The 3D-distribution of gas in the Milky Way Galaxy

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Abstract

I report on an ongoing study of the three-dimensional distribution of interstellar gas in the Milky Way Galaxy. Knowledge of the gas distribution is important for any analysis of diffuse galactic gamma rays, whether aiming at cosmic-ray physics or dark-matter signatures. Our investigations are based on a kinematic model for the inner Galaxy that includes a galactic bar as well as radial and non-axisymmetric flows.

The bar in the inner Galaxy provides a non-axisymmetric flow!

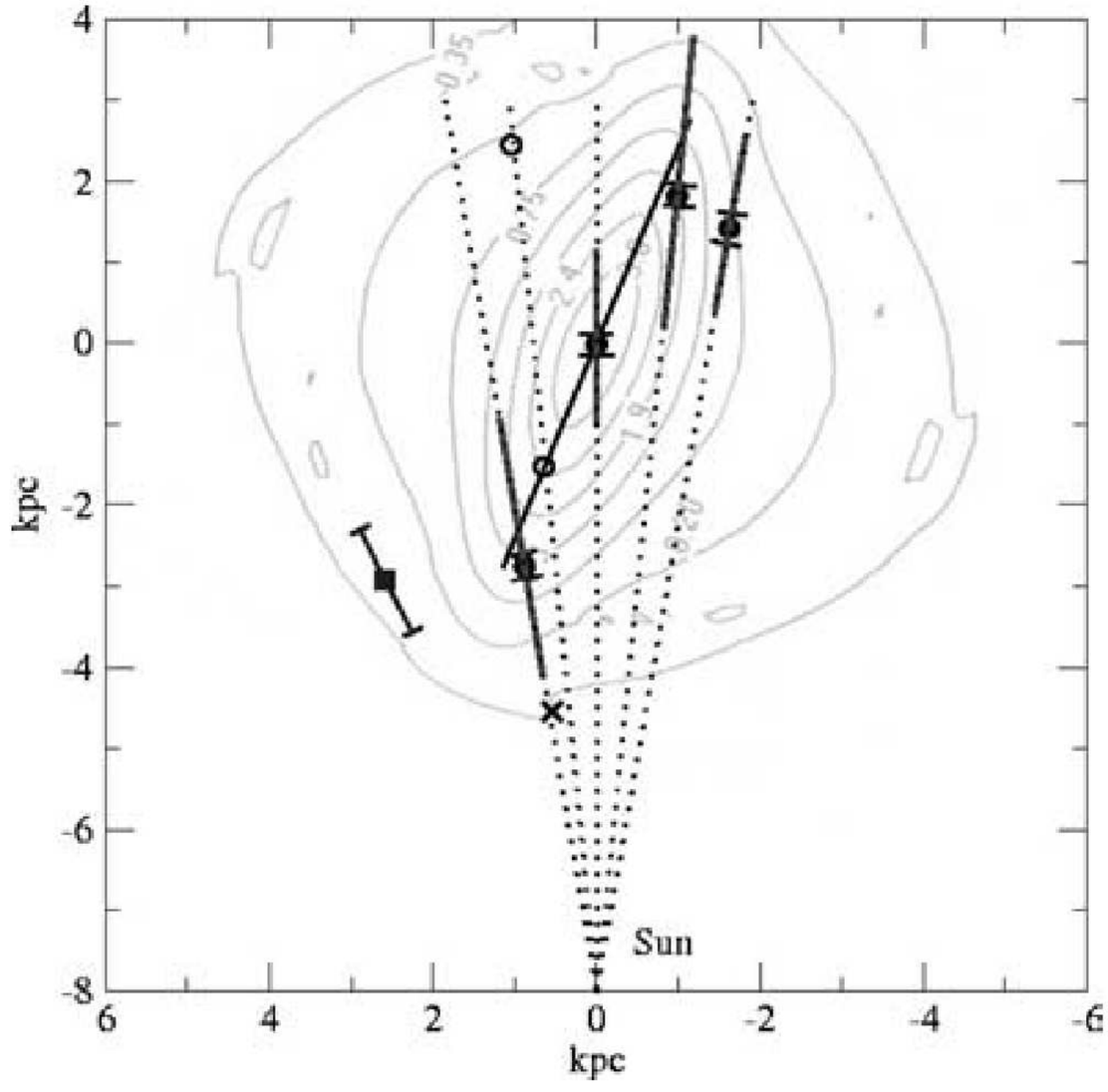
Questions:

- Does the bar model provide kinematic resolution near the Galactic Center?
- Does a bar model resolve some of the near-far ambiguity?
- Does the bar model alleviate the problem of forbidden velocities?

