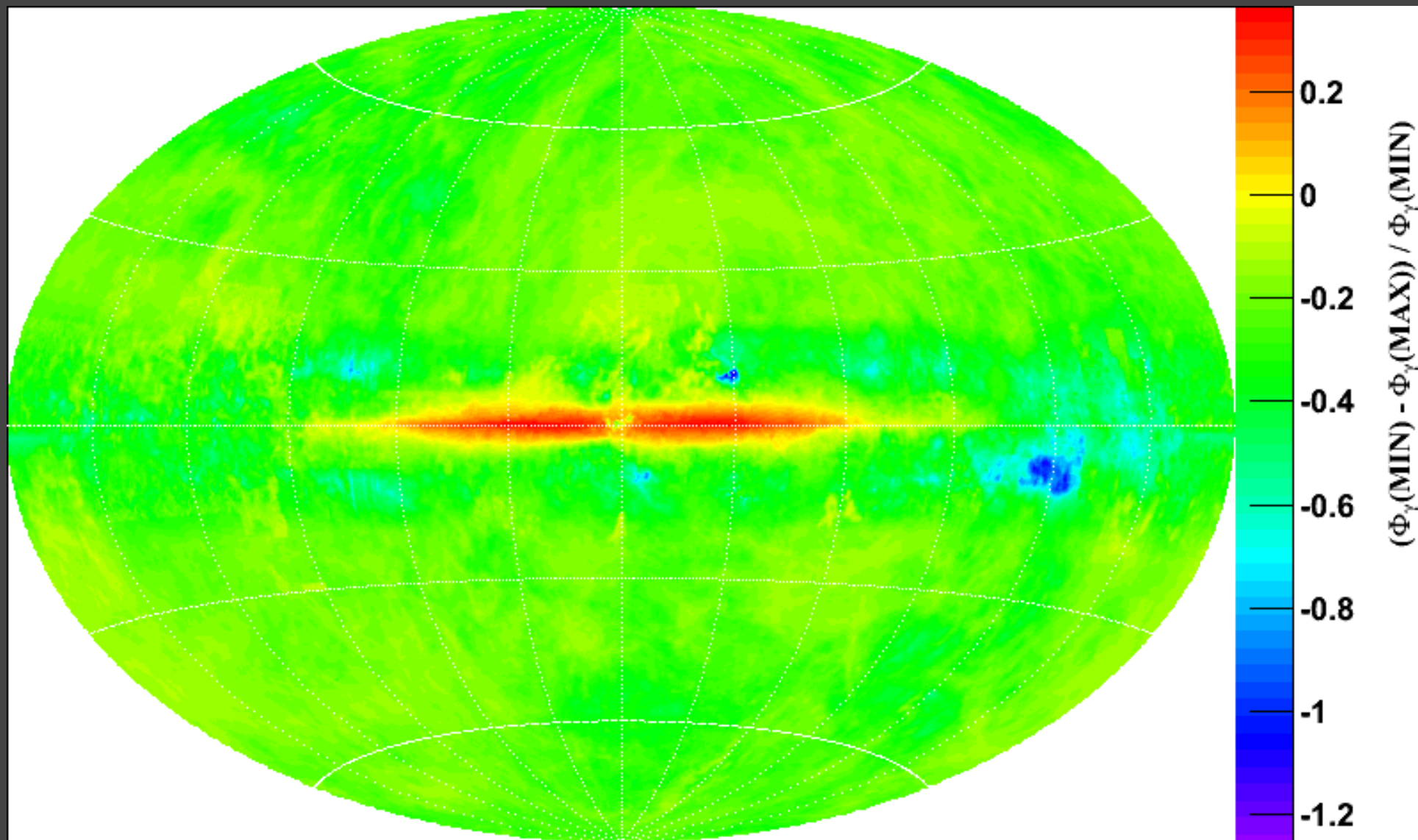
- Cosmic ray source distribution
- Cosmic ray spectrum at the Earth
- Propagation model
- π^0 production cross-sections
- Gas maps

Propagation model

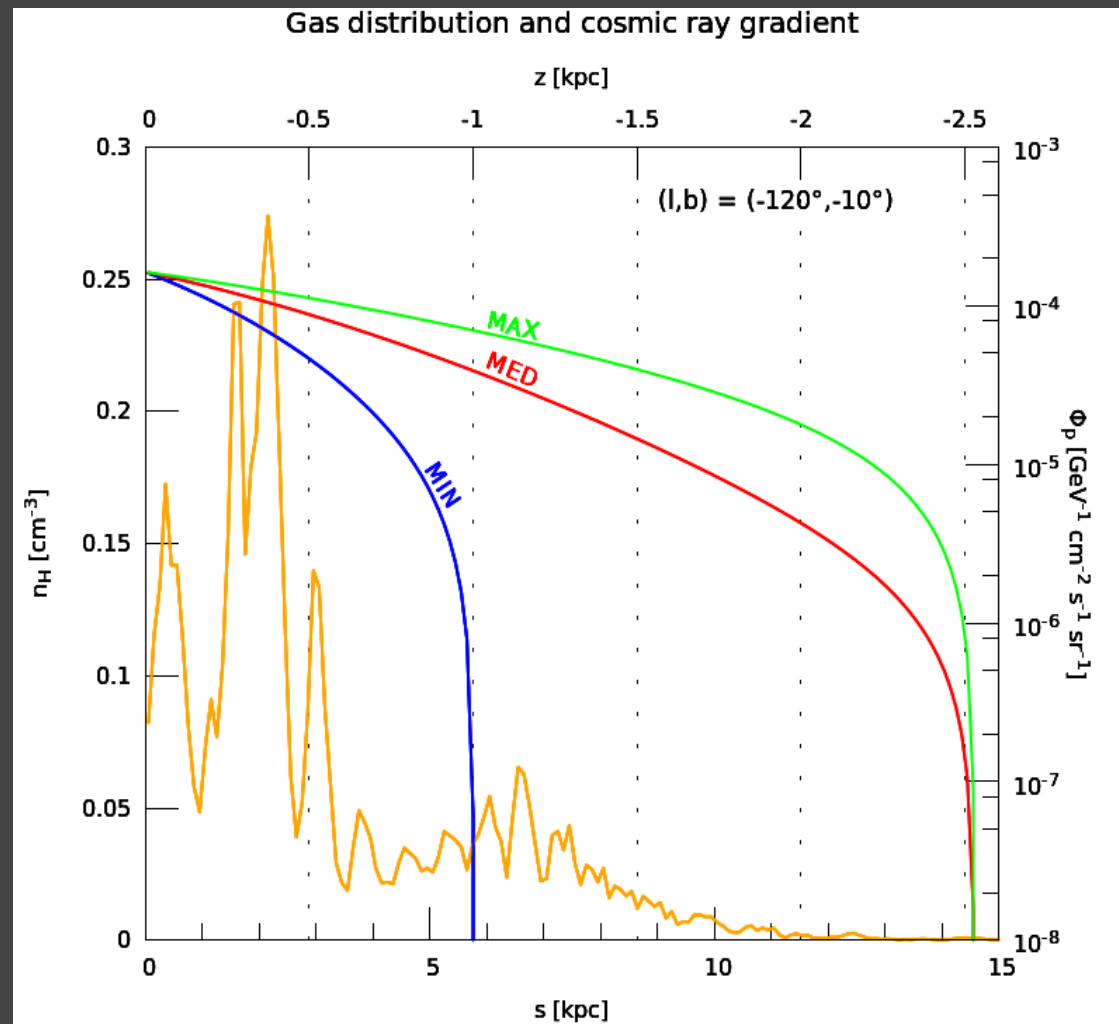
$$\partial_t \Psi + \vec{\nabla} \cdot (\vec{V}_c \Psi - K \vec{\nabla} \Psi) + \partial_E (b_{loss} \Psi - D_{EE} \partial_E \Psi) = Q - D$$



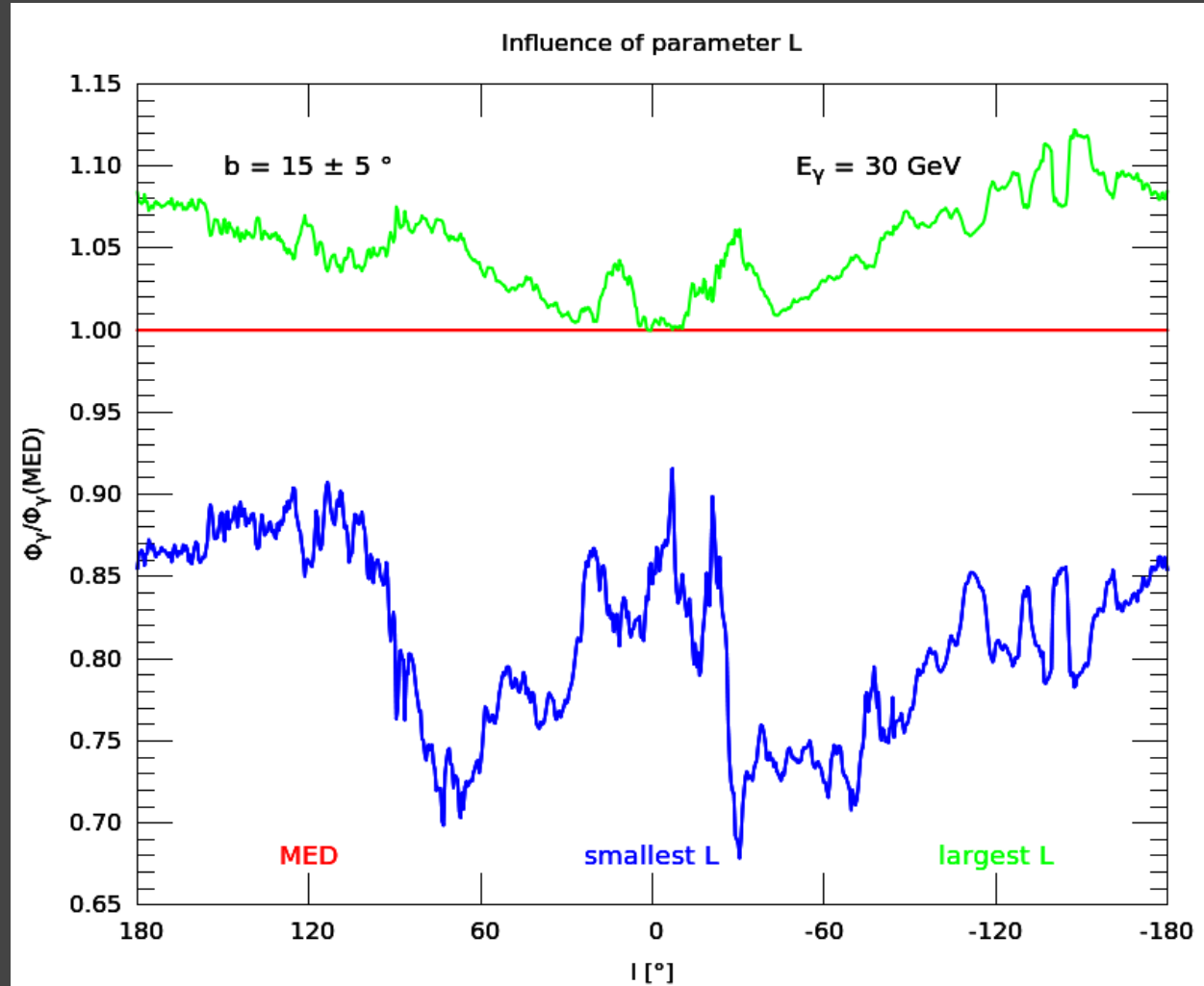
Propagation parameters



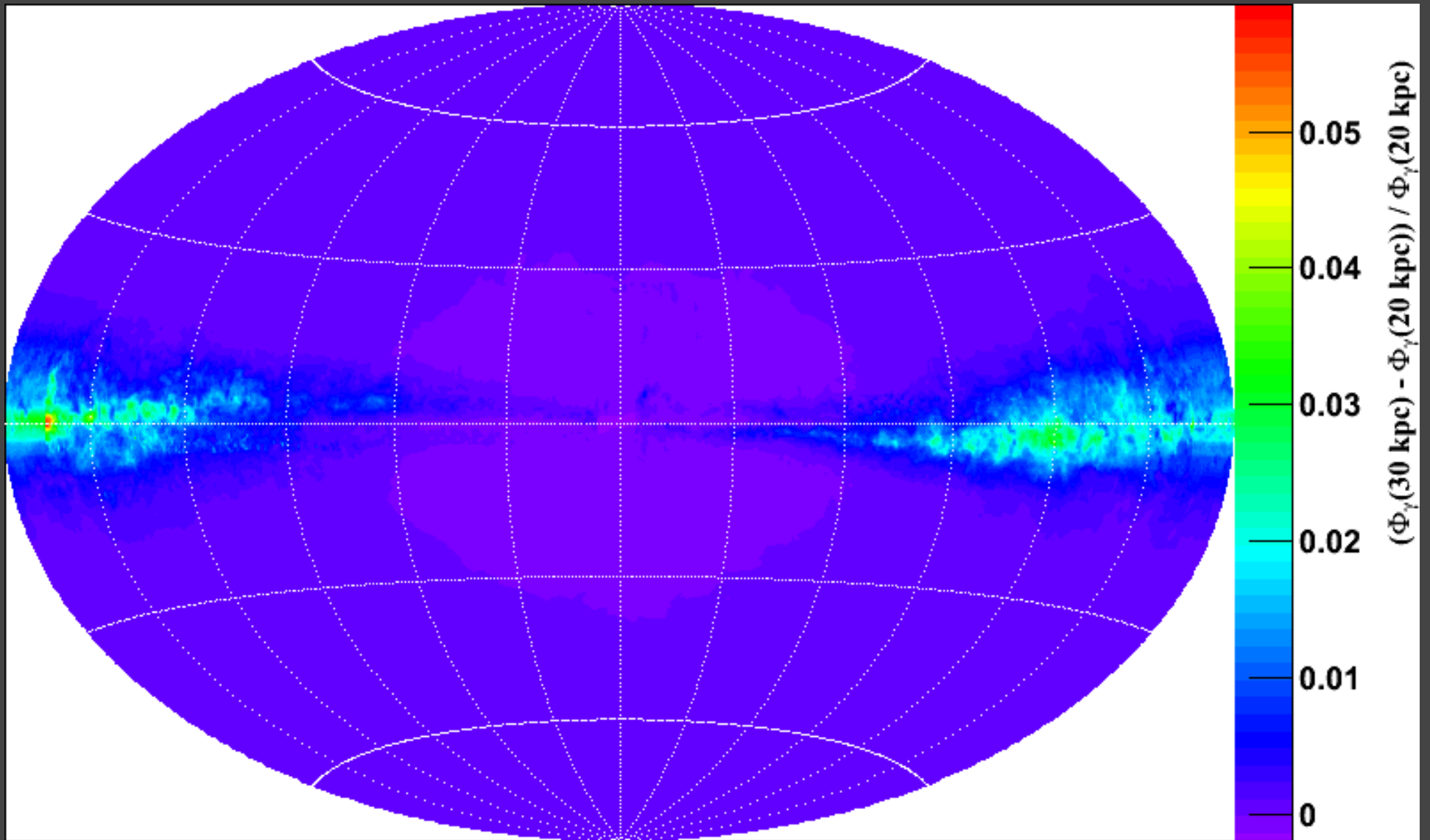
The blue spot



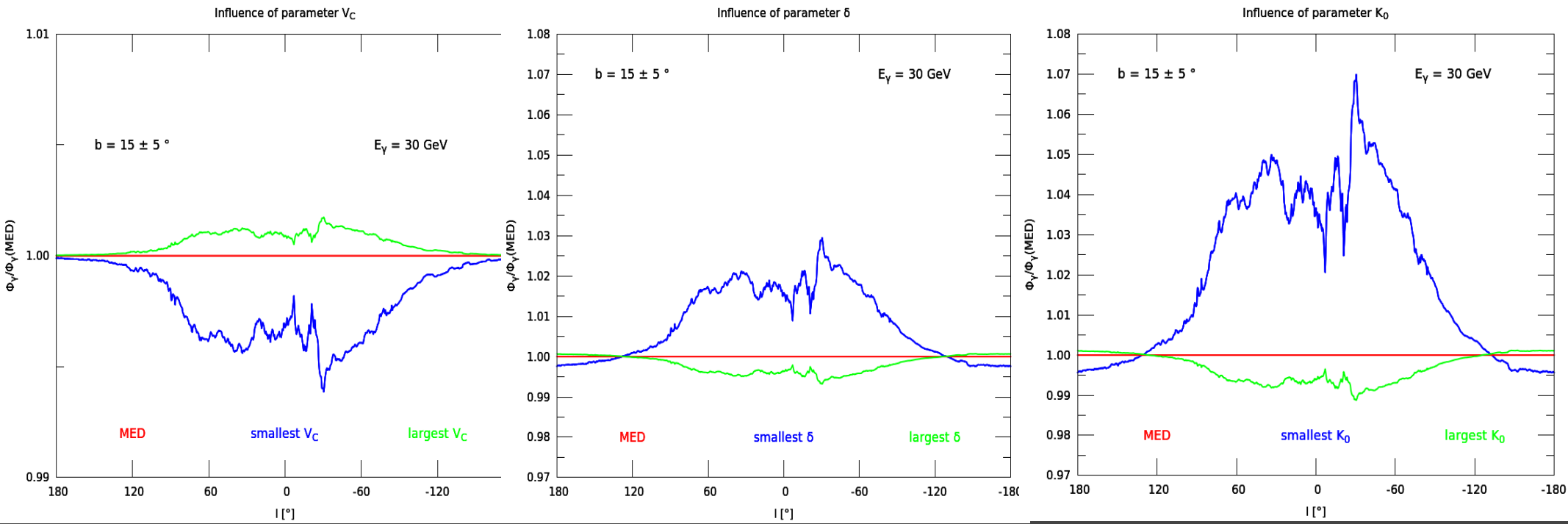
Halo half thickness L



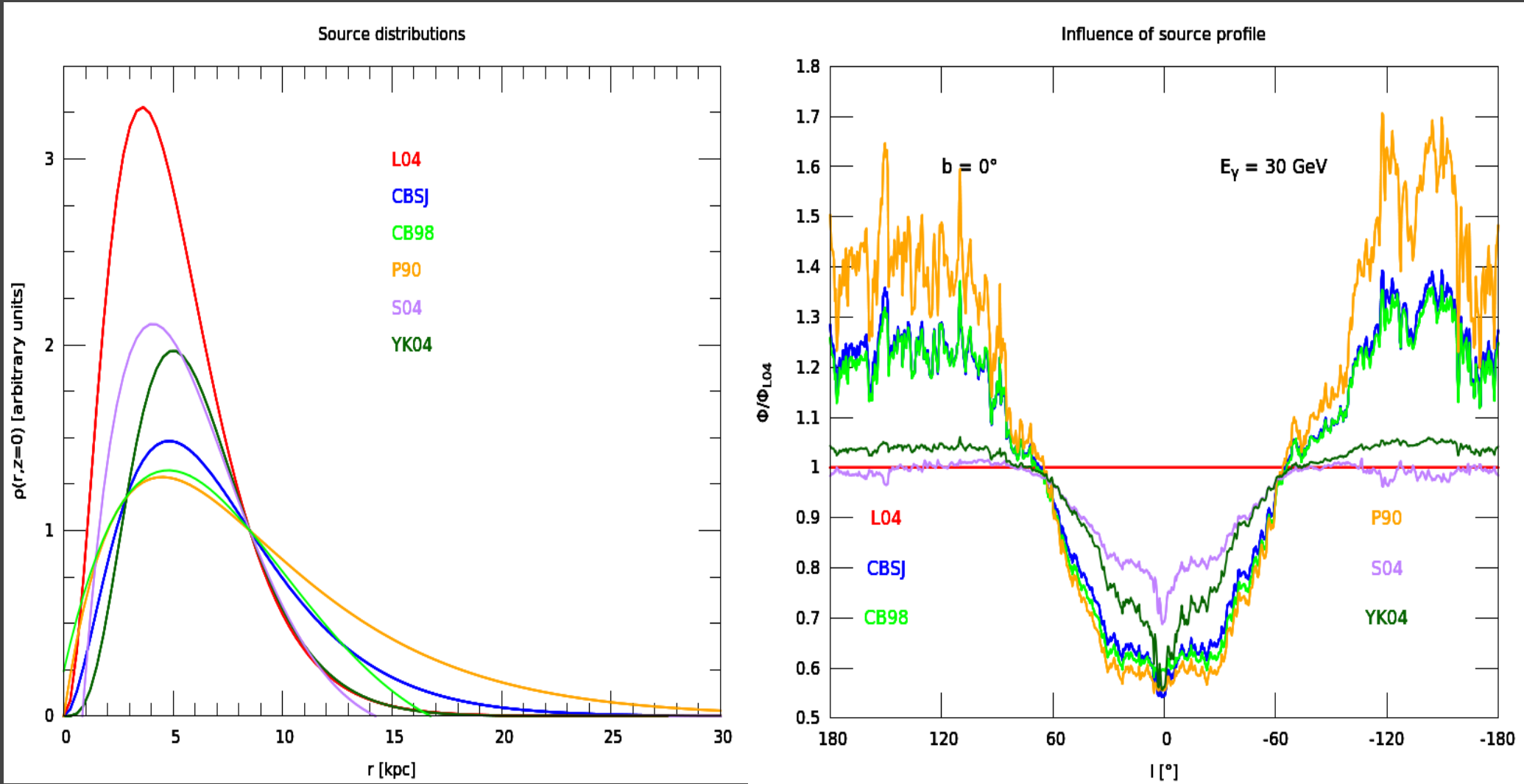
R_{Gal}



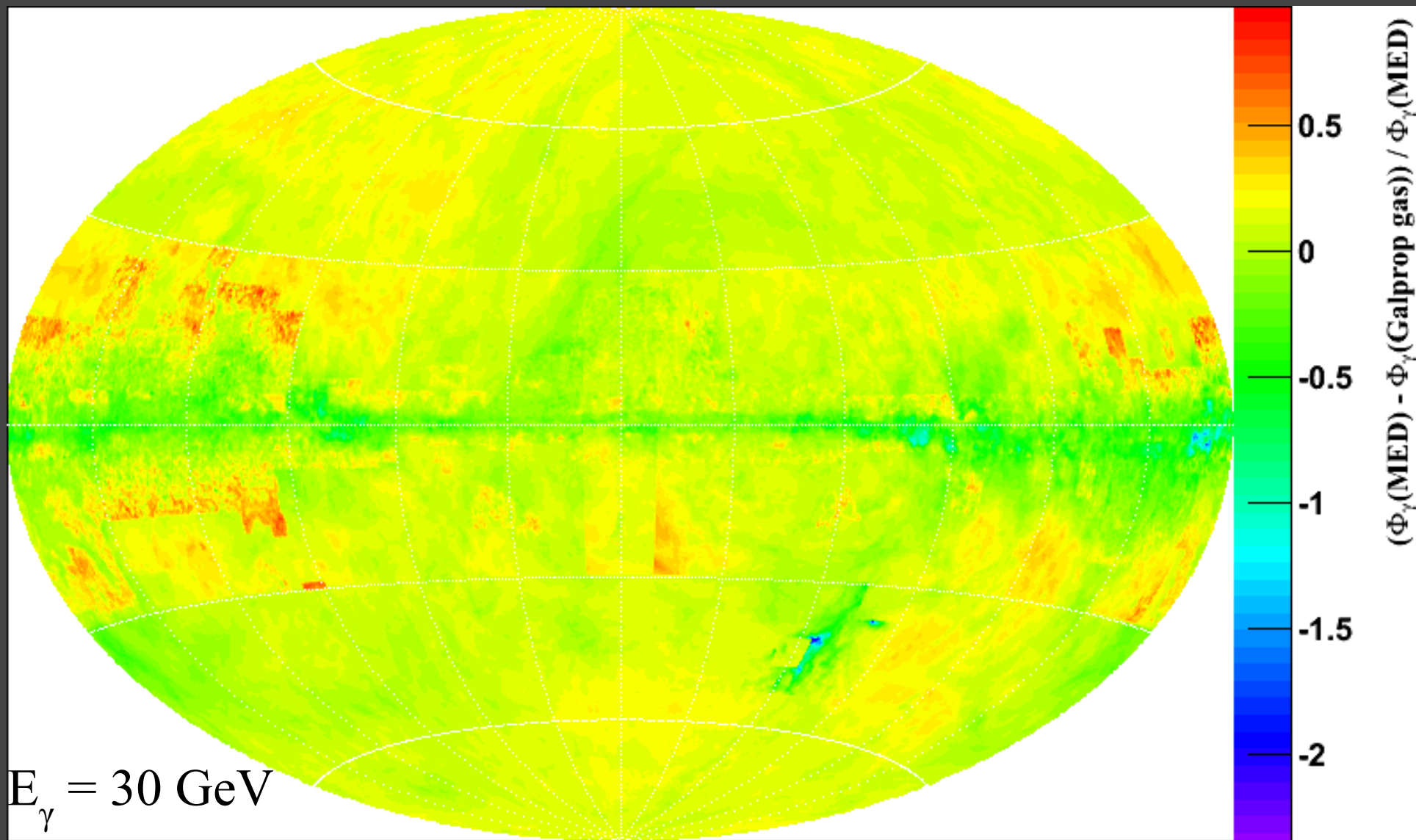
Propagation parameters



Source distribution

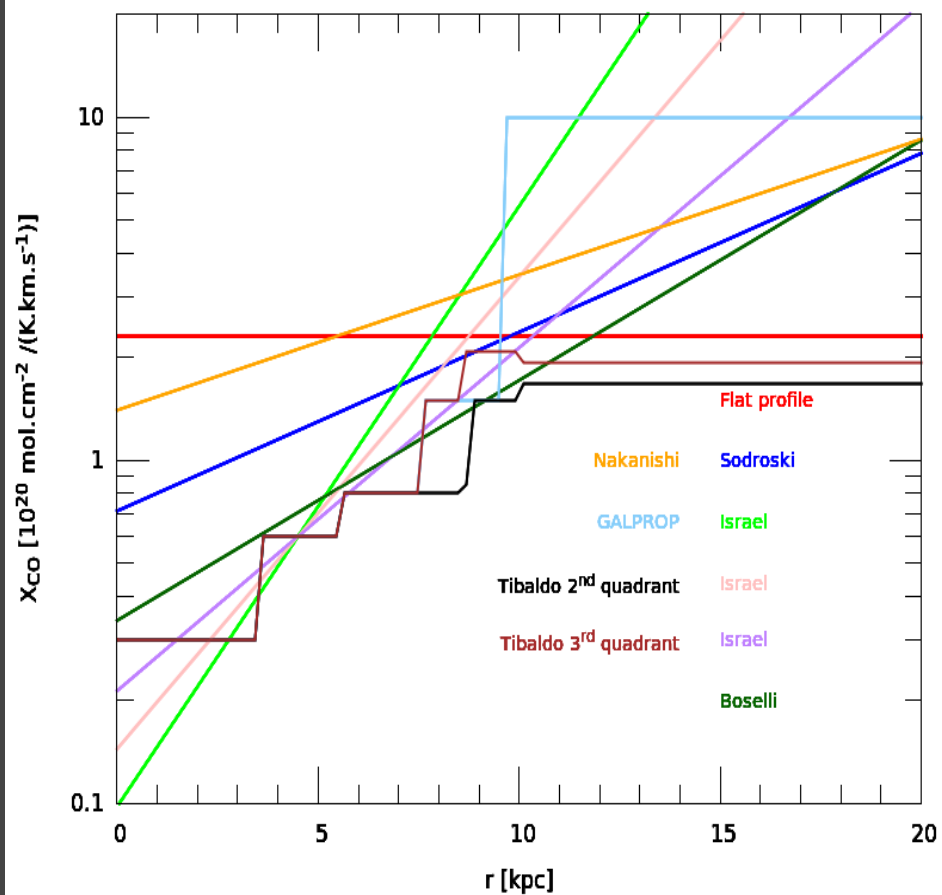


