HI absorption and the Galactic Centre Excess

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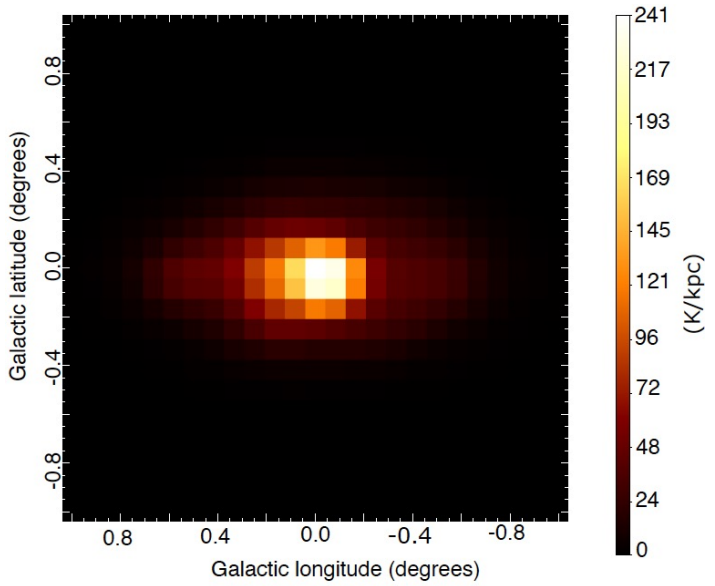
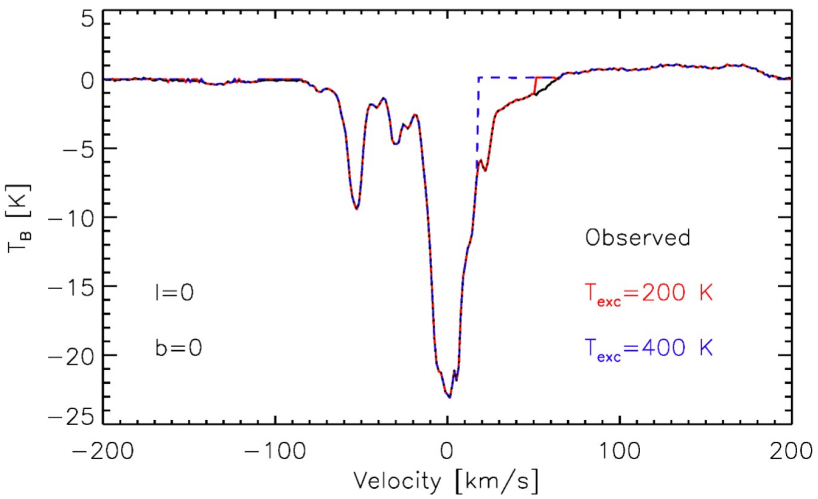
- The Fermi-LAT gamma-ray data indicate an Galactic center excess (GCE) of gamma rays which is peaked at around 1 GeV.
- The two main explanations are either a unresolved population of millisecond pulsars or self annihilating dark matter.
- It is important that the diffuse galactic background is adequately accounted for.
- This requires an accurate estimate of how the HI gas is distributed in our galaxy.
- Pohl et al. (2008) used a gas-flow model based on a smoothed-particle hydrodynamics simulation to deconvolve CO data.
- In Macias et al. (2018) an analogous deconvolution of HI data was found to provide a better fit to the diffuse gamma-ray emission from the Galactic-center region than do the gas maps of the standard Fermi-LAT data analysis.
- The absorption correction was minimal and involved only self-absorption with constant excitation temperature $T_{exc}=170$ K.
- Continuum emission was ignored, which means weak positive signal was deemed optically thin and negative signal had to be disregarded.
- In the Galactic-center region these simplifications lead to a potentially significant underestimation of the mass of atomic gas, and hence a deficit in the predicted diffuse gamma-ray emission and an artificial indication for new emission components.
- In this poster we present an advanced model of atomic gas in the Galaxy and apply it to the analysis of gamma-ray emission from the Galactic center. See proceedings for more details.
- We account for both line and continuum emission in the radiation transport, which allows the modelling of negative line intensity and traces gas in both emission and absorption.
- Our preliminary results indicate that the new HI maps provide a better fit to the Fermi-LAT data and still show that the GCE is better fit by a population of unresolved MSPs rather than self-annihilating dark matter.



Continuum emission model based on CHIPASS and Stockert data sets. Top: Cross section at a distance of 8 kpc from the solar system. Bottom: Profile for $(l,b)=(0^o, 0^o)$.

Example HI spectrum fit:



Fermi-LAT results showing improvement of test statistic for different excitation temperatures: