



Abstract

This work, using ¹²CO data taken from the Exeter-FCRAO Galactic Plane Survey, supplemented by CGPS and VGPS HI data, maps the location of spiral structure of the Outer Galaxy in both space and velocity over the Galactic longitude range of 55° – 193° in CO (augmented, in this work, to 13° longitude by Dame et al. 2001) and 14° – 179° in HI. We also present re-sampled spatially convolved position-position-velocity maps of the spiral arm regions with the ultimate goal of performing an analysis of the clouds/clumps therein.

1) Introduction

Galactic Molecular Clouds, sites of all known star formation, generally aggregate in spiral arms. Optical spiral arms are usually well traced by CO, due to the aggregation of CO being more discrete (clumpy) than other tracers such as HI. Therefore by tracing and observing the locations of these CO clouds, one may infer the probable spiral structure.

3) Position & Velocity Fields

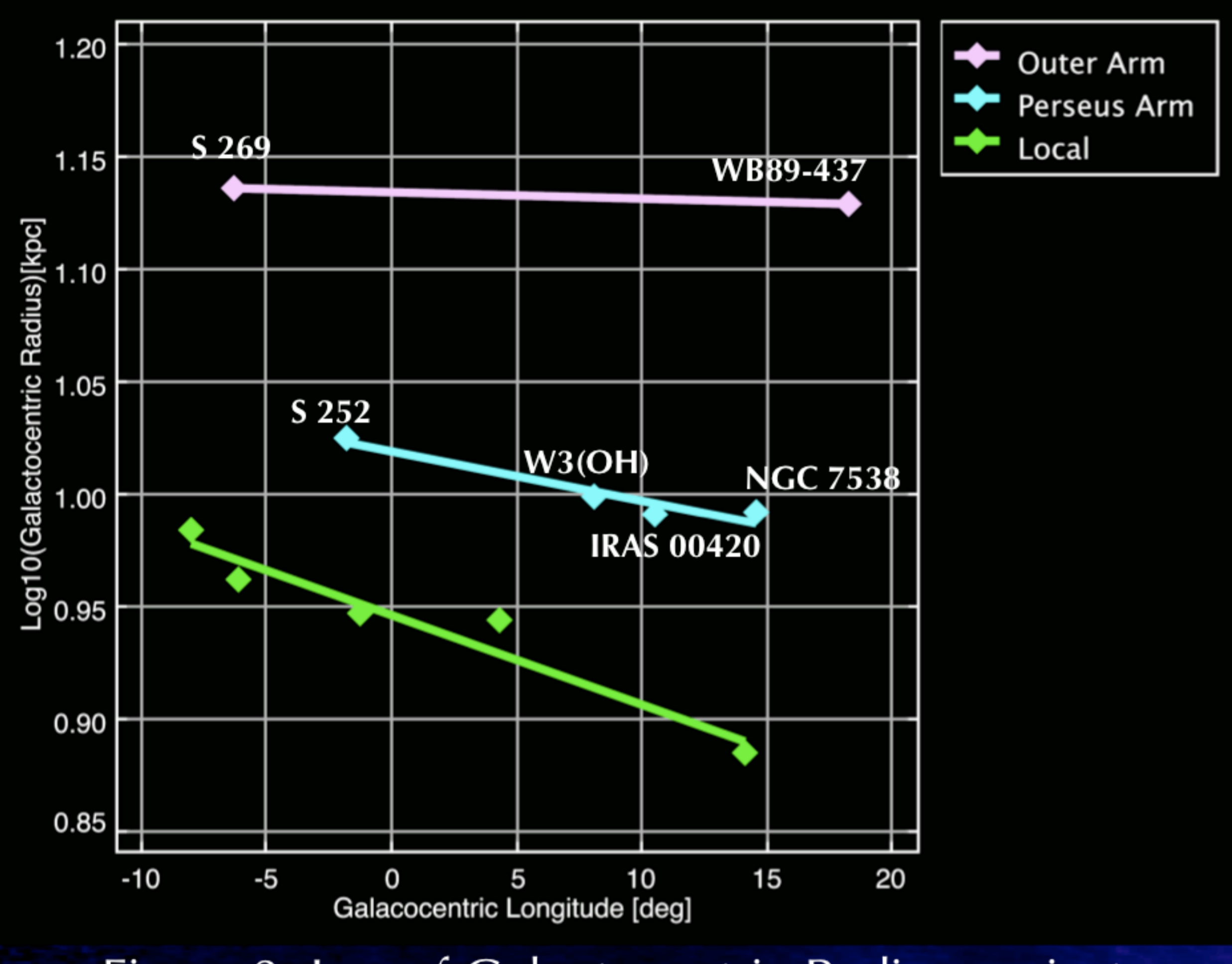


Figure 2; Log of Galactocentric Radius against Log Galactocentric Longitude

The position of each arm were fit to the trigonometric parallaxes of maser emission from high mass star forming regions taken from Reid et al. 2009 (Figure 2). The spatial position of the arms were found to be well fit by a logarithmic spiral. Once the position of the arms were determined, the velocity structure of the arms were considered.

The velocity fields were obtained by assuming that each arm has a constant shock potential across its extent, which varies only due to the line of sight observations (Summers & Brunt, in prep). Exterior to the arms, the Galaxy is assumed to have a flat rotation curve. A parametric fit to Galactic longitude and velocity to the clouds defined to be within an arm in velocity were obtained to improved the velocity estimate for the arms.