The gas maps

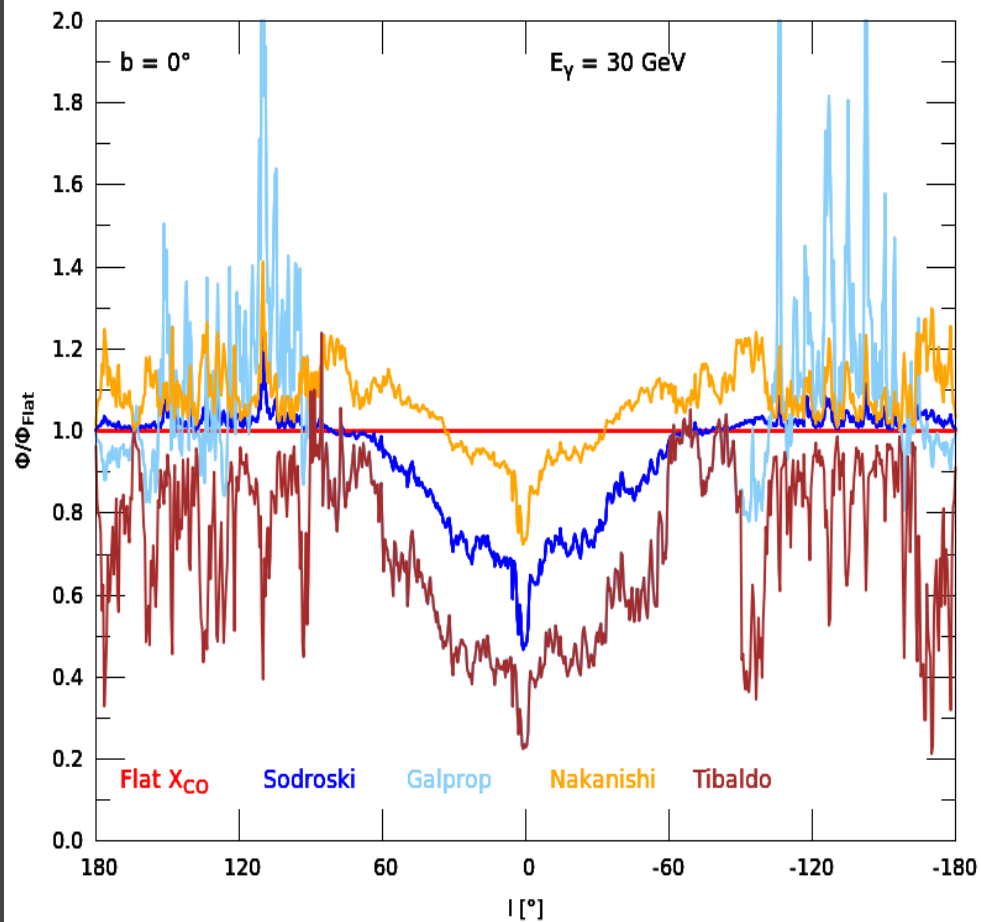


X_{CO} factor

X_{CO} profiles



Influence of X_{CO}

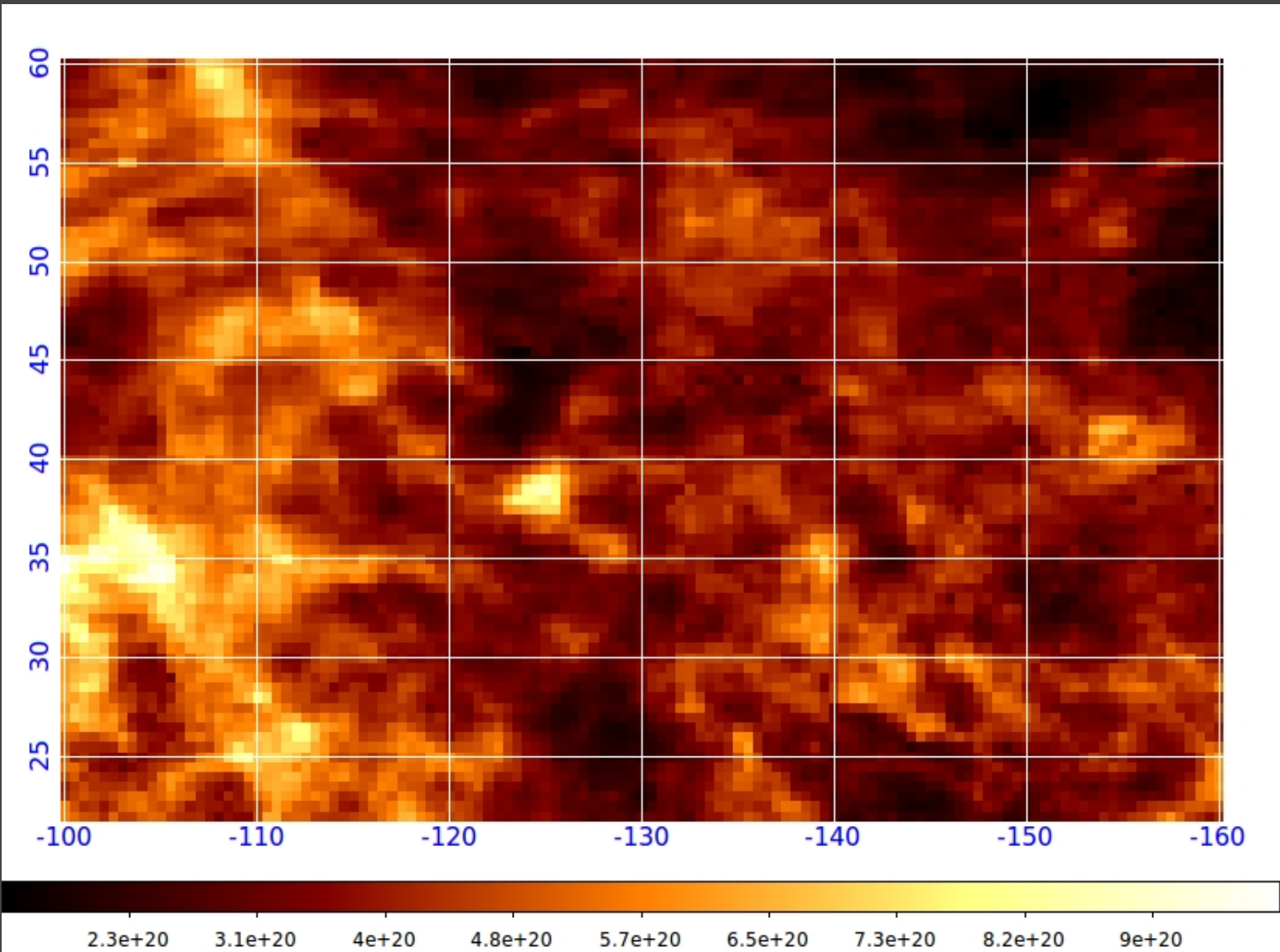


Local γ -ray emissivity

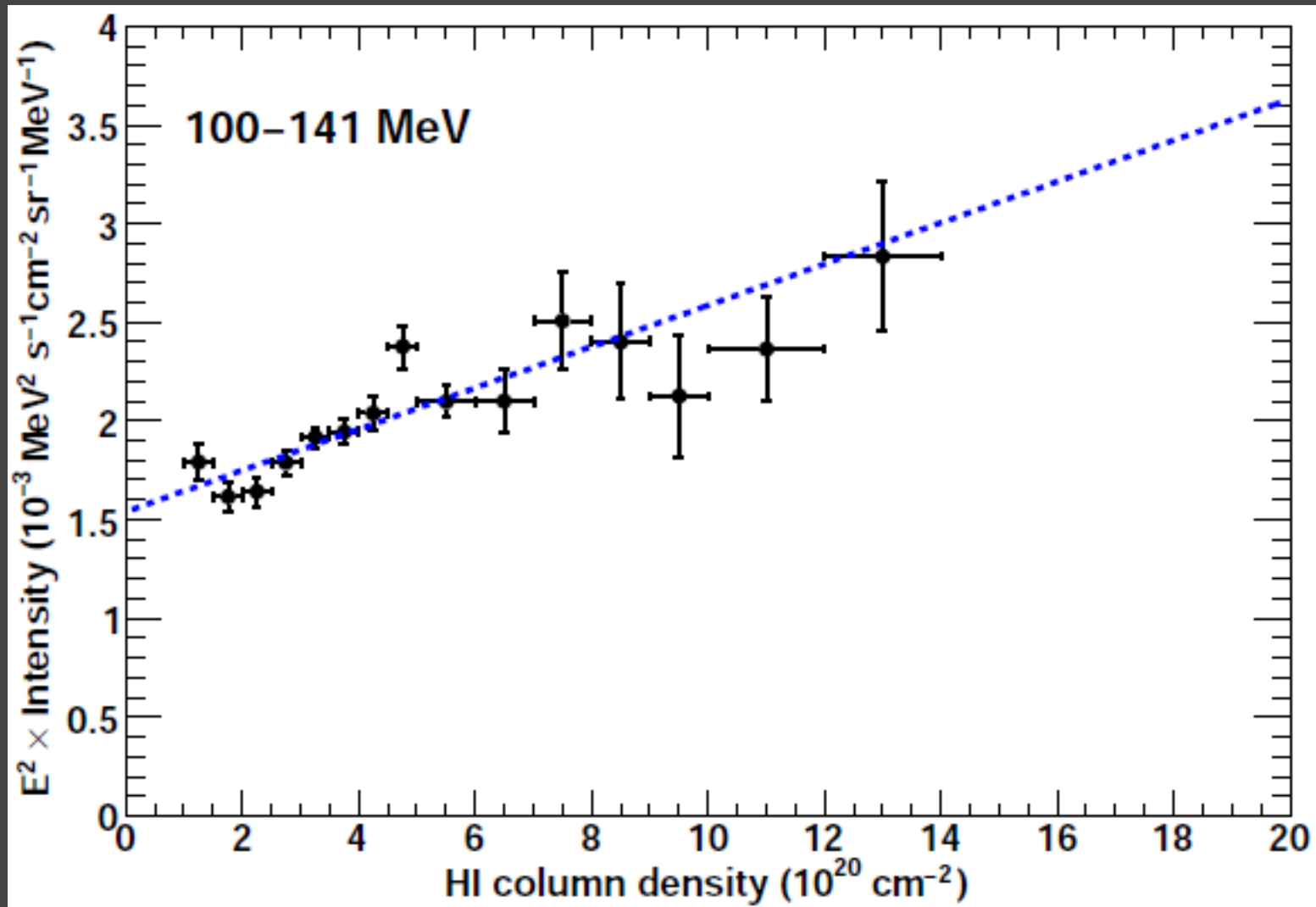
$$\mathcal{E}_{\text{eff}}(E) = \frac{1}{X_H} \sum_{i=p,\alpha} \sum_{j=H,He} \int_{T_{\min}}^{\infty} \frac{d\sigma_{ij}}{dE} \Phi_i(T, \odot) dT$$

Nuclear enhancement factor:

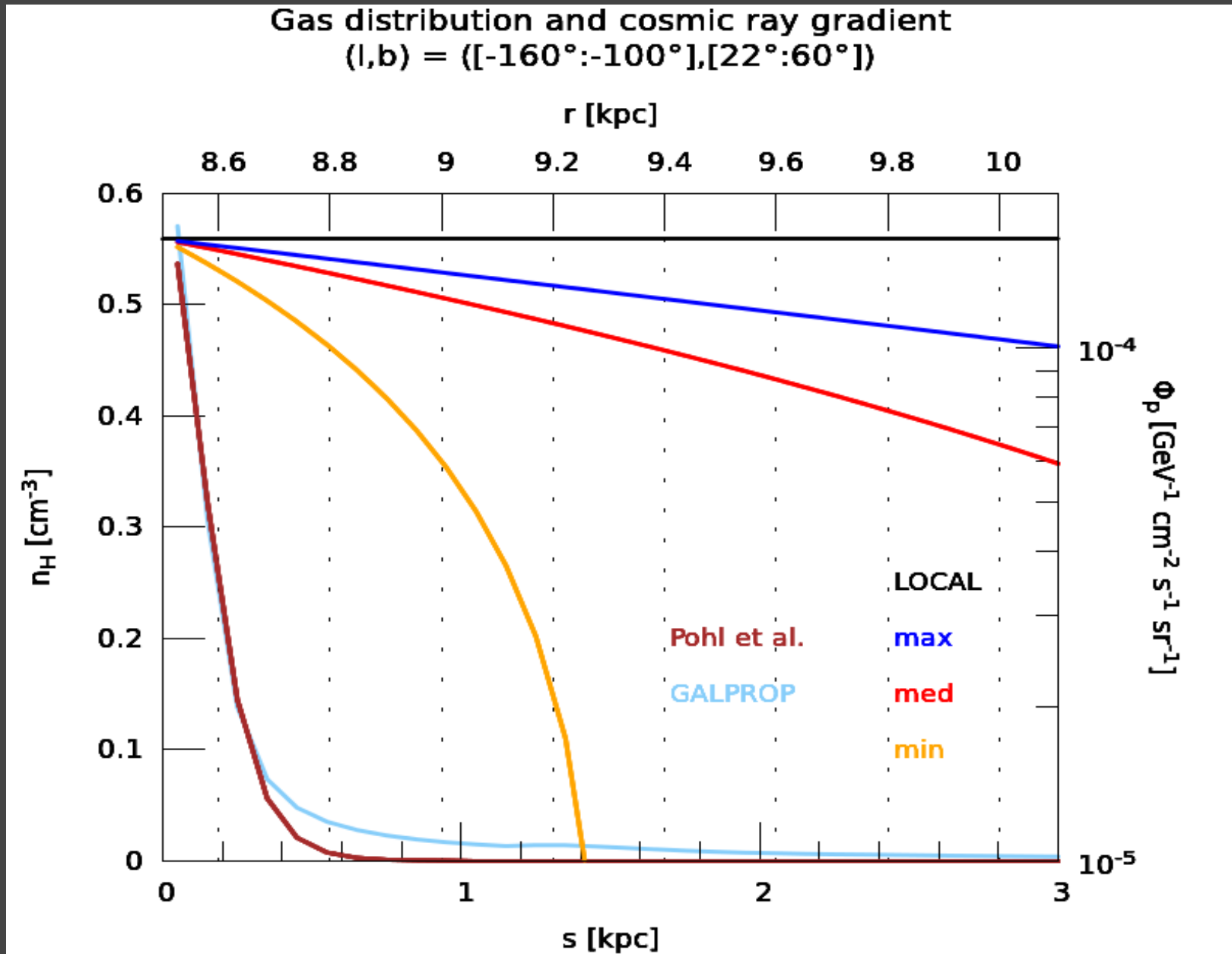
$$\epsilon_M = \frac{\mathcal{E}_{\text{eff}}(E)}{\frac{1}{X_H} \int_{T_{\min}}^{\infty} \frac{d\sigma_{pH}}{dE} \Phi_p(T, \odot) dT}$$

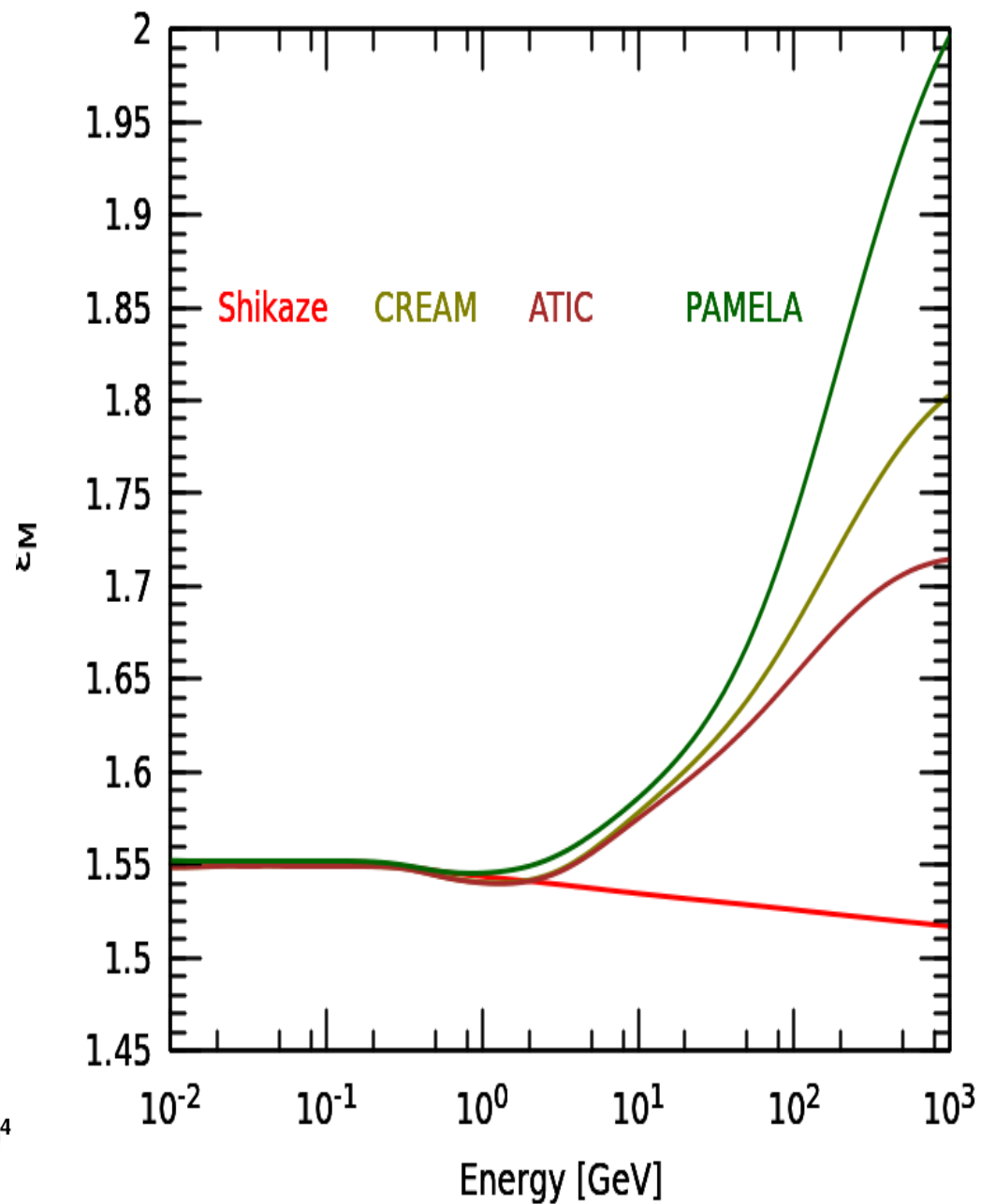
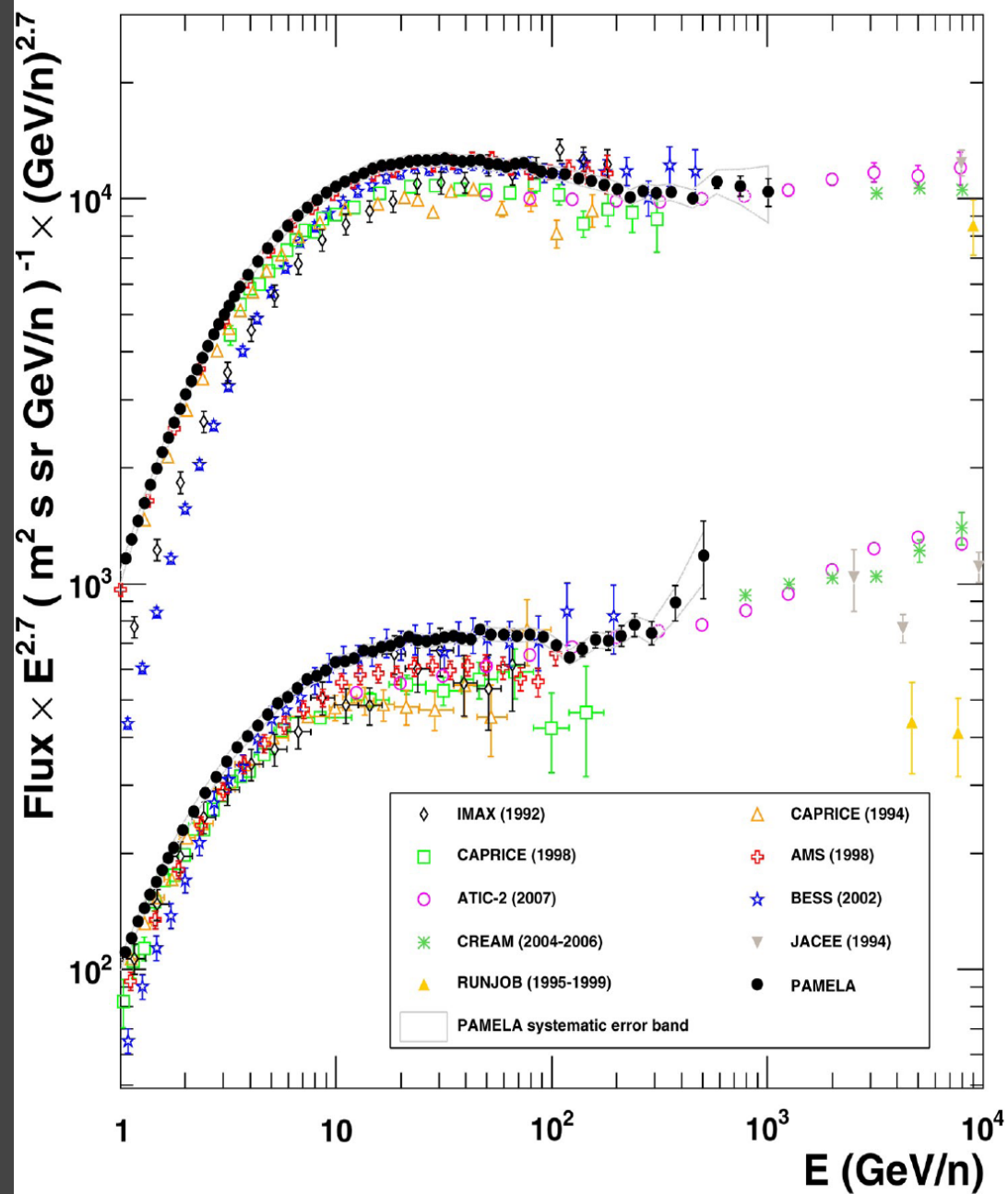