The Galactic bar

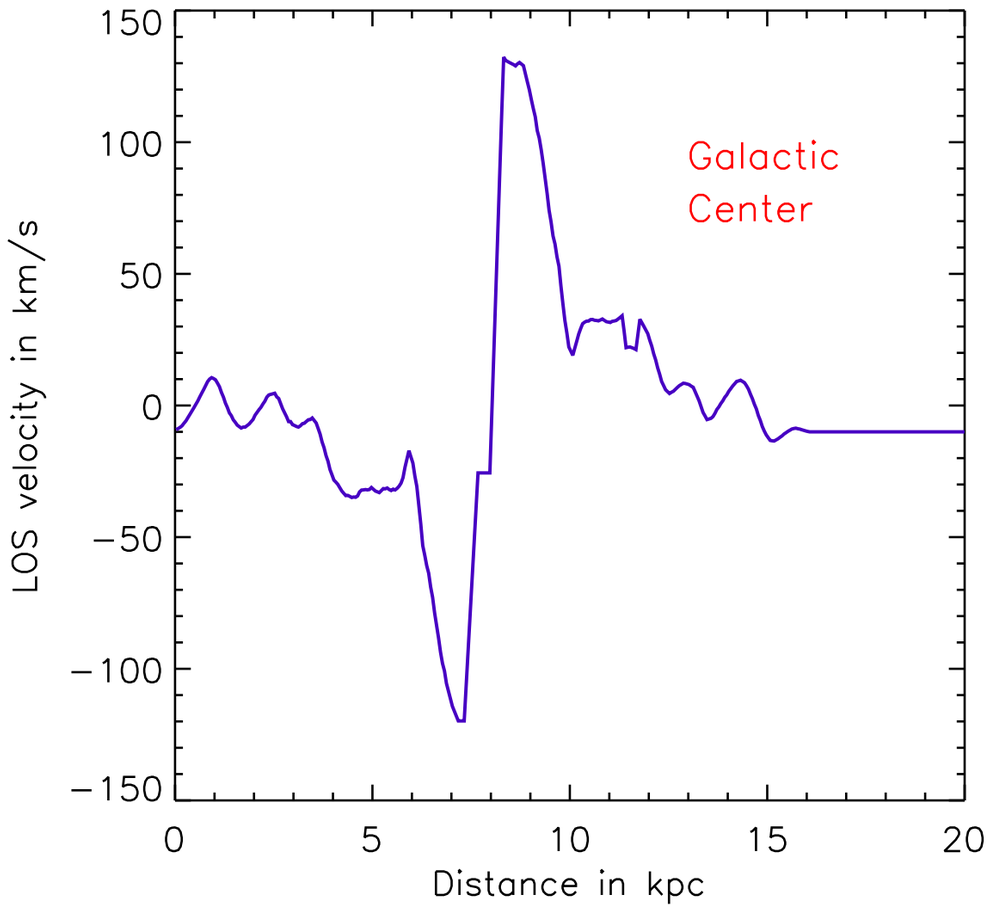
Thick lines along LOS:
location of RGB star clumps
(Babusiaux & Gilmore 2005)

Grey contours: plane projection
of COBE-based bar model
(Bissantz & Gerhard 2002)