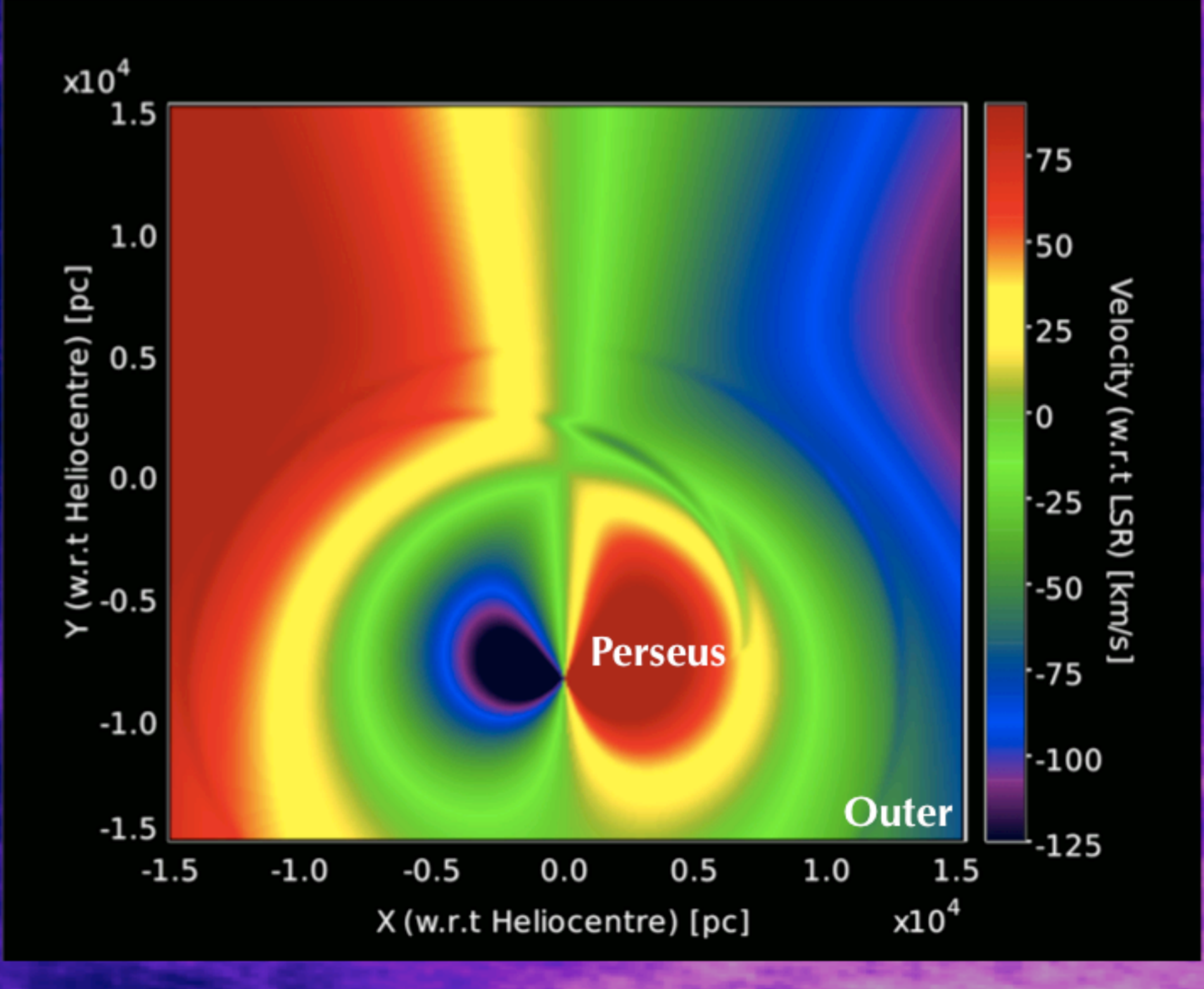


Figure 3; Position & Velocity field of the outer Galaxy in $(X_{\text{helio}}, Y_{\text{helio}}, V_{\text{LSR}})$.

2) Galactic Spiral Structure

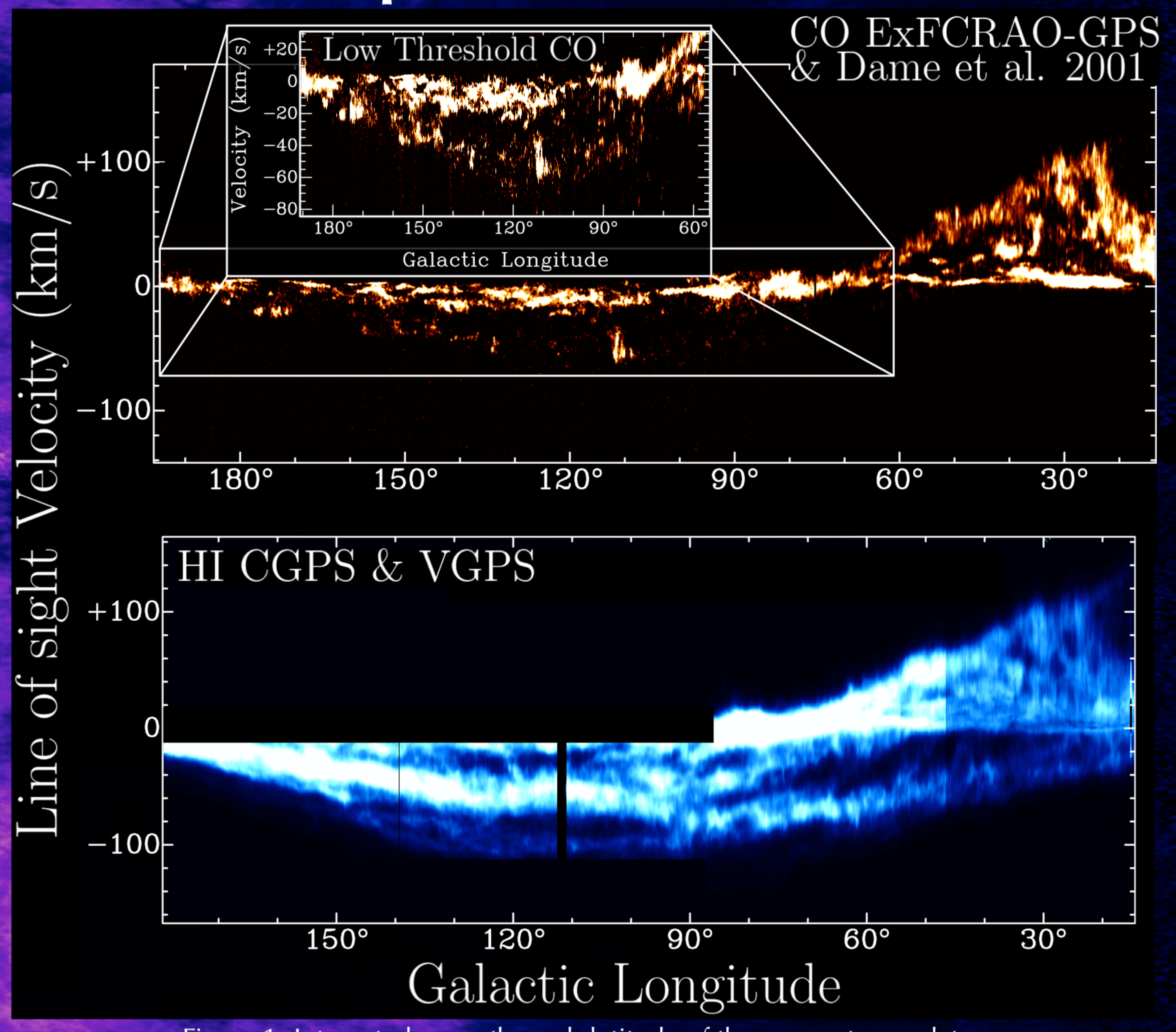


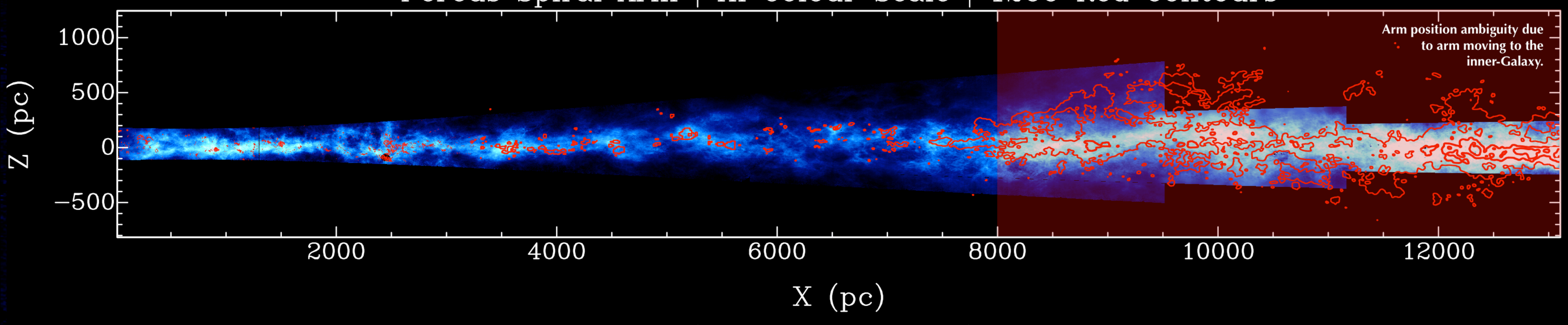
Figure 1; Integrated maps through latitude of the source tracer data. Top: ¹²CO, Bottom: HI (through ±3° latitude).

The emission in Figure 1 shows the presence of two spiral arms in the outer Galaxy. There are three bands of emission, starting at the most positive velocity; local emission, Perseus Arm emission and Outer Arm emission.