Fermi measurement of the local emissivity



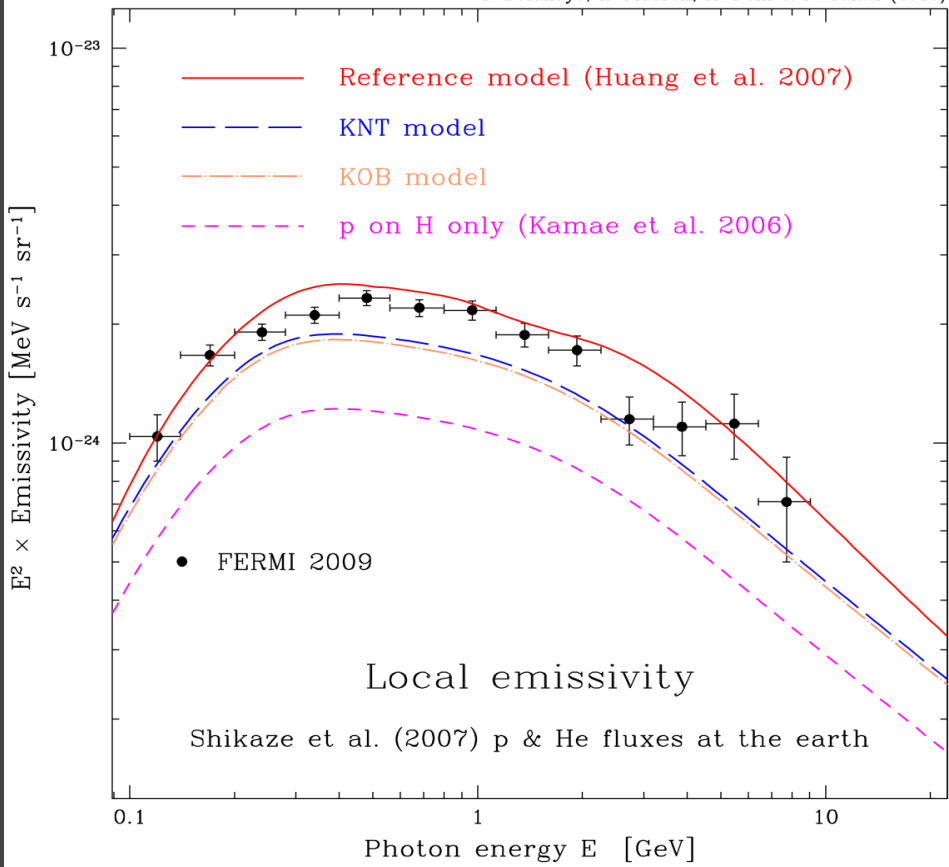
The northern patch



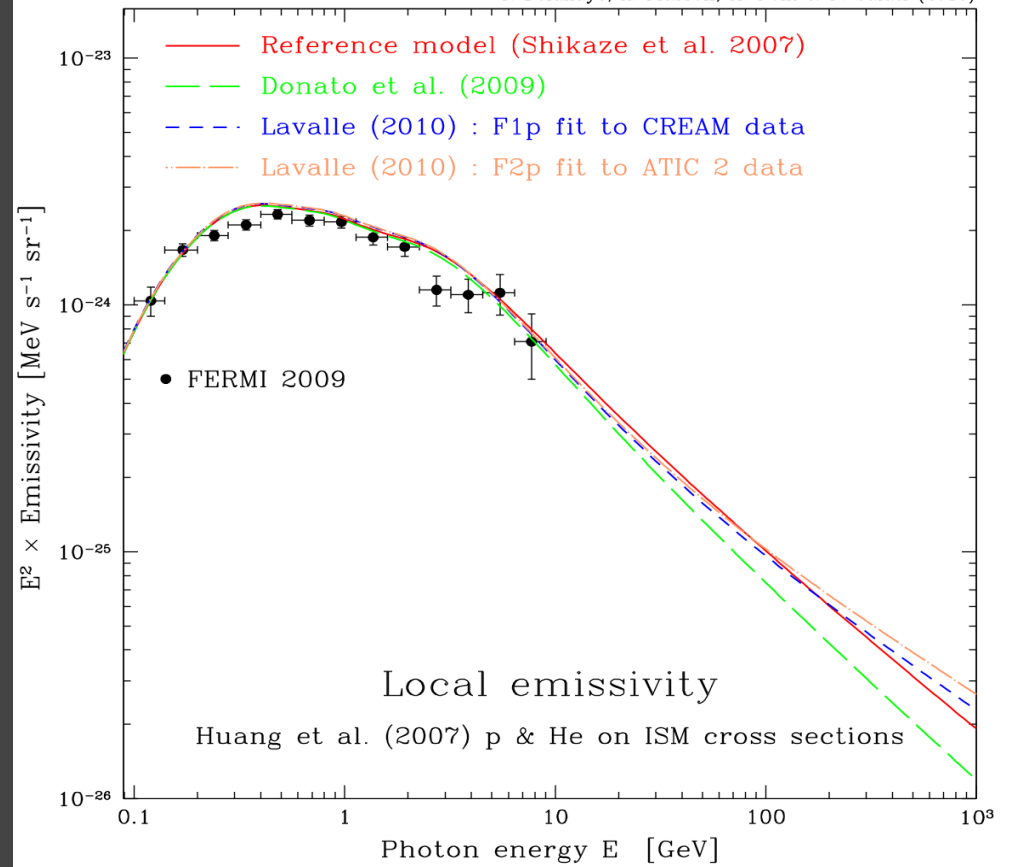
ϵ_M 

Emissivity

T. Delahaye, A. Fiasson, M. Pohl & P. Salati (2010)



T. Delahaye, A. Fiasson, M. Pohl & P. Salati (2010)



Conclusions

The diffuse γ -ray emission is well modelised but suffers from many uncertainties some of which very important.

Many more data are required

Working with Fermi people would be very nice