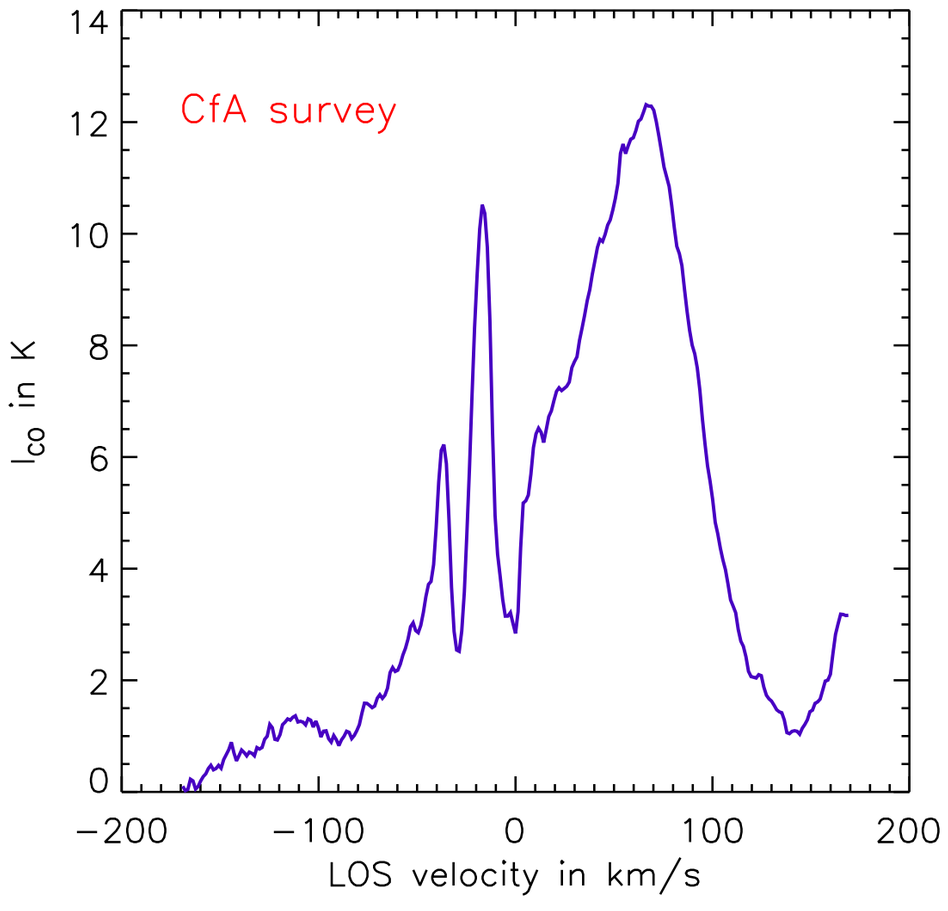


Model versus data for the Galactic Center

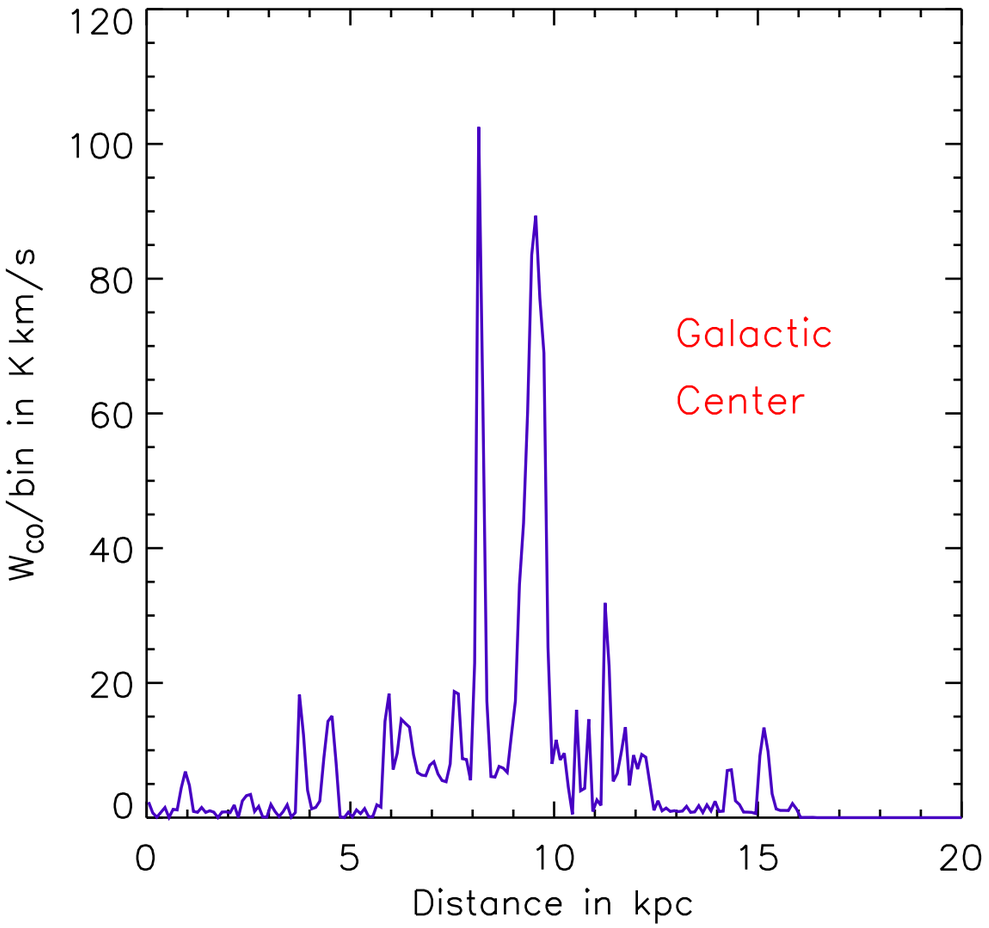
SPH model (Bissantz et al. 2003)

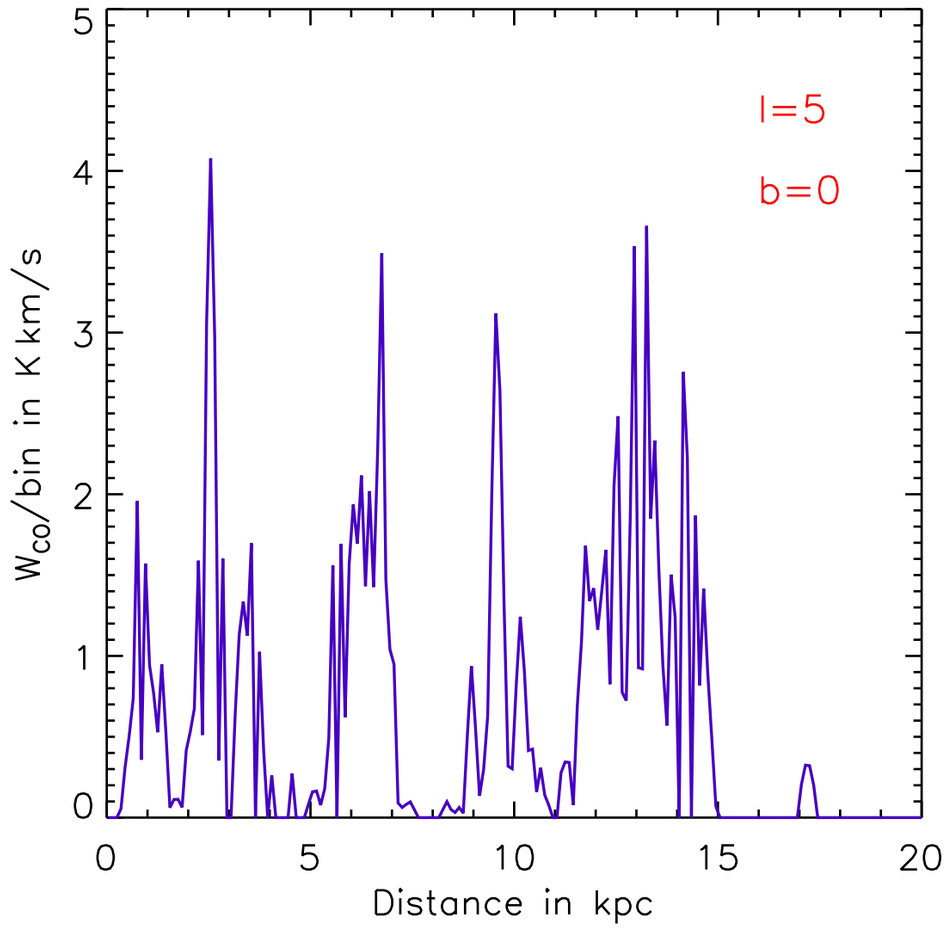


$CO_{1\rightarrow 0}$ data (Dame et al. 2001)