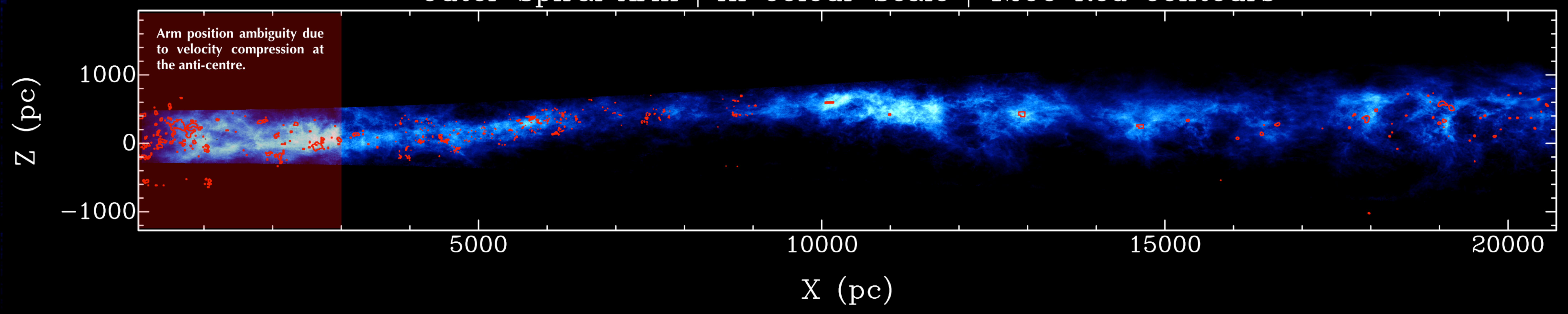
4) Spiral Arms At Common Resolution

The data were then resampled in velocity to be centred on each spiral arm and convolved to a common linear resolution of 2pc to length along the arm, X (with $l=180^\circ$ coincident with $X=0\text{pc}$), and height out of the plane, Z.

Perseus Spiral Arm | HI Colour Scale | ¹²CO Red Contours



Outer Spiral Arm | HI Colour Scale | ¹²CO Red Contours



References;