Results for two lines-of-sight

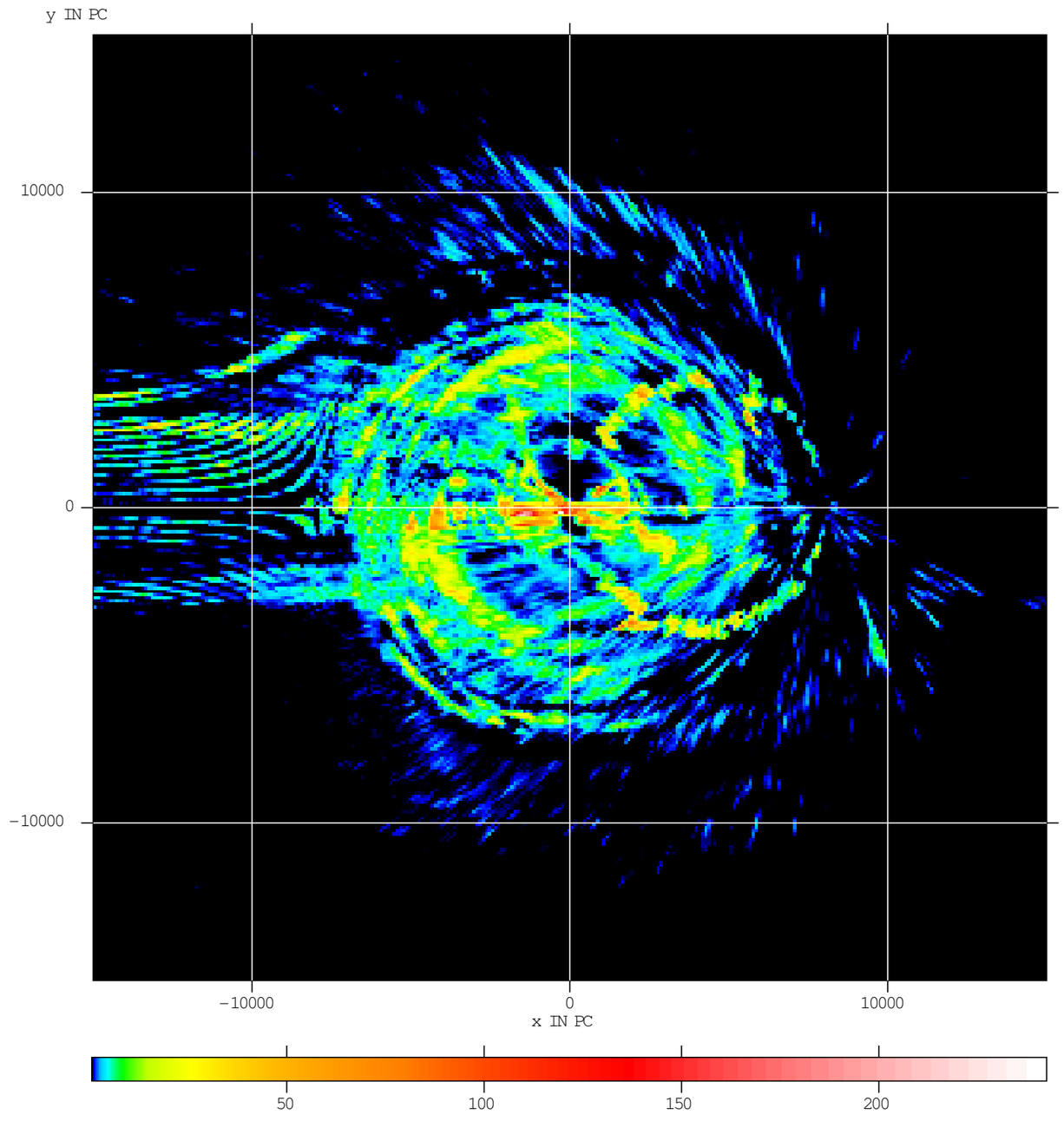




Plane-projection of the gas distribution

Surface mass density, $M_\odot/\mathrm{pc}^2$,
of molecular gas for constant X

Galactocentric coordinates,
the sun is at (8.0,0.0).



First results

- **The bar model is not perfect:**

  – still problems with forbidden velocities

  – distance ambiguities remain

  – weak correlation between distribution along neighboring lines-of-sight

- **Possible solutions:**

  – broader line profiles at Galactic Center

  – impose LOS correlation requirement to resolve distance ambiguity

- **Deconvolving atomic hydrogen spectra is the next step.**